19th International Conference
for Media in Education

Redesigning the Learning Environment in Digital Transformation and AI

Aug. 18~20, 2021

Proceedings

ICoME 2021

www.icome.media

한국교육정보미디어학회
Korean Association for Educational Information and Media
V STORY
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전남대학교 교육문제연구소
THE INSTITUTE OF EDUCATIONAL RESEARCH. CHONNAM NATIONAL UNIVERSITY

International Conference for Media in Education 2021

CONFERENCE PROGRAM
AND
PROCEEDINGS

Redesigning Learning in the Digital Transformation and AI

August 18~20, 2021

Interactive Virtual Conference

International Conference for Media in Education 2021

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Invitation for ICoME 2021

International Conference for Media in Education (ICoME) provides opportunities to research colleges to discuss and exchange multiple perspectives on various topics in using media for education. We invite you to participate in ICoME 2021, the 19th joint conference supported by the four prominent academic societies specialized in Media use in Education: Korean Association for Educational Information and Media (KAEIM), China Association for Educational Technology (CAET), Japan Association for Educational Media Study (JAEMS), and Teaching, Colleges and Community (TCC). This year's theme is "Redesigning Learning in the Digital Transformation and AI." We are going to explore how we need to redesign our learning. We will gather collaborative ideas and research topics to facilitate learning by redesigning the conference's learning experience. Our primary mission is to apply the technologies to add pedagogical value. ICoME 2021 will bring you new perspectives to implement the latest technologies for learning and training.

Wooyong EOM Ph.D.

The Chair of ICoME 2021 Executive

CommitteeProfessor, Keimyung

University, SOUTH KOREA

Conference Program

18 August 2021

Time	Program	Location
12:40-13:00	Registration	Convention center
13:00-15:00	Workshop **Research Workshop for Graduate Students** **"Systematic Literature Review"** Sanghoon Park, *Professor, University of South Florida, USA*	Conference Hall
15:00-15:10	Break	-
15:10-16:00	Help Session **"How to share your screen' & Training Session"**	Presentation Suite
16:00-16:30	Social Events-Treasure Hunt (1)	V-Story Campus

19 August 2021

Time	Program	Location
09:00- 09:40	Social Events-Treasure Hunt (2)	Auditorium
09:40- 10:20	Welcome speech: President of KAEIM and CAET, JAEMS, & TCC	Auditorium
10:20- 10:30	Break	-
10:30- 12:00	Keynote 1 **Innovative Thinking for New Generation in Digital Transformation** Paul KIM, *Chief Technology Officer and Associate Dean, Graduate School of Education at Stanford University, USA*	Auditorium
12:00- 13:00	Lunch Break	
13:00- 13:40	Invited Session **Board Room 1.** **"Teaching and learning in the age of advanced digital citizenship"** Dr.-Ing. Zizung Yoon, *Technical University of Berlin, Germany* **Board Room 2.** **"Beyond the Programs at USF Digital Learning"** Dr. Christie Nicholas, *University of South Florida, USA*	Presentation Suite
13:40- 14:20	Break	
14:20- 15:20	Roundtable Session 1	Presentation Suite
15:20- 15:30	Break	
15:30- 16:30	Roundtable Session 2	Presentation Suite
16:30- 16:40	Break	
16:40- 18:00	Virtual Hangout: Group Photo Competition	Conference Hall

20 August 2021

Time	Program	Location
09:00- 09:20	Registration	Presentation Suite
09:20- 10:20	Concurrent Session 1	Presentation Suite
10:20- 10:30	Break	
10:30- 12:00	Keynote 2 **The present and future of Metaverse in Education** Gabriel BAKER, *Product Manager for FRAME, USA*	Auditorium
13:00- 14:00	Lunch Break	
13:00- 13:40	Invited Session **" Educational Use of AR/VR and teaching Simulation in the U.S"** Sanghoon Park, *Professor, University of South Florida, USA*	Conference Hall
13:40- 14:00	Break	
14:00- 15:00	Concurrent Session 2	Presentation Suite
15:00- 15:10	Break	
15:10- 16:10	Concurrent Session 3	Presentation Suite
16:10- 16:20	Break	
16:20- 17:00	Closing Talk (Representative Panel Talk - Closing Talk of ICoME2021)	Auditorium
17:00- 17:30	Closing Ceremony (Young Scholar Awards, Information on ICoME2022, Closing Remarks)	Auditorium

***Program time and date indicate by Korea Standard Time (UTC+9:00)**

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Haruo Kurokami(Kansai Univ.), Juanting Xu (Kansai Univ.)

R101-2 Suggestions for Improving High School Students' Mathematical Explanation Skills
----------p.138

Masaki Komachi, Yuki Watanabe (Tokyo Univ. of Science)

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R102-1 Teaching and Learning about Covariational Reasoning: Focused on Causal Relationship and Difficulties in Using Technology
----------p.140

Shunya Koga (Univ. of Tsukuba)

R102-2 Cross-Cultural Adaption of International Students at Elementary School in Japan
----------p.142

Mayumi Kubota, Danhong Zhong (Kansai Univ.)

R 102-3 The Factors of Emotional Development of Adolescents in Djibouti -Focus on the interaction with an outsider -
----------p.145

Onri Seki, Makiko Kishi (Meiji Univ.)

Room R-103（14:20-15:20, August 19, 2021）

R103-1 Pre-Service Teachers' Instructional Design Motivation Factors
----------p.147

Kento Nakamura (Tokyo Univ. of Science), Tadashi Misono (Shimane Univ.), Yuki Watanabe (Tokyo Univ. of Science)

R103-2 How to Enhance the Teaching of Students with Intellectual Disability in Regular Class: A Case Study Focusing on a Teachers' Use of ICT in a Japanese Elementary School
----------p.149

Motohiro Takata, Minami Iino, Karin Ogawa, Maho Matsuura, Takayuki Konno (Meisei Univ.)

R103-3 Research Trends on the Use of 360-degree Videos in Teacher Education
----------p.152

Takahiro Kamada (Kansai Univ.)

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----------p.155

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R104-2 How to Avoid Making Online Courses Boring: Students' Suggestions for Professors
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Dahye Kim, Yeongmin Yun, Da Hyun Lee, Hoseung Byun (Chungbuk Nat'l Univ.)

R104-3 The Dynamic Change of Student's Motives and Learning Experiences during Extra-curricular Activity
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Mayuno Kubo, Makiko Kishi (Meiji Univ.)

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----------p.165

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R106-3 Design and development of virtual patients in medical simulation

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Hongyu Xiang, Jeeheon Ryu (Chonnam Nat'l Univ.)

Roundtable Session 2

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Hiroto Jisukawa, Yuki Watanabe (Tokyo Univ. of Science)

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Shota Yano, Yuki Watanabe, Fumiko Okiharu (Tokyo Univ. of Science)

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Kazuki Tokumoto, Haruo Kurokami (Kansai Univ.)

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Da-eun Kim, Jeeheon Ryu (Chonnam Nat’l Univ.)

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Yeonju Tak, Jeeheon Ryu (Chonnam National Univ.)

Concurrent Session 1

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----------p.287

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Fukushi Univ.)

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C206-2 A Study on Metacognitive Structure and Problem Solving Design of Children's Programming

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Li Bingying, Wang Fan, Sun Ruonan, Wang Wei (Northeast Normal Univ.)

Concurrent Session 3

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Shoko Tange (University of the Sacred Heart)

C303-2 Designing an Online Learning Reflection Checklist for the Development of Cultural Intelligence (CQ) in Undergraduates at a Japanese University

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Wang Fan, Wang Wei, Sun Ruonan, Li Bingying (Northeast Normal Univ.)

PROCEEDINGS

WORKSHOP

Workshop

Conference Hall

Workshop, 13:00-15:00, August 18, 2021

Research Workshop for Graduate Students "Systematic Literature Review"

Sanghoon PARK

Professor,
University of South Florida, USA

Abstract

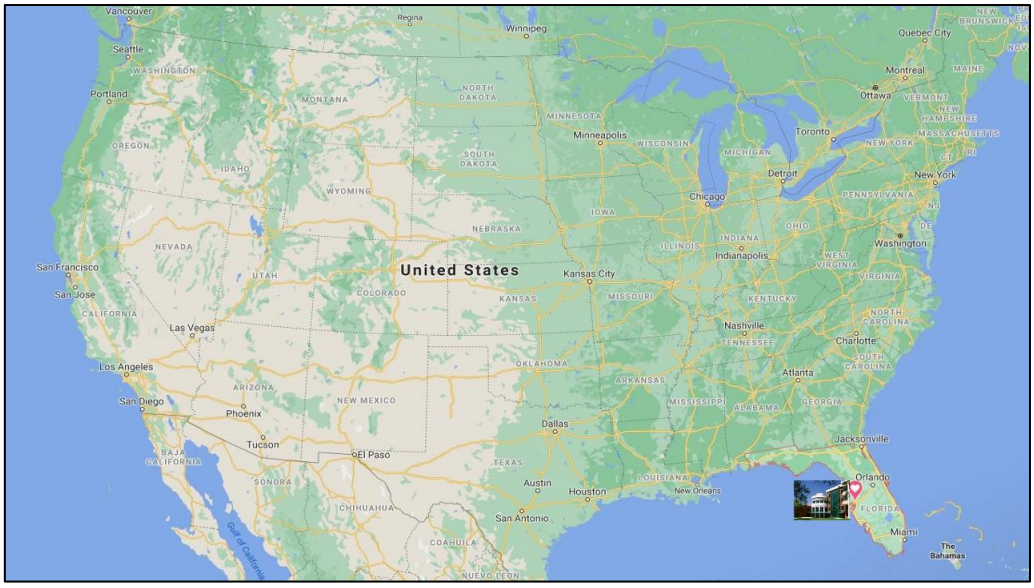
Why Systematic Literature Review (SRL) in Education? 10 STEP roadmap to your systematic review, 1. Planning and managing a review project, 2. Performing scoping searches, indentifing the review questions, and writing your protocol, 3. Literatur searching, 4. Screening titles and abstracts, 5. obtaining papers, 6. Selecting Fulltext paper, 7. Data extraction, 8. Quality Assessment, 9. Analysis and Synthesis, 10. Accessing the quality of your own systematic review.

Systematic Literature Review for Emerging Technology in Education: *Why, What, and How?*

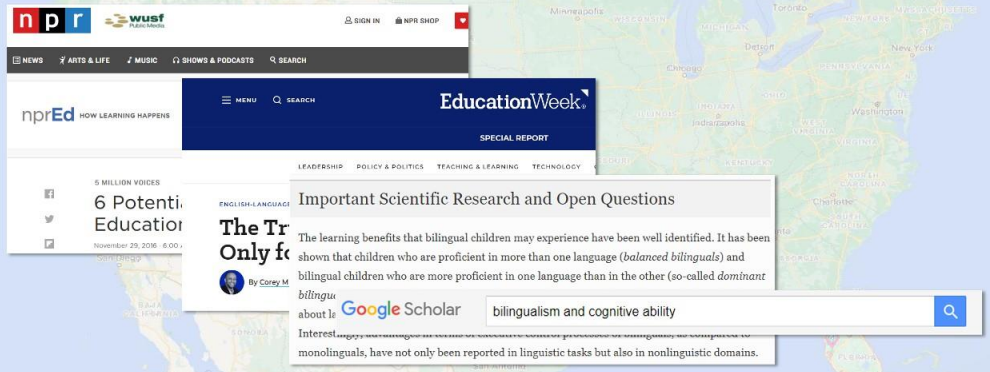
Sanghoon Park

ICoME 2021 Workshop

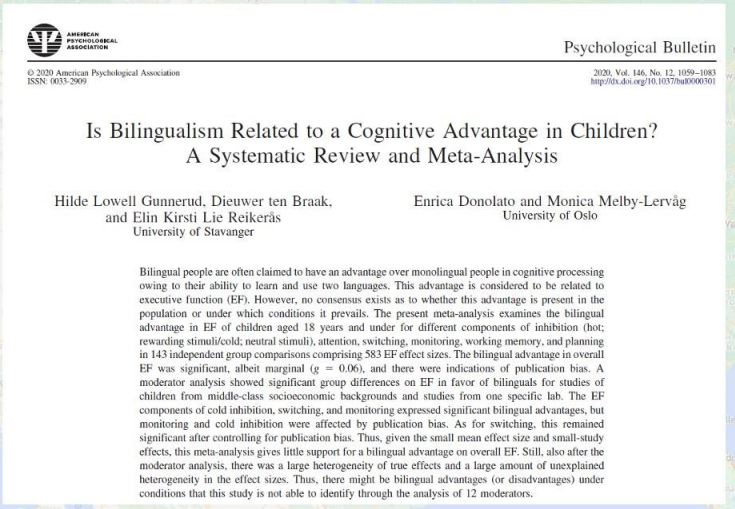
WHY?



Does “Bilingualism” help learn better?



Saalbach, H.,& Kempert, S. (2012) Bilingualism and learning. In Seel N.M. (eds) *Encyclopedia of the Sciences of Learning*. Springer, Boston, MA. https://doi.org/10.1007/978-1-4419-1428-6_349



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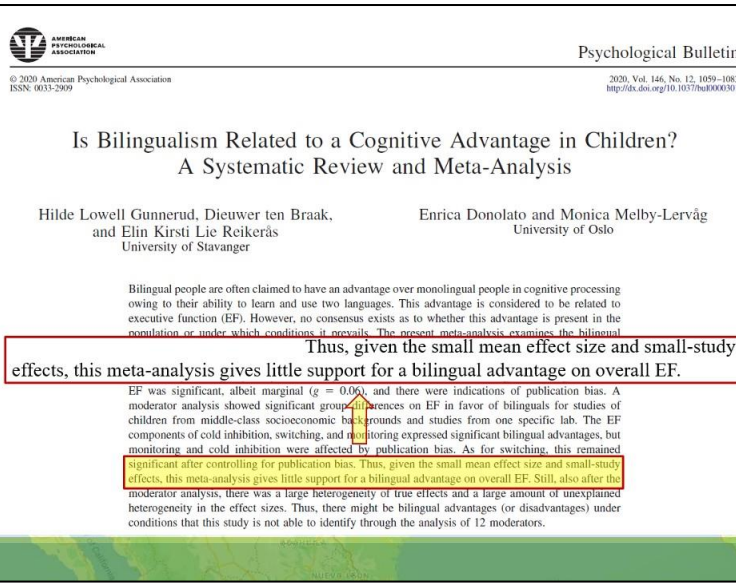
Is Bilingualism Related to a Cognitive Advantage in Children? A Systematic Review and Meta-Analysis

Hilde Lowell Gunnerud, Dieuwer ten Braak, and Elin Kirsti Lie Reikerås
University of Stavanger

Enrica Donolato and Monica Melby-Lervåg
University of Oslo

Bilingual people are often claimed to have an advantage over monolingual people in cognitive processing owing to their ability to learn and use two languages. This advantage is considered to be related to executive function (EF). However, no consensus exists as to whether this advantage is present in the population or under which conditions it prevails. The present meta-analysis examines the bilingual advantage in EF of children aged 18 years and under for different components of inhibition (hot; rewarding stimuli/cold; neutral stimuli), attention, switching, monitoring, working memory, and planning in 143 independent group comparisons comprising 583 EF effect sizes. The bilingual advantage in overall EF was significant, albeit marginal (g = 0.06), and there were indications of publication bias. A moderator analysis showed significant group differences on EF in favor of bilinguals for studies of children from middle-class socioeconomic backgrounds and studies from one specific lab. The EF components of cold inhibition, switching, and monitoring expressed significant bilingual advantages, but monitoring and cold inhibition were affected by publication bias. As for switching, this remained significant after controlling for publication bias. Thus, given the small mean effect size and small-study effects, this meta-analysis gives little support for a bilingual advantage on overall EF. Still, also after the moderator analysis, there was a large heterogeneity of true effects and a large amount of unexplained heterogeneity in the effect sizes. Thus, there might be bilingual advantages (or disadvantages) under conditions that this study is not able to identify through the analysis of 12 moderators.

Gunnerud, H. L., ten Braak, D., Reikerås, E. K. L., Donolato, E., & Melby-Lervåg, M. (2020). Is bilingualism related to a cognitive advantage in children? A systematic review and meta-analysis. *Psychological Bulletin, 146*(12), 1059-1083. http://dx.doi.org/10.1037/bul0000301



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Hilde Lowell Gunnerud, Dieuwer ten Braak, and Elin Kirsti Lie Reikerås
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Why SRL in Education?

- NECESSARY for research
- Policy/ Decision making
- Technology/intervention promotion
- Journal promotion
- Need for publication (full IRB approval not required – expedited or exempt)

WHAT & HOW?

Systematic Literature Review

Structured research process that seeks to answer a specific research question through the **identification, quality assessment and synthesis of the findings from available research reports**. Meta-Analysis is Statistical method for combining the numerical results of the findings from a number of different studies.

A review of a clearly formulated question that uses **systematic and explicit methods** to **identify, select, and critically appraise relevant research**, and to **collect and analyze data from the studies** that are included in the review. Statistical methods may or may not be used to analyze and summarize the results of the included studies. (Cochrane, 2018)

Systematic ?

- A priori specification of planned review methods/protocol.
- A clearly focused question.
- Clear, explicit criteria for inclusion and exclusion.
- Documentation of search process: sources and strategies.
- Use of tables and boxes to make methods explicit.
- Use of tables to summarize study characteristics.
- An explicit mechanism to handle quality assessment.
- Use of tables and graphics to support interpretation of data.
- Appendices including search strategies, sample data extraction and quality assessment tools.

Booth, A., Sutton, A., & Papaioannou, D. (2016). *Systematic approaches to a successful literature review* (2nd ed.). Thousand Oaks, CA: Sage.

Brief Background

Archie Cochrane (1972) - proposed that any form of healthcare used in the UK National Health Service (NHS) must be properly evaluated and shown to be clinically effective before use.

Interact Cardiovasc Thorac Surg. 2014 Jan; 18(1): 121–124.
Published online 2013 Oct 18. doi: 10.1093/icvts/ivt451
PMCID: PMC3867052
PMID: 24140816

Archibald Cochrane (1909–1988): the father of evidence-based medicine

Antonio Stavrou,[a] Dimitrios Challoumas,[a] and Georgios Dimitrakakis[b,*]

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Cochrane

The Cochrane Collaboration (1992) is an international network of more than 37,000 dedicated people from over 130 countries who work together to help healthcare providers, policymakers, and patients and their advocates and carers make well-informed decisions about healthcare.

Campbell Collaboration

The Campbell Collaboration (2000) focused on reviewing literature to demonstrate the effects of social interventions, particularly in the areas of education, crime, and justice.

Types of Reviews

Narrative reviews: typically prepared by 'experts' to provide an overview of a specific topic, to raise overlooked issues and/or identify information gaps, and to encourage new research.

Consensus statement

Sleep and the athlete: narrative review and 2021 expert consensus recommendations

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ABSTRACT
Elite athletes are particularly susceptible to sleep inadequacies, characterised by habitual short sleep (<7 hours/night) and poor sleep quality (eg, sleep fragmentation). Athletic performance is reduced by a night or more without sleep, but the influence on performance of partial sleep restriction over 1–3 nights, a more real-world scenario, remains unclear. Studies investigating sleep in athletes often suffer from inadequate experimental control, a lack of females and questions concerning the validity of the chosen sleep assessment tools. Research only scratches the surface on how sleep influences athlete health. Studies in the wider population show that habitually sleeping <7 hours/ reviewed, and practical recommendations provided. The following section, entitled sleep and the athlete, covers the influence of sleep inadequacy and sleep extension on athletic performance. We review the evidence that elite athletes are particularly susceptible to sleep inadequacy, for example, during intensified training and in those reporting symptoms of over-reaching and overtraining. The final section, entitled strategies to improve sleep, provides practical recommendations to alleviate the symptoms of jet lag, nutritional strategies to enhance sleep and a toolbox for practitioners to manage and optimise athlete sleep.

A panel of international experts review the current knowledge on sleep and the athlete, briefly covering the background, exploring continued controversies, highlighting fruitful avenues for future research and providing practical recommendations.

Walsh, N.P., Halson, S.L., Sargent, C., et al. (2020). Sleep and the athlete: Narrative review and 2021 expert consensus recommendations. *British Journal of Sports Medicine 0, 1-13.* doi: 10.1136/bjsports-2020-102025

Types of Reviews

Rapid reviews: emerged due to an ever-increasing need for information within a short time frame. Researchers take legitimate shortcuts in order to deliver findings rapidly.

Ultrasound Obstet Gynecol 2020; 55: 586–592
Published online in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/uog.22014.
This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

Coronavirus in pregnancy and delivery: rapid review

E. MULLINS[1], D. EVANS[2,3], R. M. VINER[3,4], P. O'BRIEN[5,6] and E. MORRIS[6,7]

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We conducted a rapid review to guide health policy and management of women affected by COVID-19 during pregnancy, which was used to develop the Royal College of Obstetricians and Gynaecologists' (RCOG) guidelines on COVID-19 infection in pregnancy.

Mullins, E., Evans, D., Viner, R.M., O'Brien, P., Morris, E. (2020). Coronavirus in pregnancy and delivery: Rapid review. *Ultrasound Obstet Gynecol, 55*(5):586-592. doi: 10.1002/uog.22014. PMID: 32180292.

Types of Reviews

Scoping reviews: include the concept of mapping out the evidence base pertaining to a particular research question or topic area.

The Australian Educational Researcher
https://doi.org/10.1007/s13384-020-00409-5

Vulnerable learners in the age of COVID-19: A scoping review

Catherine F. Drane[1] · Lynette Vernon[2] · Sarah O'Shea[1]

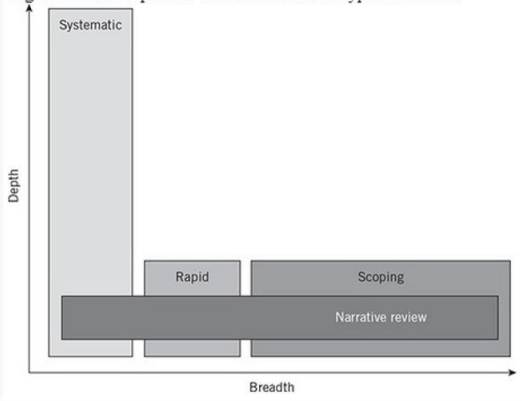
Received: 6 May 2020 / Accepted: 9 September 2020
© The Author(s) 2020

This scoping review provides an overview of COVID-19 approaches to managing unanticipated school closures and available literature related to young people learning outside-of-school.

Drane, C.F., Vernon, L., & O'Shea, S. (2020). Vulnerable learners in the age of COVID-19: A scoping review. *The Australian Educational Researcher*. https://doi.org/10.1007/s13384-020-00409-5

Types of Reviews

Figure 1.1 The depth and breadth of different types of reviews



Boland, A., Cherry, M. G., & Dickson, R. (2017). *Doing a systematic review: A student's guide* (2nd ed.). London: Sage.

1. Planning and managing a review project

Time and Resources:
- Submission deadline and work backwards from then to plan your time.
- How much contribution you can get from others such as SMEs or information specialist.
- Potential collaborators for specific review tasks.
- Tools (bibliographic software, electronic storage, online meeting, etc.).

2. Performing scoping searches, identifying the review questions, and writing your protocol

Review questions tell you your destination.
: Clear, well defined, appropriate, manageable and relevant to the outcomes that you are seeking.

: **Interesting to you!** Motivating and spark your own thoughts and interests.
: **Feasible!** researchable (can be completed to a high standard within the timelines set and resources available), neither too broad nor too narrow, and focus on information that is both available (published or grey literature) and accessible.
: **Contribution!** Helps the academic growth in your field of study.

Review protocol details your proposed route and research.

2. Performing scoping searches, identifying the review question and writing your protocol

How do I develop my review question? (6 steps)

Step 1

Identify a topic area of interest to you.
- Keep your topic area broad and remain open-minded when initially looking at the available evidence.

Step 2

Carry out early scoping searches.
- Has the review that I want to carry out already been published?
- Who are the individuals or groups of researchers / leaders in my topic area of interest?
- How much published literature and information are available in my topic area?

2. Performing scoping searches, identifying the review question and writing your protocol

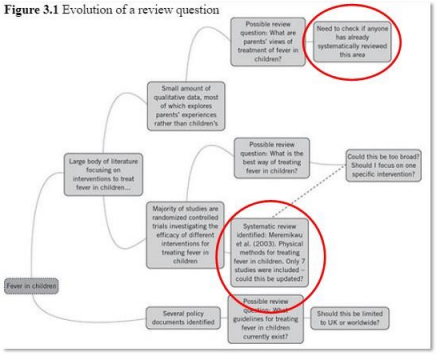
How do I develop my review question? (6 steps)

Step 3

Focus your ideas to define the scope of the review.

- Produce a short summary of your ideas.
- A **mind map** of the results of your earlier scoping searches can be a useful way to summarize your ideas.

Figure 3.1 Evolution of a review question



Boland, A., Cherry, M. G., & Dickson, R. (2017). *Doing a systematic review: A student's guide* (2nd ed.). London: Sage.

2. Performing scoping searches, identifying the review question and writing your protocol (examples)

Each study provides valuable insight into the learning advantages that this technology might provide in its application field, and some reviews have synthesized the results of previous studies to identify broader research trends (Akçayır & Akçayır, 2017; Bacca et al., 2014; Radu, 2014). However, there are few recent studies providing comprehensive explanations of the educational effects and implications of AR in the STEM fields (Cheng & Tsai, 2013). To fill this gap, this study systematically reviews and synthesizes the relevant literature, and analyzes the main tendencies and uses of AR in educational STEM settings together with its advantages and limitations in terms of providing insights for helpful AR design features and promising instructional processes to be included in future AR STEM learning environments

Ibáñez, M., & Delgado-Kloos, C. (2018). Augmented reality for STEM learning: A systematic review. *Computers & Education, 123*. 109-123. https://doi.org/10.1016/j.compedu.2018.05.002

We did not identify any existing systematic reviews on the effectiveness of later school start times. We have, however, identified non-systematic reviews and summaries as well as systematic reviews on related topics. For instance, the Evidence for Policy and Practice Information and Coordinating Centre (EPPI-Centre) at the Social Science Research Unit, Institute of Education, University of London recently completed a review on the effects of block scheduling (one form of class scheduling) on students. As part of this review,

. None of these previous studies or reviews has provided a comprehensive, systematic picture of the effectiveness of later school start times for improving the education, health, or well-being of high school students

Marx, R., Tanner-Smith, E.E., Davison, C.M., Ufholz, L-A., Freeman, J., Shankar, R., Newton, L., Brown, R.S., Parpia, A.S., Cozma, I., & Hendrikx, S. (2017). Later school start times for supporting the education, health, and well-being of high school students. *Campbell Systematic Reviews, 15*.

2. Performing scoping searches, identifying the review question and writing your protocol

How do I develop my review question? (6 steps)

A systematic review question can be:

- **Descriptive:** What are the trends in….
- **Normative** (exploring preferences about what should happen): How do students perceive..
- **Observational or relational** (investigating a relationship between two or more variables): Is there a relationship between..
- **Causal** (investigating the effect of one or more independent variables on one or more outcome variables): Do students-centered learning interventions have an impact on friend relationship and learning achievement?
- **Theoretical** (exploring factors that cause a condition, event or process): : What reasons do high school teachers give for non-compliance with school policy?

2. Performing scoping searches, identifying the review question and writing your protocol (examples)

1. What are the general characteristics and specific design features of AR-based learning applications for STEM-AR studies?
2. What are the instructional processes followed by STEM-AR studies?
3. What are the measured outcomes addressed in AR for STEM learning studies?

Ibáñez, M., & Delgado-Kloos, C. (2018). Augmented reality for STEM learning: A systematic review. *Computers and Education, 123*. 109-123. https://doi.org/10.1016/j.compedu.2018.05.002

To assess the effects of a later school start time for supporting health, education, and well-being in high school students.

Secondary objectives were to explore possible differential effects of later school start times in student subgroups and in different types of schools; to identify implementation practices, contextual factors, and delivery modes associated with positive and negative effects of later start times; and to assess the effects of later school start times on the broader community (high school faculty and staff, neighborhood, and families).

Marx, R., Tanner-Smith, E.E., Davison, C.M., Ufholz, L-A., Freeman, J., Shankar, R., Newton, L., Brown, R.S., Parpia, A.S., Cozma, I., & Hendrikx, S. (2017). Later school start times for supporting the education, health, and well-being of high school students. *Campbell Systematic Reviews, 15*.

2. Performing scoping searches, identifying the review question and writing your protocol (examples)

Meta-analysis research questions

Our first aim was to conduct three meta-analyses to examine the average effect of a flipped classroom on assessed learning outcomes, perceived learning outcomes, and student satisfaction in comparison with a traditional classroom.
Our second aim was to conduct moderator analyses to investigate if variety of effects between studies can be explained by instructional design characteristics, educational context, or study quality characteristics.

Altenm D.C.D., Phielix, C., Janssen, J., & Kester, L. (2019). Effects of flipping the classroom on learning outcomes and satisfaction: A meta-analysis. *Educational Research Review, 28*. https://doi.org/10.1016/j.edurev.2019.05.003

1. What is the effect of scaffolding on learning outcomes in an online learning environment?
2. To what extent do the effects of scaffolding influence learning outcomes based on the scaffolding purposes and sources?

Doo, M. Y., Bonk, C., & Heo, H. (2020). A meta-analysis of scaffolding effects in online learning in higher education. *The International Review of Research in Open and Distributed Learning, 21*(3), 60-80. https://doi.org/10.19173/irrodl.v21i3.4638

2. Performing scoping searches, identifying the review question and writing your protocol

How do I develop my review question? (6 steps)

Step 4

Finalize your review question and develop your inclusion and exclusion criteria.

- Inclusion criteria describe the specific attributes that a study must have if it is to be included in your review (aka. eligibility criteria).
- Exclusion criteria describe the specific attributes that *disqualify* a study from inclusion in your review.
- Development of your inclusion/exclusion criteria and review question often occur in parallel (complementary rather than separate tasks).
- Generate a **PICO** table (**P**opulation, **I**ntervention, **C**omparator, and **O**utcome) + (**S**tudy design and **S**etting) = **PICOSS.**
- Pay attention to **Language bias / Publication bias**.

2. Performing scoping searches, identifying the review question and writing your protocol (examples)

Table 1
Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
(a) Published between January 2010 and August 2017.	(a) Studies that mentioned the term "augmented reality" but were about "virtual reality" or "mixed reality".
(b) Peer-reviewed journal article.	(b) Used for professional learning (e.g., teacher education).
(c) Available in full-text.	(c) Emphasized application design and development as opposed to students' outcomes.
(d) Empirical research.	
(e) Related to science learning.	
(f) Described applications for augmented reality in science education as primary component.	

Ibáñez, M., & Delgado-Kloos, C. (2018). Augmented reality for STEM learning: A systematic review. *Computers & Education, 123*. 109-123. https://doi.org/10.1016/j.compedu.2018.05.002

2. Performing scoping searches, identifying the review question and writing your protocol (examples)

To achieve these purposes, we identified all of the articles that investigated the flipped classroom model published in all of the Social Sciences Citation Indexed (SSCI) journals to 31 December 2016. The following research questions (RQs) specifically guided this analysis:

RQ1. What advantages of the flipped classroom are indicated in the studies published in the SSCI-indexed journals?
RQ2. What challenges imposed by the flipped classroom are indicated in the studies published in the SSCI-indexed journals?
RQ3. Which activities (in-class and out-of-class) were used in flipped classrooms in the studies published in the SSCI-indexed journals?

Table 1
Advantages of the flipped classroom.

Inductive categories	Sub-categories	*f*	%	Sample research
Learner Outcomes	Improves learning performance	37	52.11	Bhagat et al. (2016)
	Satisfaction	13	18.31	Bösner, Pickert, and Stibane (2015)
	Engagement	10	14.08	Khanova et al. (2015)
	Motivation	7	9.86	Huang and Hong (2016)
	Increases knowledge	7	9.86	Galway et al. (2014)
	Improves critical thinking skills	6	8.45	van Vliet, Winnips, and Brouwer (2015)
	Feeling more confident	5	7.04	Sockalingam et al. (2016)
	Promotes creativity	2	2.82	Al-Zahrani (2015)
	Focus on Problem solving skills	1	1.41	L. Chen, Chen, and Chen (2015)
	Better retention	1	1.41	Liou, Bhagat, and Chang (2016)
	Improves application skills	1	1.41	Liou et al. (2016)
	Improves ICT skills	1	1.41	Huang and Hong (2016)

Akçayır, G., & Akçayır, M. (2018). The flipped classroom: A review of its advantages and challenges. *Computers & Education, 126*, 334-345. https://doi.org/10.1016/j.compedu.2018.07.021

2. Performing scoping searches, identifying the review question and writing your protocol (examples)

5.2.1. Learner outcomes

The advantages in terms of students' learning outcomes (such as satisfaction, engagement, and motivation) are gathered under this category. More than half of the studies (52%) reported that using the flipped model improves the learning performance of students, when measured by GPAs, standardized test scores, and course grades. According to these results, one of the most significant advantages of this model is that it helps to improve learning performance, which is one of the key elements of quality education.

7. Limitations

In this review, specific criteria were used to search the SSCI database for relevant studies to be examined. This scientific approach allowed us to capture a strongly representative selection of studies on the flipped classroom model. However, different search criteria might yield slightly different selection/data results. For example, if conference papers were to be analyzed, the reported advantages and challenges might be different. Thus, further research is needed to review the flipped classroom model using different selection criteria.

Akçayır, G., & Akçayır, M. (2018). The flipped classroom: A review of its advantages and challenges. *Computers & Education, 126*, 334-345. https://doi.org/10.1016/j.compedu.2018.07.021

2. Performing scoping searches, identifying the review question and writing your protocol

How do I develop my review question? (6 steps)

Step 5

Consider contacting experts in the topic area.
- To ensure that your question is relevant and that you are indeed on the right track in relation to currently accepted practice.

Step 6

Write a review protocol.
- Results of scoping searches can help you to describe the quality and quantity of relevant evidence available.
- It is important to make a case for why your review question is important and needs to be addressed.
- Clearly stated inclusion and exclusion criteria are essential to the successful completion of your review.

2. Performing scoping searches, identifying the review question and writing your protocol

TABLE 3.3 Example of a protocol structure

Title	Content
Background, including summary of existing literature	This section can be developed from the results of your scoping search. It should provide a context for your review, and should include a discussion of relevant literature. However, it should generally not make specific reference to any of the studies that you are likely to include in your review. This section should end with a rationale explaining why your review question is important and why it needs to be addressed. This text can eventually form the background section of your thesis.
Research question	You should present your research question in as much detail as possible.
Methods	This is the section where you detail what you will do during the review process and how long you think each task will take. Under the heading of search strategy, we recommend that you describe the resources that you want to search and give summary details of how you will look for published literature (e.g. journal articles and conference proceedings) and, if appropriate, unpublished or grey literature (e.g. registry data and government reports). In a protocol, you don't have to list all the specific search terms you used; however, it is good practice to provide one example search strategy in an appendix. It should then clearly state your inclusion and exclusion criteria; it can also be helpful to reproduce your PICO/PICOSS table, if appropriate, in your protocol. Finally, this section should go on to describe what data will be extracted, how data will be quality assessed, who will do each task and how the data will be analysed. If you plan to carry out a meta-analysis then you need to think about subgroups and heterogeneity in advance. It's also helpful to outline your plans for PPI (if relevant) in your protocol, together with details of how you plan to disseminate the findings of your review.
Search strategy	
Inclusion and exclusion criteria	
Screening and selection	
Data extraction	
Quality assessment	
Data analysis	
Patient and public involvement	
Dissemination plan	
Time frame	You should include a plan of how long you anticipate that each important review activity will take. Chapter 2 may help you to set realistic timelines for your review.

Boland, A., Cherry, M. G., & Dickson, R. (2017). *Doing a systematic review: A student's guide* (2nd ed.). London: Sage.

2. Performing scoping searches, identifying the review question and writing your protocol

Registry for systematic literature review and meta-analysis

2. Performing scoping searches, identifying the review question and writing your protocol

PRISMA is an evidence-based minimum set of items for reporting in systematic reviews and meta-analyses. PRISMA focuses on the reporting of reviews evaluating randomized trials but can also be used as a basis for reporting systematic reviews of other types of research, particularly evaluations of interventions.

Moher *et al. Systematic Reviews* 2015, 4:1
http://www.systematicreviewsjournal.com/content/4/1/1

SYSTEMATIC REVIEWS

RESEARCH Open Access

Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement

David Moher[1*], Larissa Shamseer[1], Mike Clarke[2], Davina Ghersi[3], Alessandro Liberati[4], Mark Petticrew[4], Paul Shekelle[5], Lesley A Stewart[6] and PRISMA-P Group

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item
ADMINISTRATIVE INFORMATION		
Title:		
Identification	1a	Identify the report as a protocol of a systematic review
Update	1b	If the protocol is for an update of a previous systematic review, identify as such
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number
Authors:		
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments
Support:		
Sources	5a	Indicate sources of financial or other support for the review
Sponsor	5b	Provide name for the review funder and/or sponsor
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol
INTRODUCTION		
Rationale	6	Describe the rationale for the review in the context of what is already known
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)
METHODS		
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated
Study records:		
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review

http://www.prisma-statement.org/documents/PRISMA-P-checklist.pdf

Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall's τ)
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.

http://www.prisma-statement.org/documents/PRISMA-P-checklist.pdf

Systematic Literature Review Planning Guide

(1) Name:

(2) Literature review topic:

(3) Research Question(s) for the systematic literature review:

(4) Rationale (why this research question(s) is important, cite and list potential references if possible):

(5) Inclusion and exclusion criteria (what will be included and excluded, e.g., Are you limiting your review to higher education or higher school only or will you include all grade level? If you are interested in the effects of technology integration, are you including all types of technologies or are you including only certain types? If so, what types will be included in your review? What type of studies will you include? Will you include conference papers or only published journal articles? What type of outcome measures are you including, attitudes, achievement, performance, learning processes, interests, etc.? Are you limiting the publication year, say last 10 years?):

3. Literature searching

How to conduct literature searching? (6 steps)

Step 1

Think about how comprehensive your search needs to be.

- A pragmatic approach to searching by considering specificity (it identifies the relevant evidence) and sensitivity (it does not identify too many irrelevant sources or pieces of evidence).

Step 2

Consider the different types of evidence available to you.

- Published literature (peer-reviewed journal articles or academic books) bibliographic databases, volumes of specialist journals, reference lists from already retrieved articles.
- Grey literature (vast array of evidence *not* controlled by commercial publishers) legislation, government documents or databases, annual reports, bulletins, statistics, dissertations or theses, **conference proceedings** and research registers of ongoing or unpublished studies.

3. Literature searching

What is the most relevant evidence for your review question?

TABLE 4.1 Strengths and limitations of searching for published and grey literature

	Published literature	Grey literature
Pros	• Easier to locate • Easier to systematically and transparently search • Easier to clearly report results in thesis • Easier to transfer results of search to reference management software • Usually peer reviewed	• Allows access to diverse evidence sources • Reduces risk of publication bias • Often not limited by restricted word count • Searches can identify ongoing or unpublished studies
Cons	• Data might be limited • Risk of publication bias	• Harder to locate • Peer-review status is often unclear, and therefore evidence may be more likely to be biased • Harder to search systematically and transparently • Harder to store results of searches • Harder to clearly report methods in thesis

Boland, A., Cherry, M. G., & Dickson, R. (2017). *Doing a systematic review: A student's guide* (2nd ed.). London: Sage.

3. Literature searching

How to conduct literature searching? (6 steps)

Step 3

Identify the specific bibliographic databases that you will search for evidence.

- The majority of systematic reviews rely on bibliographic databases as their primary data source.

Database	Platform/interface
Multidisciplinary	
British Library Archives	http://searcharchives.bl.uk
Copac*	http://copac.ac.uk/
Google Scholar*	scholar.google.com/
JSTOR	www.jstor.org/
Library of Congress Catalogue	https://catalog.loc.gov/vwebv/searchBrowse
ProQuest Dissertations & Theses (PQDT)	ProQuest
Scopus	SciVerse
Web of Science (formally Web of Knowledge)	Thomson Reuters
Zetoc*	http://zetoc.mimas.ac.uk

3. Literature searching

How to conduct literature searching? (6 steps)

Step 4

Identify and refine your key search terms.

- Choose key search terms and refine these until you arrive at a final search strategy.

Boolean operators: AND, OR, NOT

- education AND university
- education OR university
- education NOT university

Year, Language

'wildcards' (commonly a question mark (?), an asterisk (*) or a symbol such as '$') when searching for free-text words

- Search for part of a word ('wom?n' => 'woman' and 'women'; 'psychiatr*' => 'psychiatrist', 'psychiatry' or 'psychiatric')
- Search for a whole word that may have different spellings ('behavi*r' => 'behavior' and 'behaviour');
- Include a search term and its plural ('trial$' => 'trial' and 'trials').

3. Literature searching

How to conduct literature searching? (6 steps)

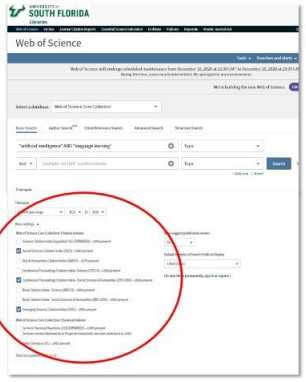
Step 5

Search bibliographic databases using your final search strategies and collate citations.

- Make a note of the number of citations retrieved for each database before exporting them to your reference management software, as you will need to report this information in the 'Results' section of your thesis.
- Copy and paste your search strategies into a separate electronic file so that you know exactly how your search strategies were configured, as you'll need to include this in your 'Methods' section.

3. Literature searching

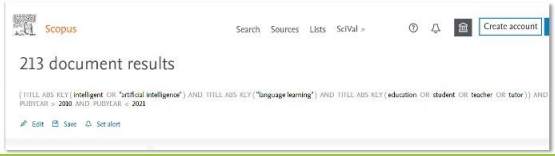
TITLE-ABS-KEY ("artificial intelligence" AND "language learning") AND PUBYEAR > 2010 AND PUBYEAR < 2021



3. Literature searching

TITLE-ABS-KEY ("artificial intelligence" AND "language learning") AND PUBYEAR > 2010 AND PUBYEAR < 2021

(TITLE-ABS-KEY (intelligent OR "artificial intelligence") AND TITLE-ABS-KEY ("language learning") AND TITLE-ABS-KEY (education OR student OR teacher OR tutor)) AND PUBYEAR > 2010 AND PUBYEAR < 2021



3. Literature searching

How to conduct literature searching? (6 steps)

Step 6

Consider complementary searching activities.

- Complementary searching activities such as citation chaining (**snowballing**) by looking at the **bibliography** of one article to find other related articles.
- Using a key reference, check its bibliography to find other relevant research that your search may have missed (**backward searching**). Alternatively, check citation record by using a database such as Web of Science (using the 'Cited Reference Search') or a search engine such as Google Scholar (**forward searching**).
- Contacting relevant researchers in the field (researchers who publish widely in the topic area).

3. Literature searching

What to report in the "Method" section?

- The date that each search was carried out (including scoping searches, if any),
- The version of each bibliographic database searched (Scopus 2010- present),
- All of the search terms used for each specific search,
- Any complementary search activities, such as contacting experts or performing hand searching or citation chaining,
- The bibliographic software that was used to store and manage the results of your searches.

3. Literature searching (examples)

What to report in the "Method" section?

3. Method

3.1. The manuscript selection process

To find relevant literature sources, seven well-known online research databases were used which are related to education and technology (ACM Digital Library, ERIC, IEEExplore, ISI Web of Science, ScienceDirect, Scopus, and Springer), using the query string: "augmented reality" AND (education OR learning) AND (STEM OR science OR technology OR engineering OR mathematics). The last search was conducted on 22 August 2017. The search produced 1358 results from previously-used search terms, including 616 duplicates, which were deleted. Titles and abstracts were reviewed to determine whether they were suitable for the purposes of the study. During this examination, a set of inclusion and exclusion criteria were adopted (see Table 1). Authors developed this criteria list by adapting established criteria used in earlier reviews (e.g. Akcayir & Akcayir, 2017; Cheng & Tsai, 2013; Zydney & Warner, 2016) and considering that previous studies (Akcayir & Akcayir, 2017; Zydney & Warner, 2016) already presented complete reviews before 2010. By reviewing titles and abstracts, the number of articles was narrowed down to 112.

Ibáñez, M., & Delgado-Kloos, C. (2018). Augmented reality for STEM learning: A systematic review. *Computers and Education, 123*. 109-123. https://doi.org/10.1016/j.compedu.2018.05.002

3. Literature searching (examples)

What to report in the "Method" section?

After creating the research questions, the second step was started. Two of the biggest databases, Web of Science and Scopus, were scanned with this code;

(TS=("gamification" OR "gamifying" OR "gamified" OR "game dynamics" OR "gameful pedagogy") AND TS=("distance education" OR "distance learning" OR "e-learning" OR "online learning")) AND DOCUMENT TYPES: (Article)

Alturkistani, A., Lam, C., Foley, K., Stenfors, T., Blum, R., Van Velthoven, M.H., Meinert, E. (2020). Massive open online course evaluation methods: Systematic review. *Journal of Medical Internet Research, 22*(4), e13851. DOI: 10.2196/13851

Search Strategy

We searched the following databases for potentially relevant literature from January 2008 to October 2018: (1) Scopus, (2) Education Resources Information Center, (3) IEEE (Institute of Electrical and Electronic Engineers) Xplore, (4) Medical Literature Analysis and Retrieval System Online/PubMed, (5) Web of Science, (6) British Education Index, and (7) Google Scholar search engine. The first search was performed in Scopus. The search words and terms for Scopus were as follows: (mooc* OR "massive open online course" OR coursera OR edx OR odl OR udacity OR futurelearn AND evaluat* OR measur* OR compar* OR analys* OR report* OR assess* AND knowledge OR "applicable knowledge" OR retent* OR impact OR quality OR improv* OR environment OR effect "learning outcome" OR learning). The asterisks after the search terms allow all terms beginning with the same root word to be included in the search. The search terms were then adjusted for each database. The complete search strategy for each database can be found in the protocol by Foley et al [13] and in Multimedia Appendix 2. In addition, we scanned the reference lists of included studies.

Literature search strategies

Search terms used:

Sources (which electronic databases did you use, which journals did you browse? When you use the electronic databases, you can limit the "type of articles or publications" to "research reports" only):

In your initial searches of the electronic databases, how many records were retrieved?

After you are browsing the titles and abstracts, how many remain as potential includes?

How many full text research articles were retrieved as potential includes?

Did you identify and retrieve any **prior reviews and/or major conceptual papers** on the topic? If so, list the articles and the features that they discussed as important:

What **methodology, demographic and substantive features** do you plan to include in your codebook/web form?

4/5/6. Screening titles and abstracts, obtaining papers, Selecting full-text papers

How to choose included studies? (5 steps)

Step 1 **De-duplicate references.**
- Park, S. / Park, S. H./ Park, S-H.

Step 2 **Develop and pilot your screening and selection tool.**
- Create an electronic or paper screening and selection 'tool'.
- Pilot with a fellow researcher.
- Reduces the chances of regular disagreements later in the review about what studies should or should not be included.

4/5/6. Screening titles and abstracts, obtaining papers, Selecting full-text papers

TABLE 5.1 An example of a bespoke screening and selection tool

Review question: What is the clinical effectiveness of different regimens of first-line chemotherapy in addition to radiotherapy for adult patients with locally advanced non-small cell lung cancer?

Inclusion criteria (based on PICOSS):

Population = adult patients aged 18 years or over) with non-small cell lung cancer

Intervention = any chemotherapy + radiotherapy regimen

Comparator = any other chemotherapy + radiotherapy regimen

Outcomes = overall survival, progression-free survival, time to progression, death, adverse events and/or quality of life

Setting = any

Study design = randomized controlled trials (RCTs) only

CHEMOTHERAPY + RADIOTHERAPY SCREENING AND SELECTION TOOL

Reviewer name:		**Date:**
Author name/Study ID:		**Year:**
Title:		**Journal:**
Patient population	**Include**	**Exclude**
	☐ Adult patients aged 18 years or over with non-small cell lung cancer	☐ Adults aged 18 years or under with other cancers ☐ Patients aged under 18 years
Interventions	**Include**	**Exclude**
	☐ Chemotherapy + radiotherapy regimen	☐ Chemotherapy only ☐ Radiotherapy only
Comparators	**Include**	**Exclude**
	☐ Chemotherapy + radiotherapy regimen	☐ Chemotherapy only ☐ Radiotherapy only
Outcomes	**Include if one of more of:**	**Exclude**
	☐ Overall survival ☐ Progression-free survival ☐ Time to progression ☐ Death ☐ Adverse events ☐ Quality of life	☐ Does not report any outcome specified in inclusion criteria
Study design	**Include** ☐ RCT	**Exclude** Any study design other than RCT
Overall decision	☐ **INCLUDED**	☐ **EXCLUDED**
Notes		

Boland, A., Cherry, M. G., & Dickson, R. (2017). *Doing a systematic review: A student's guide* (2nd ed.). London: Sage.

4/5/6. Screening titles and abstracts, obtaining papers, Selecting full-text papers

How to choose included studies? (5 steps)

Step 3

Screen all titles and abstracts identified via searches against your inclusion and exclusion criteria.

- Applying your inclusion and exclusion criteria to the title and abstract in order to determine whether the study appears relevant to your review question.
- If unclear, it is always safest to include it.
- Note of any references that are useful and that can be used to inform the 'Introduction' or 'Discussion' sections.
- Each reference should be dual screened (you and a fellow researcher) independently and discuss/resolve any discordant opinions as they arise.
- Do it alone? - screen your titles and abstracts, put the results to one side, and repeat this process a few days (or weeks) later, reflecting upon and resolving any discrepancies.

4/5/6. Screening titles and abstracts, obtaining papers, Selecting full-text papers

How to choose included studies? (5 steps)

Step 4

Obtain the full-text papers of all potentially eligible references.

- Library service / Bibliographic program such as EndNote.
- Contact the author – check the author's academic social network – google scholar or Academia.
- What if I still can't get it? - identify which references you have been unable to obtain, as this is a limitation of your review

4/5/6. Screening titles and abstracts, obtaining papers, Selecting full-text papers

How to choose included studies? (5 steps)

Step 5

Use your screening and selection tool to help you identify full-text papers for inclusion in review.

- If a paper is not eligible for inclusion in your review, note the reason you excluded the paper at this stage.
- Have a 'final' set of included papers, it may be worth emailing experts in the topic area to check that you haven't missed any relevant studies.

4/5/6. Screening titles and abstracts, obtaining papers, Selecting full-text papers

What to report in the "Method" section?

- Inclusion and exclusion criteria;
- Detail on the methods by which these were applied to identified citations, and by whom;
- Detail on how disagreements, if any, were resolved between reviewers.

What to report in the "Results" section?

- Number of references identified by each search;
- Number of duplicates removed;
- Number of references you looked at when screening titles and abstracts;
- Number of references you looked at when selecting full-text papers;
- Number of references you excluded and the reasons for exclusion.

4/5/6. Screening titles and abstracts, obtaining papers, Selecting full-text papers (examples)

Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
(a) Published between January 2010 and August 2017. (b) Peer-reviewed journal article. (c) Available in full-text. (d) Empirical research. (e) Related to science learning. (f) Described applications for augmented reality in science education as primary component.	(a) Studies that mentioned the term "augmented reality" but were about "virtual reality" or "mixed reality". (b) Used for professional learning (e.g., teacher education). (c) Emphasized application design and development as opposed to students' outcomes.

The selected articles then were examined by the first author to determine whether they were suitable for the purposes of the study. The second author independently reviewed approximately 20% of the articles to confirm the reliability of the coding method. The intercode agreement rate for coding was 96.6%. Disagreements between the two coders were resolved through discussion and further review of the disputed studies. The articles were downloaded and the methods sections reviewed in order to verify that the articles met the criteria for inclusion in the review. The second author independently reviewed approximately 20% of the downloaded articles. The intercode agreement was initially 97.3%, and this was brought to 100% after discussion. A total of 28 articles met the criteria for inclusion in the final review.

Ibáñez, M., & Delgado-Kloos, C. (2018). Augmented reality for STEM learning: A systematic review. *Computers and Education, 123*. 109-123. https://doi.org/10.1016/j.compedu.2018.05.002

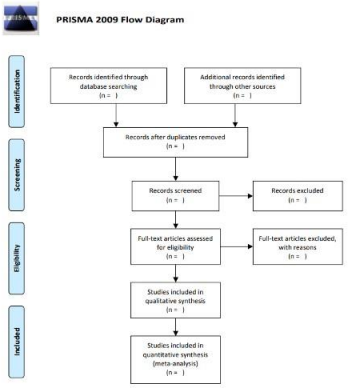
4/5/6. Screening titles and abstracts, obtaining papers, Selecting full-text papers (examples)

Table 2
Number of excluded articles based on the exclusion criteria

Exclusion criteria	Number of articles excluded based on information in	
	Title/abstract	Full text
Review articles, framework analysis	16	2
Written in languages other than English	11	
No reported details related to learning outcomes and assessments in MOOCs	107	25
Focus not on higher education	1	
Duplicates	3	

Wei X., Saab N., & Admiraal W. (2020). Assessment of cognitive, behavioral, and affective learning outcomes in massive open online courses: A systematic literature review, *Computers & Education*, https://doi.org/10.1016/j.compedu.2020.104097.

4/5/6. Screening titles and abstracts, obtaining papers, Selecting full-text papers



4/5/6. Screening titles and abstracts, obtaining papers, Selecting full-text papers (examples)

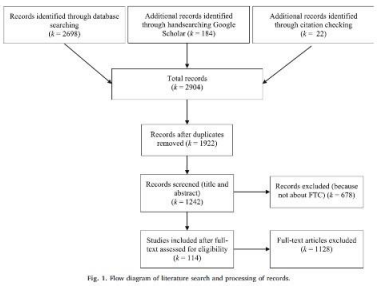
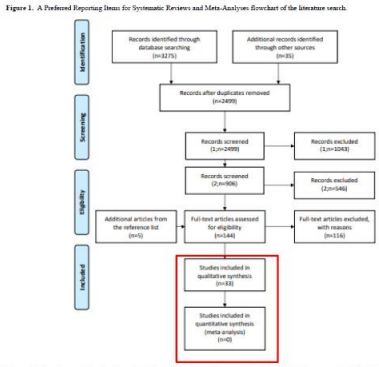


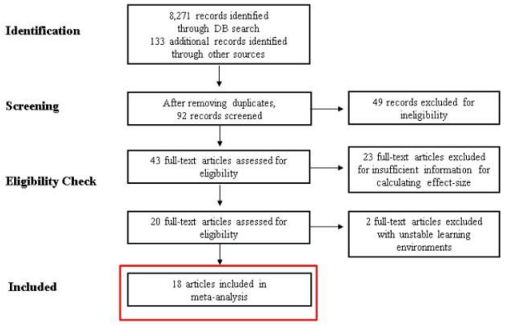
Fig. 1. Flow diagram of literature search and processing of records.

Altenm D.C.D., Phielix, C., Janssen, J., & Kester, L. (2019). Effects of flipping the classroom on learning outcomes and satisfaction: A meta-analysis. *Educational Research Review, 28*. https://doi.org/10.1016/j.edurev.2019.05.003



Alturkistani, A., Lam, C., Foley, K., Stenfors, T., Blum, R., Van Velthoven, M.H., Meinert, E. (2020). Massive open online course evaluation methods: Systematic review. *Journal of Medical Internet Research, 22*(4), e13851. DOI: 10.2196/13851

4/5/6. Screening titles and abstracts, obtaining papers, Selecting full-text papers (examples)

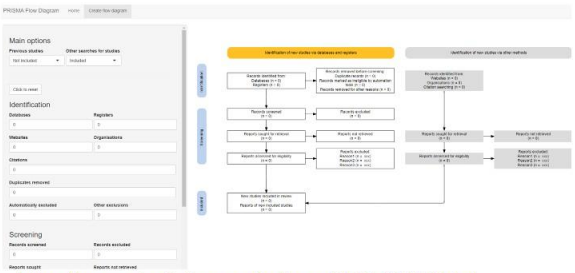


Doo, M. Y., Bonk, C., & Heo, H. (2020). A meta-analysis of scaffolding effects in online learning in higher education. *The International Review of Research in Open and Distributed Learning*, *21*(3), 60-80. https://doi.org/10.19173/irrodl.v21i3.4638

4/5/6. Screening titles and abstracts, obtaining papers, Selecting full-text papers (examples)

PRISMA
TRANSPARENT REPORTING OF SYSTEMATIC REVIEWS AND META-ANALYSES

http://www.prisma-statement.org/PRISMAStatement/FlowDiagram



https://www.eshackathon.org/software/PRISMA2020.html

7. Data extraction

How to extract and report data from studies? (5 steps)

Step 1

Identify the data that you want to extract.

- Primarily interested in two types of data: descriptive data (study characteristics) and analytical data (outcomes).
- Compile a list of all data that help summarize, describe and interpret the results of included studies.
- Plan to extract more, rather than less data.

Step 2

Build and pilot your data extraction form or data extraction table(s).

- Pilot your data extraction form/table(s) using at least two or three of your included studies. (to ascertain how easy the process is and also to check whether all the necessary data are being captured)
- Include a check on whether both reviewers share the same understanding of extraction table(s) and the data that need to be collected.

7. Data extraction

Tips to design a data extraction table(s)

- ✓ Having **a unique identification number for each study** and paper, particularly where there are many studies by the same authors.
- ✓ If a study has linked publications, record information about these (**study author, year of publication, journal or other source where published**), even if you do not extract data from these papers.
- ✓ Extract study characteristics data, including:
  - ✓ study design;
  - ✓ where and when the study was conducted;
  - ✓ the study's inclusion and exclusion criteria;
  - ✓ number of participants (including any dropouts);
  - ✓ intervention(s) and comparator(s), if appropriate;
  - ✓ study outcomes (including which were primary outcomes and which were secondary outcomes, and which were pre-specified);
  - ✓ analyses;
  - ✓ number of participants included in analyses;
  - ✓ length of follow-up (if appropriate);
  - ✓ study sponsorship.
- ✓ Extract participants' **demographic information**. This may vary depending on your review question, but should include, as a minimum, participants' age, sex and ethnicity. Specific demographic characteristics may also be required; for example, participants' religion, educational level, socio-economic status or mental or physical health diagnoses.
- ✓ For certain study designs (such as randomized controlled trials), you should extract **baseline participant data** (if your review investigates the effects of an educational intervention on participants' reading ability, then it will be important to know **pre-intervention reading proficiency**).

7. Data extraction

How to extract and report data from studies? (5 steps)

Step 3

Extract relevant data.

- Simply copy and paste relevant data into your data extraction forms (saves time and reduces the chances of making data-entry errors).
- Aware of potential stylistic differences between papers. a mean and standard deviation may be presented as '64 (12)' in one paper and '64 ± 12' in another.
- Two people would independently carry out data extraction, and then meet to discuss any discordant opinions to minimize data extraction errors.
- If working independently, put data aside for a week or so and then redo your data extraction, cross-checking that both sets of extracted data are the same.
- Contacting authors for further information and clarification can improve the quality of your review

7. Data extraction

How to extract and report data from studies? (5 steps)

Step 4

Complete the data tables.

- Study Characteristics table (e.g. study name, date of publication, study design, study population, country, follow-up, outcomes, study sponsorship/funder(s)).
- Participant Characteristics' table (e.g. mean age, sex, specific participant characteristics of interest).
- Study Results table (e.g. primary outcomes, secondary outcomes and statistical analyses; numerical data in your review).

Step 5

Report your extracted data.

- Narrative synthesis simply refers to any presentation of results using words only (with reference to your data tables).
- Begin by presenting a summary of descriptive data for all of the included studies in a series of tables.
- Might want to investigate your data using quantitative synthesis (e.g. meta-analysis) but a systematic review does not necessarily require one.

7. Data extraction (examples)

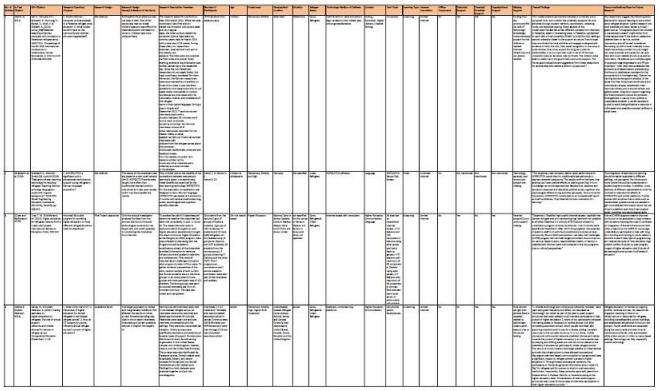
Article coding and analyses

Each article was coded based on its research methodology, participant information and demographics, substantive features, support offered or needed, findings and future implications. Each of these general headings was then disaggregated further into subcategories to obtain a more holistic understanding of refugee education around the world and how technology impacts refugee learning. The primary focus was on education and how technology was supportive of refugee populations achieving their academic goals. It was essential to discover if the current research considered both online and offline capabilities and used different types of technology depending on the content being taught. In the support offered or needed category, the support that was available or not available for refugees was listed. In the final section of the codebook, the focus was on the findings and identified gaps in the research and the implications, according to the reviewed studies, for future research.

Each study was read and coded separately by the authors of this review. To ensure reliability, the authors met and had multiple meetings to agree on exact coding terms. Consultations with an experienced researcher were held in face to face meetings and multiple e-mails as part of the ongoing iterations until the final codebook was agreed upon by the authors. In order to synthesize the data collected in the final codebook, the authors reviewed the research questions and refined them. Multiple discussions were held to determine which of aggregated data would best answer the research questions completely.

Taftaf, R., & Williams, C. (2020). Supporting refugee distance education: A review of the literature. *American Journal of Distance Education, 34*(1), 5-18, DOI: 10.1080/08923647.2020.1691411

7. Data extraction (examples)



Taftaf, R., & Williams, C. (2020). Supporting refugee distance education: A review of the literature. *American Journal of Distance Education, 34*(1), 5-18. DOI: 10.1080/08923647.2020.1691411

7. Data extraction (examples)

Table 2
Background information on reviewed articles.

Primary author (year of publication)	Science domain	Educational level	Educational context	No. of students	Duration of instruction
Akçayır et al. (2016)	Physics	Higher education	In-class (Laboratory)	76	15 h
Bursztyn et al. (2017)	Earth Sciences	High school	Out-of-class	874	20 min
Cai et al. (2017)	Physics	Middle	In-class	42	1 h
Cascales-Martínez et al. (2017)	Mathematics	Primary	In-class	22	9 h
Chen et al. (2016)	Life Sciences	Primary	In-class	71	180 min
Chen and Wang (2015)	Earth Sciences	Middle	In-class	144	55 min
Chiang et al. (2014)	Life Sciences	Elementary	In-class	57	120 min
Cuendet et al. (2013)	Mathematics (Geometry)	Technical	In-class	24	90 min
Dünser et al. (2012)	Physics	Middle	In-class	10	18 min
Enyedy et al. (2015)	Physics	Elementary	In-class	43	15 weeks
Estapa and Nadolny (2015)	Mathematics	Higher education	In-class	61	–
Frank and Kapila (2017)	Physics	Higher education	In-class (Laboratory)	75	10 min
Gopalan et al. (2015)	Multidisciplinary	Middle	In-class	70	–
Gutiérrez de Ravé et al. (2016)	Mathematics (Geometry)	Higher education	In-class	20	–
Huang et al. (2016)	Life Sciences	Middle	Out-of-class (botanical garden)	21	8 h
Ibáñez et al. (2014)	Physics	High school	In-class	64	40 min
Ibáñez et al. (2016)	Physics	Middle	In-class	82	100 min
Kamarainen et al. (2013)	Life Sciences	Middle	In-class	71	35 h
Lin et al. (2015)	Mathematics (Geometry)	Middle	In-class	76	–
Liou et al. (2016)	Life Sciences	Higher education	Out-of-class	92	18 weeks
Martín-Gutiérrez et al. (2010)	Mathematics (Geometry)	Higher education	In-class	24	9 h
Salmi et al. (2017)	Physics	Middle	Out-of-class (science museum)	146	1 month
Sommerauer and Müller (2014)	Mathematics	Primary, middle, high school	Out-of-class (science museum)	101	90 min
Tarng et al. (2015)	Life Sciences	Middle	Out-of-class (campus butterfly garden)	120	6 weeks
Tarng et al. (2016)	Earth Sciences	Elementary	In-class	56	1 month
Wang et al. (2014)	Physics	Higher education	In-class	40	15 min
Yoon et al. (2017)	Physics	Middle	Out-of-class (science museum)	58	11 min
Zimmerman et al. (2016)	Life Sciences	Elementary, families	Out-of-class (nature center)	42	7 weeks

Ibáñez, M., & Delgado-Kloos, C. (2018). Augmented reality for STEM learning: A systematic review. *Computers and Education, 123*. 109-123. https://doi.org/10.1016/j.compedu.2018.05.002

7. Data extraction (examples)

Table 3
General characteristics of augmented reality applications.

Primary author (year of publication)	Building tools	AR Features	Type	Assets
Akçayır et al. (2016)	Metaio	Image-based (markers)	Simulator	Text, video, animations
Bursztyn et al. (2017)	Native app. (Android, iOS)	Location-based	Game	Text, images, videos
Cai et al. (2017)	Native app. (3D modeling tool 3DS Max and graphics engine Java 3D)	Image-based (Kinect RGB camera)	Simulator	Animations
Cascales-Martínez et al. (2017)	Native app. (TUIO protocol)	Image-based (video projector and two cameras)	Game	Text
Chen et al. (2016)	Not specified	Image based	Exploration	Text, image, 3D model
Chen and Wang (2015)	Not specified	Image-based (turntable, PC, webcam)	Simulator	Image
Chiang et al. (2014)	Native app. (iOS)	Location-based	Exploration	Image, text, websites
Cuendet et al. (2013)	Not specified	Image-based (markers)	Simulator	Image
Dünser et al. (2012)	Native app.	Image-based	Exploration	Text, video, animations
Enyedy et al. (2015)	Not specified	Image-based (markers)	Simulator	Video
Estapa and Nadolny (2015)	Layar Creator	Location-based	Exploration	Video, websites, audio, image
Frank and Kapila (2017)	Native app. (iOS)	Image-based (markers)	Exploration	Video, text
Gopalan et al. (2015)	Not specified	Image-based	Exploration	Text, image, video
Gutiérrez de Ravé et al. (2016)	Vuforia	Image-based	Exploration	3D model
Huang et al. (2016)	Not specified	Location-based	Exploration	Text, image
Ibáñez et al. (2014)	Unity 3D, Vuforia	Image-based	Simulator	Text, image, animation
Ibáñez et al. (2016)	Unity 3D, Vuforia	Image-based	Simulator	Text, image, animation
Kamarainen et al. (2013)	FreshAIR, Vuforia	Location-based	Exploration	Text, image, audio, video
Lin et al. (2015)	Not specified	Image-based (markers)	Exploration	3D object
Liou et al. (2016)	Unity 3D, Vuforia	Image-based (markers)	Exploration	3D object, animation, video, audio
Martín-Gutiérrez et al. (2010)	Native app.	Image-based	Exploration	3D object
Salmi et al. (2017)	Not specified	Not specified	Simulator	Not specified
Sommerauer and Müller (2014)	Aurasma	Image-based	Exploration	Video
Tarng et al. (2015)	Native app. (Android)	Location-based	Simulator	3D model, animation
Tarng et al. (2016)	Native app. (Android)	Location-based	Simulator	3D model, animation
Wang et al. (2014)	Native app.	Image-based (markers)	Simulator	Text, 3D model, animation
Yoon et al. (2017)	Native app.	Image-based	Simulator	Animation
Zimmerman et al. (2016)	Native app.	Image-based	Exploration	Text, images

Ibáñez, M., & Delgado-Kloos, C. (2018). Augmented reality for STEM learning: A systematic review. *Computers and Education, 123*. 109-123. https://doi.org/10.1016/j.compedu.2018.05.002

7. Data extraction (examples)

Table 4
Instructional processes followed in the reviewed articles.

Primary author (year of publication)	Instructional strategies	Learner characteristics considered	Instructional techniques
Alçayır et al. (2016)	Discovery	ICT competences	Inquiry
Bursztyn et al. (2017)	Discovery	Student major Student initial interest in the topic Gender	Game
Cai et al. (2017)	Presentation	Student's physics achievements	Observation
Cascales-Martínez et al. (2017)	Cooperative/Collaborative	Students with special needs	Game
Chen et al. (2016)	Discovery	–	Concept map
Chen and Wang (2015)	Cooperative/Collaborative	Learning style ICT competences	Inquiry
Chiang et al. (2014)	Cooperative/Collaborative (field trip)	–	Observation
Cuendet et al. (2013)	Cooperative/Collaborative	–	Structured observation
Dünser et al. (2012)	Presentation	–	Observation
Enyedy et al. (2015)	Cooperative/Collaborative	–	Inquiry
Estapa and Nadolny (2015)	Discovery	–	Structured observation
Frank and Kapila (2017)	Presentation	–	Inquiry
Gopalan et al. (2015)	Presentation	–	Structured observation
Gutiérrez de Ravé et al. (2016)	Presentation	–	Structured observation
Huang et al. (2016)	Discovery	–	Field trip
Ibáñez et al. (2014)	Discovery	ICT competences	Structured observation
Ibáñez et al. (2016)	Discovery	Previous knowledge	Inquiry
Kamarainen et al. (2013)	Discovery (field trip)	–	Role-play
Lin et al. (2015)	Presentation	Low/medium/high-performing students	Observation
Liou et al. (2016)	Presentation	–	Observation
Martín-Gutiérrez et al. (2010)	Presentation	–	Structured observation
Salmi et al. (2017)	Discovery	Low/medium/high-performing students Gender	Inquiry
Sommerauer and Müller (2014)	Discovery	–	Observation
Tarng et al. (2015)	Discovery	–	Inquiry
Tarng et al. (2016)	Discovery	–	Observation
Wang et al. (2014)	Cooperative/Collaborative	–	Inquiry
Yoon et al. (2017)	Discovery	–	Inquiry
Zimmerman et al. (2016)	Cooperative/Collaborative	–	Observation

Ibáñez, M., & Delgado-Kloos, C. (2018). Augmented reality for STEM learning: A systematic review. *Computers and Education, 123*. 109-123. https://doi.org/10.1016/j.compedu.2018.05.002

7. Data extraction (examples)

Table 5
Research purposes, methods, and outcomes.

Primary author (year of publication)	Research purpose				Research approach	Affective outcomes	Cognitive outcomes	Problems reported
	A	C	D	L				
Alçayır et al. (2016)	X			X	Mixed method (quasi-experimental study; interpretative study)	Satisfaction Motivation Enjoyment Attitude	Remembering information	Students need to be tra technology
Bursztyn et al. (2017)	X	X			Quasi-experimental study	Motivation	Remembering information	–
Cai et al. (2017)				X	Quasi-experimental study	Attitude	Remembering information	Students need to be tra technology System instability System too slow Lack of user-friendly in
Cascales-Martínez et al. (2017)	X	X		X	Quasi-experimental study	Motivation	Applying knowledge	–
Chen et al. (2016)				X	Experimental design	Motivation Attitude	Understanding	–
Chen and Wang (2015)	X			X	Mixed method (quasi-experimental study; interpretative study)	Enjoyment	Self-evaluate progress	–
Chiang et al. (2014)	X			X	Content analysis	Engagement Immersion	Creating knowledge	–
Cuendet et al. (2013)				X	Interpretative study	–	Understanding	–
Dünser et al. (2012)			X	X	Quasi-experimental study	–	Remembering information	–
Enyedy et al. (2015)	X			X	Case study	Engagement	Creating knowledge	–
Estapa and Nadolny (2015)	X			X	Quasi-experimental study	Motivation	Remembering information	–
Frank and Kapila (2017)				X	Mixed method (experimental design; interpretative study)	Engagement	Remembering information	Difficult to use Students do not read
Gopalan et al. (2015)	X		X		Mixed method (quasi-experimental study; interpretative study)	Motivation Engagement Enjoyment	–	System too slow Interface is not intuitiv
Gutiérrez de Ravé et al. (2016)			X	X	Experimental study	–	Remembering information	–
Huang et al. (2016)	X			X	Mixed method (experimental design; interpretative study)	Engagement Interest	Remembering information	Students need to be tra technology
Ibáñez et al. (2014)	X			X	Experimental design	Flow	Applying knowledge	–
Ibáñez et al. (2016)		X			Content analysis	–	Remembering information	Distraction
Kamarainen et al. (2013)	X			X	Mixed method (experimental design; interpretative study)	Self-efficacy Engagement Attitudes	Remembering information	Teachers need to be tra Novelty effect
Lin et al. (2015)		X	X	X	Mixed method (experimental design; interpretative study)	Attitude	Remembering information	–
Liou et al. (2016)				X	Quasi-experimental study	–	Remembering information	–
Martín-Gutiérrez et al. (2010)	X			X	Mixed method (quasi-experimental; interpretative study)	Satisfaction	Remembering information	–
Salmi et al. (2017)	X			X	Quasi-experimental study	Enjoyment Interest	Remembering information	–
Sommerauer and Müller (2014)				X	Experimental design	–	Remembering information	–
Tarng et al. (2015)	X			X	Quasi-experimental study	Motivation	Remembering information	.
Tarng et al. (2016)			X	X	Experimental design	–	Understanding	.
Wang et al. (2014)				X	Content analysis	–	Creating knowledge	–
Yoon et al. (2017)				X	Mixed method (quasi-experimental study; interpretative study)	–	Remembering information	–

Ibáñez, M., & Delgado-Kloos, C. (2018). Augmented reality for STEM learning: A systematic review. *Computers and Education, 123*. 109-123. https://doi.org/10.1016/j.compedu.2018.05.002

7. Data extraction (examples)

Coding Information for Meta-Analysis

Type of variable	Variable category	Sub-Category coding
Independent variable	Scaffolding	Control group or treatment group
Moderating variables	Scaffolding purposes	Conceptual, meta-cognitive, strategic, or procedural
	Scaffolding sources	Computers, instructors, or peers
Dependent variable	Learning outcomes	Effect sizes (sample size, mean, correlation, p-value, and F- or t-values) Types of learning outcomes (cognitive, meta-cognitive, or affective)
Other variables	Publication	Title, author, year, and name of journal
	Research design	Experimental, quasi-experimental, pre-experimental, or non-experimental
	Learning disciplines	Language and literature, science, education, communication, computing, and others

Doo, M. Y., Bonk, C., & Heo, H. (2020). A meta-analysis of scaffolding effects in online learning in higher education. *The International Review of Research in Open and Distributed Learning, 21*(3), 60-80. https://doi.org/10.19173/irrodl.v21i3.4638

8. Quality Assessment

"Quality" in a systematic review refers to:
The degree to which a study employs measures to minimize bias and error in its design, conduct, and analysis. (Khan et al., 2003, p. 39)

- Assess whether the studies have been designed, conducted and reported in such a way that they can be considered reliable (i.e. have rigor) and whether they provide meaningful answers to your research question (i.e. have relevance).
- published in a peer-reviewed academic journal, then it must be of good quality?; not always true!
- You can do it before, during or after data extraction. If intending to exclude poor-quality studies from your review, then you need to carry out your quality assessment before extracting data.

Khan, K., Kunz, R., Kleijnen, J. and Antes, G. (2003) *Systematic Reviews to Support Evidence-Based Medicine: How to Review and Apply Findings of Healthcare Research*. London: Royal Society of Medicine Press.

8. Quality Assessment

Selection bias
- Were the individuals selected to participate in the study likely to be representative of the target population? How were the participants selected?
- Assess how generalizable and transferable the study results are to the target population.

Allocation bias
- How were participants allocated to the treatment groups? Could anyone in the study predict or control allocation to treatment groups?
- Assess if participants were allocated to treatment groups with less risk of bias from allocation to treatment.

Performance bias
- Were the participants, providers of the intervention or the study investigators aware of the treatment that participants received, or were they blinded?
- Assess whether there was awareness of treatment received by certain study personnel and whether this could bias study results.

8. Quality Assessment

Detection bias
- Were the people who measured the study outcomes aware of what treatment participants received or were they blinded?
- Assess whether there was awareness of treatment received by study personnel and whether this could bias study results.

Attribution bias
- What proportion of participants in each group stopped having the treatment? Did they stop by themselves (dropouts) or were they stopped by study personnel (withdrawal) for whatever reason.
- Also assess the withdrawal/dropout rates.

Reporting bias
- Were all outcomes stated to be measured actually reported or did the study authors fail to report outcomes that showed no (or a negative) effect?
- The treatment may appear more favorable than it really is if negative results from other outcomes are not reported in the paper.

8. Quality Assessment

Confounders
- At baseline, were the participant characteristics, such as age, gender or health status, similar across all treatments?
- Participants should be equally balanced in terms of variables considered important to study outcomes (sex, age, etc).

Concurrent/ subsequent intervention
- Did any of the participants receive other treatments that could have influenced the study outcomes?
- Were all participants treated in the same way except for study intervention?

Analysis
- Were the data for all participants included in the final analysis (missing data).

Funding bias
- Who funded the study (expect positive outcomes).

8. Quality Assessment

How to assess the quality of studies? (5 steps)

Step 1

Identify the type(s) of quality assessment tool(s) to suit your review.
- If included a range of designs, decide whether to use an assessment tool for each design or an all-inclusive tool that can be used across a range of designs.
- Quality assessment tools can be scales that give a numerical value of the 'quality' of a study, or they can be checklists that generate an overall picture of quality. A checklist is preferred.

Step 2

Choose the appropriate quality assessment tool(s).
- RoB 2 / ROBINS-I (Risk of bias tools)
- For the social scientist, the American Educational Research Association (AERA) has developed guidance for ensuring high-quality research (AERA, 2013).

8. Quality Assessment

How to assess the quality of studies? (5 steps)

Step 3

Carry out quality assessment using the appropriate tool(s).
- Pilot testing.
- Use the quality assessment tool in a consistent way and treat all the studies the same way when assessing quality.
- keep careful notes about your decisions, and consistently mark the text of the papers where you found information.

8. Quality Assessment

TABLE 7.4 Example tool for quality assessment of randomized controlled trials

Reviewer name:	
Author name/Study ID:	
Quality item	
Randomization (check for allocation bias)	
Was the method used to assign participants to the treatment groups truly random?	
Was the allocation of treatment concealed?	
*Was the number of participants randomized stated?	
Comparability (check for confounding)	
*Were details of baseline comparability presented?	
Was baseline comparability achieved?	
Eligibility (check for selection bias)	
*Were eligibility criteria for study entry specified?	
*Were there any co-interventions that may influence outcomes for each group?	
Blinding (check for detection bias)	
Were outcome assessors blinded to treatment allocation?	
Were the individuals who administered the intervention blinded to treatment allocation?	
Were participants blinded to treatment allocation?	
*Was the success of the blinding procedures assessed?	
Withdrawals (check for attrition bias)	
*Were ≥ 80% of participants randomized included in the final analysis?	
*Were reasons for participant withdrawals stated?	
Were there any unexpected dropouts in either group?	
Was an intention-to-treat analysis included?	
Outcomes (check for outcome reporting bias)	
Is there evidence that more outcomes were measured than were reported?	

* Indicates the modifications that we made to the original CRD checklist

Randomized controlled studies

The Ottawa Hospital Research Institute | L'Hôpital d'Ottawa Institut de recherche

The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses

Source: K. Tineke, M. S., & Doreen, R. (2021). Risk of bias assessment: A student's guide (2nd ed.). London: Sage.

8. Quality Assessment

RoB 2 tool

A revised Cochrane risk of bias tool for randomized trials

ROBINS-I tool

(Risk Of Bias In Non-randomized Studies - of Interventions)

8. Quality Assessment

How to assess the quality of studies? (5 steps)

Step 4

Tabulate and summarize the results of your quality assessment.

- Tabulate and summarize the results of your quality assessment.
- Think about how the results of your quality assessment exercise might impact on the conclusions and recommendations of your systematic review.

Step 5

Impact of quality assessment exercise.

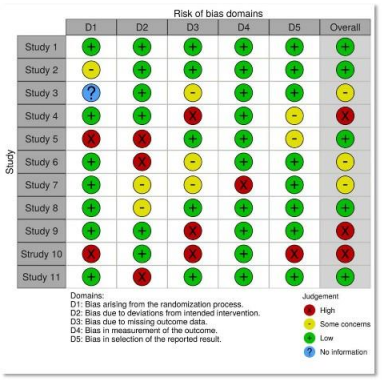
- Consider how the quality of your studies might impact on the credibility of the overall results of your systematic review.
- Present the results of your quality assessment exercise in the 'Results' section; save discussion of these findings for the 'Discussion' section.

8. Quality Assessment

robvis

Create publication quality risk-of-bias assessment figures

	A	B	C	D	E	F	G
1	Study	D1	D2	D3	D4	D5	Overall
2	Study 1	Low	Low	Low	Low	Low	Low
3	Study 2	Some concerns	Low	Low	Low	Low	Low
4	Study 3	No information	Low	Some concerns	Low	Low	Some concerns
5	Study 4	Low	Low	High	Low	Some concerns	High
6	Study 5	High	High	Low	Low	Some concerns	Low
7	Study 6	Low	High	Some concerns	Low	Low	Some concerns
8	Study 7	Low	Some concerns	Some concerns	High	Low	Some concerns
9	Study 8	Low	Some concerns	Low	Low	Low	Low
10	Study 9	Low	Low	High	Low	Low	High
11	Strudy 10	High	Low	High	Low	High	High
12	Study 11	Low	High	Low	Low	Low	Low



8. Quality Assessment

Tips for quality assessment

- ✓ Quality assessment can be a time-consuming process and should not be left until the last minute.
- ✓ Carefully document where in the study you found information relating to each quality assessment question. This can save time later when you go back and check your reasoning.
- ✓ Some degree of subjective judgement will be required to enable you to answer some of the questions. This is why it is useful to have a second reviewer to quality assess your studies.
- ✓ Ideally each included study should be quality assessed by two reviewers independently.
- ✓ Keep records of how you came to make your decisions, especially when you were unable to give a clear 'yes' or 'no' response to a question.

8. Quality Assessment (examples)

Table 3
Quality assessment checklist.

Item	Assessment Criteria	Description of checklist
QA1	Does the paper clearly describe the aim of the studies?	No, the aim is not described Partially, the aim is not clearly described. Yes, the aim is well described and clear.
QA2	Does the paper clearly present a theory of personal traits?	No, the personal trait theory is not clearly presented. Partially, but the theories are not clearly presented and require reading related works. Yes, it does.
QA3	Do the studies state a detailed description of the findings?	No, the details are not fully described. Partially, but the details are unclear and must be determined from the references. Yes, the techniques can be used with the details as described.
QA4	Does the study present a methodology?	No, no methodology is stated. Partially, the methodology is present but unclear. Yes, it does.
QA5	Has the study been cited by other authors?	No. Partially, 1–5 other articles cite this study Yes, more than 5 articles cite this study.

Normadhi, N. B. A., et al. (2019). Identification of personal traits in adaptive learning environment: Systematic literature review. *Computers and Education, 130*, 168-190. DOI: 10.1016/j.compedu.2018.11.005

8. Quality Assessment (examples)

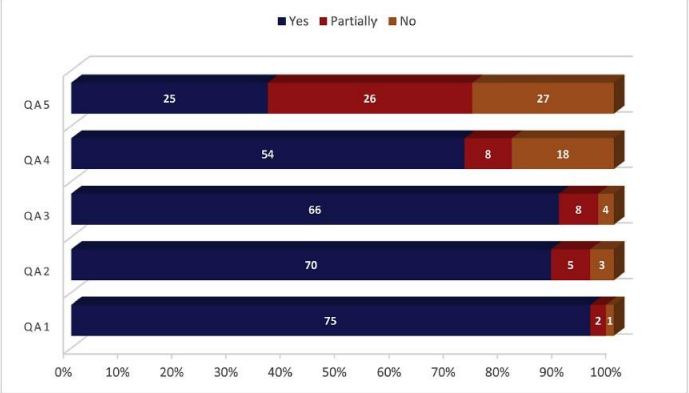


Fig. 3. Result of quality assessment.

Normadhi, N. B. A., et al. (2019). Identification of personal traits in adaptive learning environment: Systematic literature review. *Computers and Education, 130,* 168-190. DOI: 10.1016/j.compedu.2018.11.005

8. Quality Assessment (examples)

Methodological Quality

The RCT included in this study [20] received a low risk-of-bias classification (Multimedia Appendix 4).

Of the 31 cross-sectional studies, 26 received poor ratings because of a high risk of bias (Multimedia Appendix 5). The remaining 5 studies received a fair rating because of a higher consideration for possible bias. In total, 2 studies that were able to measure exposure before outcomes such as studies that performed pretests and posttests [21,22], 3 studies that accounted for confounding variables [21-23], 2 studies that used validated exposure [24,25], and 2 studies that used outcome measures [23,25] received a better quality rating.

A quality assessment of the quasi-experimental study using longitudinal pretests and posttests [26] is included in Multimedia Appendix 6.

Alturkistani, A., Lam, C., Foley, K., Stenfors, T., Blum, R., Van Velthoven, M.H., Meinert, E. (2020). Massive open online course evaluation methods: Systematic review. *Journal of Medical Internet Research, 22*(4), e13851.DOI: 10.2196/13851

8. Quality Assessment (examples)

Study	Rubio F, 2015 [21]
1. Was the study question or objective clearly stated?	Yes
2. Were eligibility/selection criteria for the study population prespecified and clearly described?	Yes
3. Were the participants in the study representative of those who would be eligible for the test/service/intervention in the general or clinical population of interest?	Yes
4. Were all eligible participants that met the prespecified entry criteria enrolled?	CD
5. Was the sample size sufficiently large to provide confidence in the findings?	No
6. Was the test/service/intervention clearly described and delivered consistently across the study population?	Yes
7. Were the outcome measures prespecified, clearly defined, valid, reliable, and assessed consistently across all study participants?	Yes
8. Were the people assessing the outcomes blinded to the participants' exposures/interventions?	Yes
9. Was the loss to follow-up after baseline 20% or less? Were those lost to follow-up accounted for in the analysis?	Yes
10. Did the statistical methods examine changes in outcome measures from before to after the intervention? Were statistical tests done that provided p values for the pre-to-post changes?	Yes
11. Were outcome measures of interest taken multiple times before the intervention and multiple times after the intervention (i.e., did they use an interrupted time-series design)?	No
12. If the intervention was conducted at a group level (e.g., a whole hospital, a community, etc.) did the statistical analysis take into account the use of individual-level data to determine effects at the group level?	Yes
Quality rating	Good

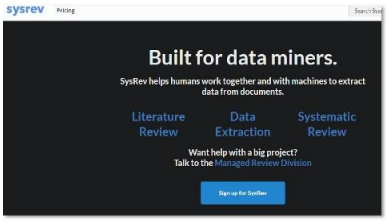
Cochrane Collaboration Risk of Bias Tool for Before-After (Pre-Post) Studies With No Control Group

Alturkistani, A., Lam, C., Foley, K., Stenfors, T., Blum, R., Van Velthoven, M.H., Meinert, E. (2020). Massive open online course evaluation methods: Systematic review. *Journal of Medical Internet Research, 22*(4), e13851. DOI: 10.2196/13851

Tools for systematic literature review

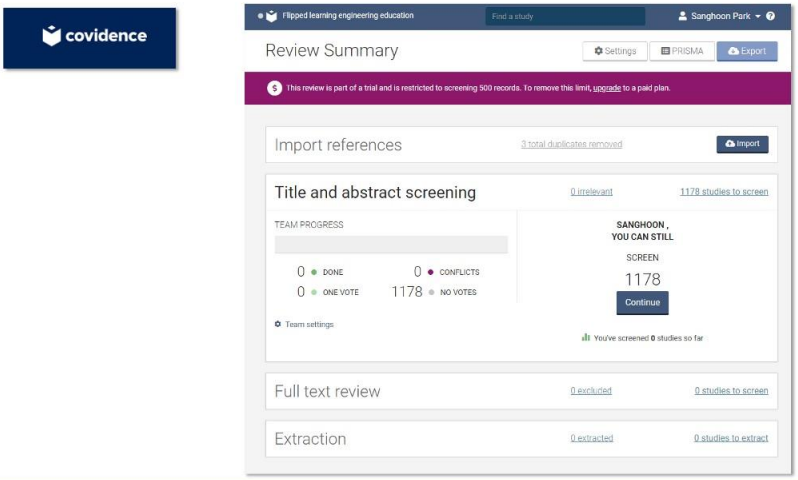
www.covidence.org

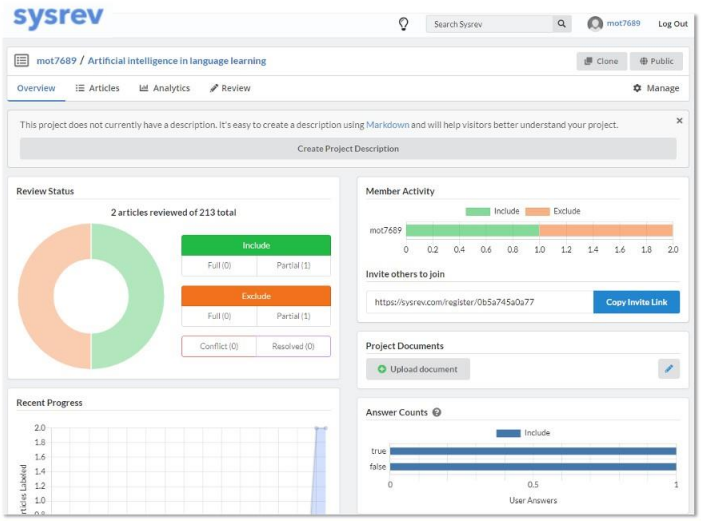
Covidence is a Cochrane technology platform working to improve 'the production and use of systematic reviews for health and wellbeing' that supports you in all practical aspects of systematic reviewing from screening to data extraction and quality assessment.



https://sysrev.com/systematic-review

Search the literature.
Upload research documents.
Add friends and review.





9. Analysis and synthesis

A systematic review is review of a clearly formulated question using systematic and explicit methods to identify, select and critically appraise all relevant research. Data is collected and analyzed from all the studies that are included in the review.

Meta-analysis, on the other hand, is the process of using statistical methods to combine the samples and analyze the results of the included studies. The overall sample size is increased, thereby improving the statistical power of the analysis as well as the precision of the estimates of treatment effects.

9. Analysis and synthesis

A meta-analysis allows results from individual intervention studies to be combined to give an overall measure of the effect of one intervention compared with another (Glass, 1976).

- Meta-analysis is **not a required element** of a systematic review.
- Meta-analysis should only be carried out as part of the review process if data from included intervention studies are **sufficiently similar and it is sensible to combine them.**

The main assumption underlying a meta-analysis is that the RCTs are sufficiently similar for the results to be combined, that is, homogeneous. Studies are not too different and can be grouped together, and that it is sensible to combine the results of these studies to get an overall measure of effect.

Glass, G.V. (1976). Primary, secondary, and meta-analysis of research. *Educational Researcher, 5*(10), 3–8.

9. Analysis and synthesis

When to conduct Meta–analysis? (5 key steps)

Step 1

Assess whether it is appropriate to combine your studies in a meta-analysis (check that the assumption of homogeneity is satisfied)

- RCTs should be similar in terms of the students they recruit (inclusion criteria and baseline characteristics across RCTs).
- RCTs should compare the same interventions (or exposures) and comparators; trial publications should provide detailed descriptions of each.
- RCTs should report the same outcomes. If one RCT has the outcome of interest as a primary outcome, while another RCT has it as a secondary outcome, data can still be combined.
- Results of the RCTs should describe similar effects (i.e. all trials conclude that one intervention is better than another, or all RCTs indicate that there is no difference between interventions). A good way to check this is by producing a forest plot using a statistical package.

9. Analysis and synthesis

When to conduct Meta–analysis? (5 key steps)

Step 2

Justify your decision to conduct (or not conduct) a meta-analysis in your text.

- (Example) A meta-analysis was not performed. Only a narrative summary of the data is presented. The differences across the RCTs, including poor quality of the RCT reports, diversity of protocols, and the inconsistency in reporting of outcomes, precluded a statistical synthesis of the included trial results.

Step 3

Choose an appropriate meta-analysis method.

- Weighted average of the treatment effects.
- 'fixed effects model' and 'random effects model.'

9. Analysis and synthesis

When to conduct Meta–analysis? (5 key steps)

Step 4

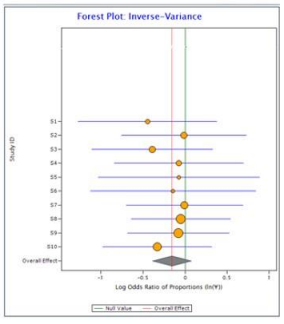
Identify and discuss any heterogeneity in the meta-analysis results.

- Examine the **forest plot** to identify whether there is substantial heterogeneity between studies.
- The I^2 statistic describes the percentage of the total variation across studies that is due to heterogeneity rather than chance, and results lie between 0 and 100 per cent.
- Heterogeneity is commonly investigated using subgroup analysis. Subgroup analyses determine whether different effects are observed in different subgroups of participants.
- Check "**publication bias**".

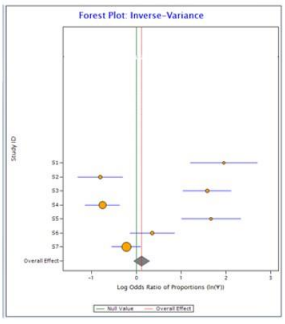
Step 5

Present and interpret the results.

9. Analysis and synthesis (examples)



Homogeneous



Heterogeneity

https://www.cytel.com/blog/tackling-heterogeneity-in-meta-analysis

9. Analysis and synthesis (examples)

The overall effect size of the effects of scaffolding on learning outcomes, which is greater than 0 at a statistically significant level, $z = 8.242$, $p < .001$, indicates that scaffolding produced better learning outcomes than those without scaffolding. The heterogeneity test results ($Q = 699.991$, $I^2 = 91.0\%$, $p < .001$) showed a considerable difference between effect size estimates in the meta-analysis, which validated our decision to use the random-effects model (Borenstein et al., 2009; Higgins & Green, 2008) in which I^2 index below 25% is small, 50% is moderate, and beyond 75% is a large amount of heterogeneity. Thus, it was necessary to conduct a sub-group analysis to systematically examine the effects of scaffolding on learning outcomes.

Doo, M. Y., Bonk, C., & Heo, H. (2020). A meta-analysis of scaffolding effects in online learning in higher education. *The International Review of Research in Open and Distributed Learning*, *21*(3), 60-80. https://doi.org/10.19173/irrodl.v21i3.4638

9. Analysis and synthesis (examples)

Table 3
Results of the univariate random-effects meta-analyses.

Dependent variable	*k* (#students)	*g* (*p*)	*SE*	95% CI	*Q* (*p*)	df_q	τ^2 (*SE*)	I^2
Assessed learning outcomes	114 (20318)	0.36 (< .001)	0.04	[0.28, 0.44]	1221.86 (< .001)	113	0.14 (0.02)	88%
Perceived learning outcomes	8 (953)	0.36 (.13)	0.21	[-0.13, 0.85]	39.45 (< .001)	7	0.28 (0.18)	87%
Student satisfaction	22 (3501)	0.05 (.73)	0.13	[-0.23, 0.32]	181.99 (< .001)	21	0.33 (0.12)	92%

Note. *k* = number of studies; # students = total number of participants; *g* = mean weighted effect size in Hedges' *g*; *SE* = standard error; CI = confidence interval; *Q* = Cochran's heterogeneity test; df = degrees of freedom Q-test; τ^2 = between-study variance; I^2 = percentage of variation between studies that is due to heterogeneity rather than sampling error.

Van Alten, D. C. D., Phielix, C., Janssen, J., & Kester, L. (2019). Effects of flipping the classroom on learning outcomes and satisfaction: A meta-analysis. *Educational Research Review, 28,* 100281. DOI: /10.1016/j.edurev.2019.05.003

9. Analysis and synthesis

Publication bias

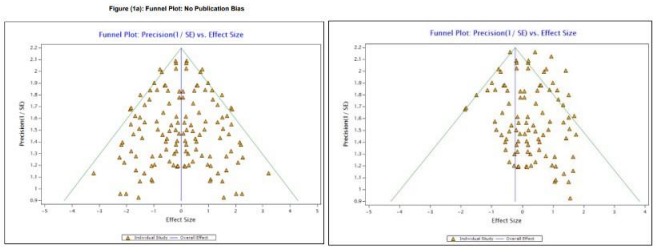
- "Statistical significance" and "direction of the intervention effect" are often favored for publication - may be systematically different from those of unpublished studies.
- Published studies can be easily included in meta-analysis thus any bias in the literature is also reflected in the meta-analysis.

Why??

- Many studies remain unpublished because researchers do not publish their work in the publication.
- Journals may be biased toward positive results because negative results are less likely to be published.
- Study sponsors or funding sources may be biased towards results that favor their interests.
- Some studies get started but do not complete. Such studies are available sometimes in the abstracts of conferences but not in the clinical trial study databases.
- While searching for studies for systematic review, people rely on publications in only one language (generally only English - language bias).

9. Analysis and synthesis

Publication bias



1. Begg-Mazumdar
- Highly heterogeneous data (I^2 > 30).
- Large dataset (n~=100).

2. Eggers regression
- Highly heterogeneous data (I^2 > 30).
- Large dataset (n~=100).

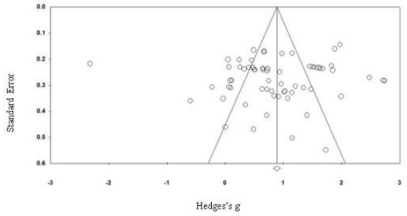
3. Trim-and-Fill
- Highly heterogeneous data (I^2 > 30).
- Small dataset (n~=20).

4. Fail-Safe N
- Low heterogeneous data (I^2 <= 30).
- Small dataset (n~=20).

Kale, J., & Nirpharake, A. (2017). *Comparison of different methods of detecting publication bias*. Pharmaceutical Users Software Exchange 2017 (paper AS04) October 8-11, 2017, Edinburgh, Scotland.

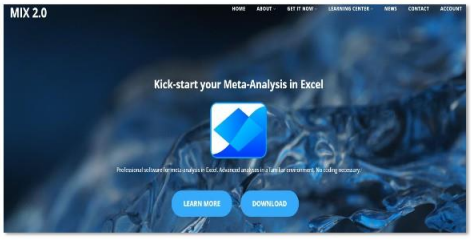
9. Analysis and synthesis (examples)

To estimate the potential influence of publication bias on the results, a funnel plot was created, as shown in Figure 2 (Harbord, Egger, & Sterne, 2006). The funnel plot for the effects of scaffolding on learning outcomes showed that more samples had large effect sizes, but the plot was moderately symmetrical, indicating that the research findings were not greatly influenced by publication bias. All analyses were conducted using Comprehensive Meta-Analysis 3.0 for Windows (Borenstein et al., 2009).



Doo, M. Y., Bonk, C., & Heo, H. (2020). A meta-analysis of scaffolding effects in online learning in higher education. *The International Review of Research in Open and Distributed Learning*, *21*(3), 60-80. https://doi.org/10.19173/irrodl.v21i3.4638

9. Analysis and synthesis



COMPREHENSIVE META-ANALYSIS

10. Accessing the quality of your own systematic review

PRISMA
TRANSPARENT REPORTING OF SYSTEMATIC REVIEWS AND META-ANALYSES

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) is an evidence-based minimum set of items for reporting in systematic reviews and meta-analyses. PRISMA focuses on the reporting of reviews evaluating randomized trials but can also be used as a basis for reporting systematic reviews of other types of research, particularly evaluations of interventions.

AMSTAR (A **MeaSurement Tool** to **Assess** systematic **Reviews**) quality assessment tool, which is suitable for use with systematic reviews. The AMSTAR checklist and guidance notes are available at http://Amstar.ca/Amstar_Checklist.php.

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https://www.neca.re.kr//lay1/bbs/S1T12C49/A/12/view.do?article_seq=2841

THANK YOU

park2@usf.edu

UNIVERSITY of SOUTH FLORIDA

KEYNOTE

Keynote 1

Auditorium

Keynote 1, 10:30-12:00, August 19, 2021

Innovative Thinking for New Generation in Digital Transformation

Paul KIM

Chief Technology Officer,

Associate Dean of the Graduate School of Education at Stanford University, USA

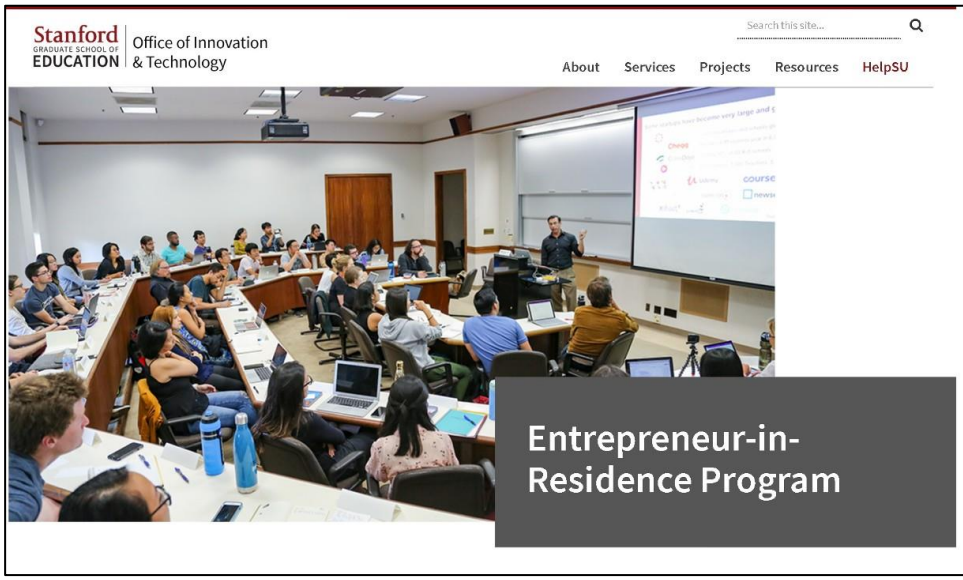
Keywords

Entrepreneur-in-Residence Program, The Transforming Learning Accelerator leverages advances in neuroscience, data, and technology to create more effective and equitable learning solutions. Chatbots for education, Journeys Online, EDNet, AI in Education Challenge 2022, Stanford online Designing a New Learning Environment, MOOC, SMILE(Stanford Mobile Inquiry-Based Learning Environment), Higher Order Learning, Notable Changes, Conundrums, Learn to Create, Create to Learn

Innovative Thinking for the New Generation in Digital Transformation

Paul Kim, PhD.
Associate Dean & Chief Technology Officer
Stanford University Graduate School of Education
phkim@stanford.edu

ICoME 2021 **19th International Conference for Media in Education**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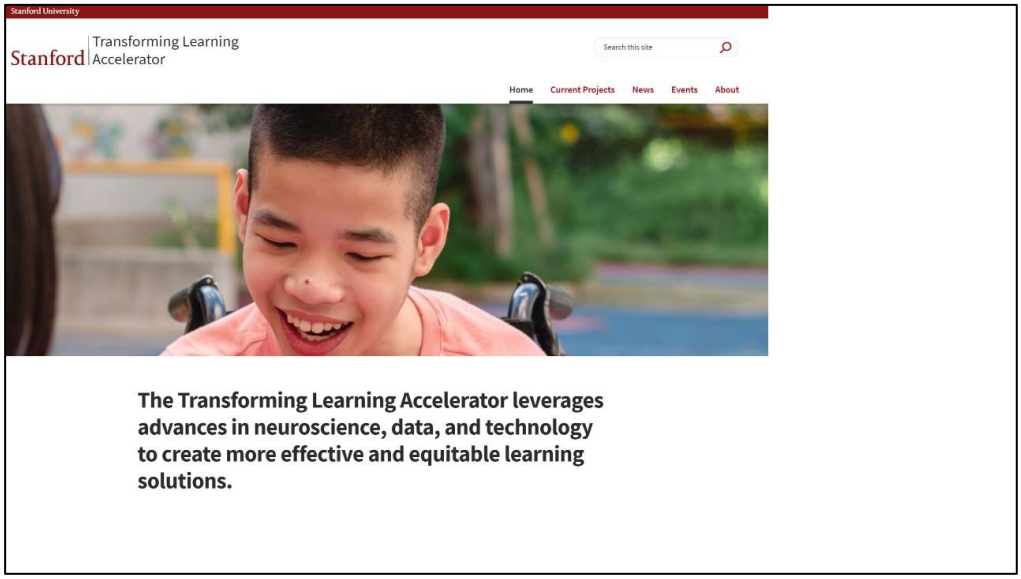
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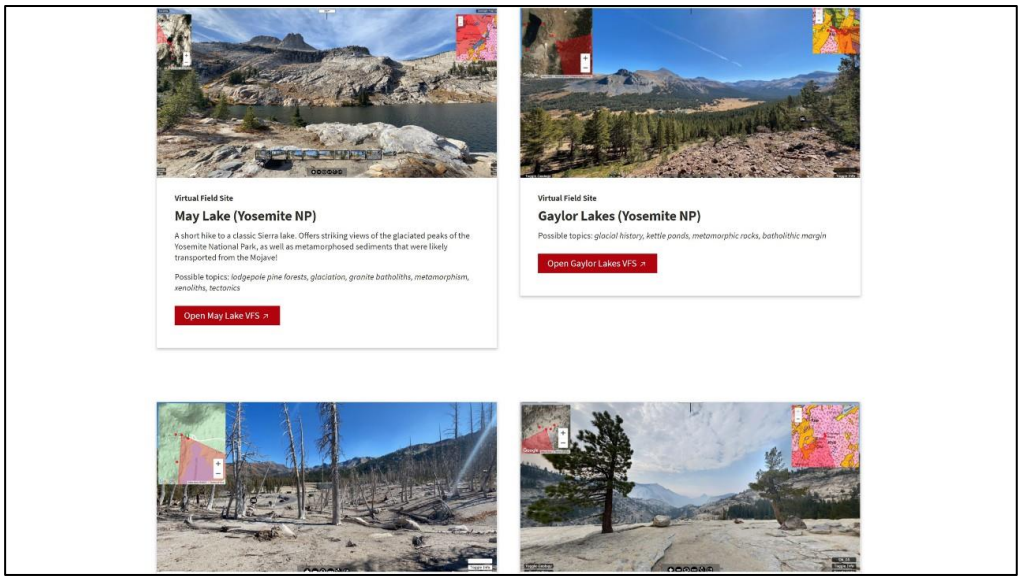
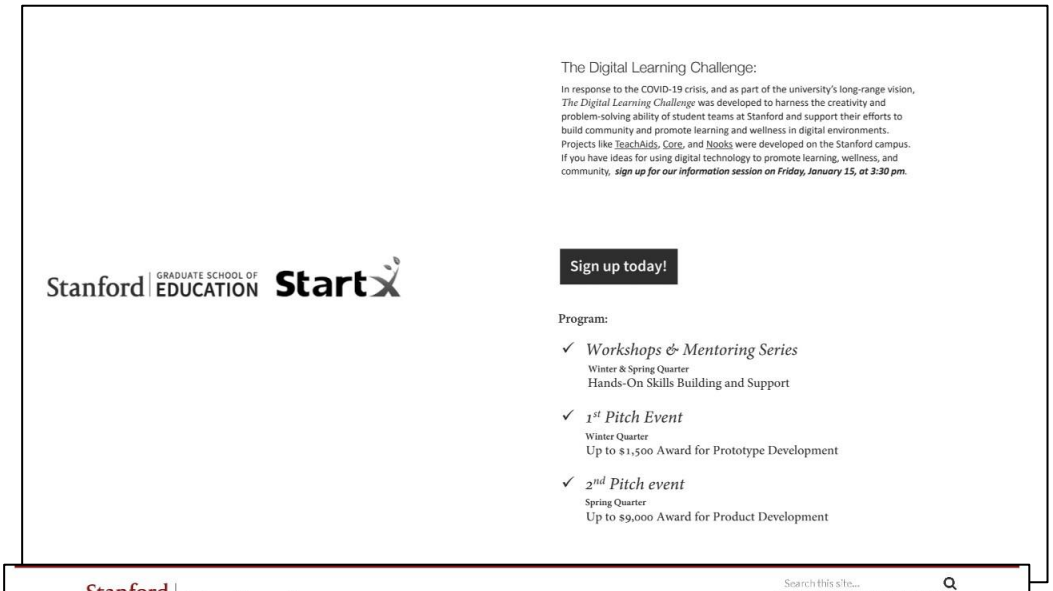
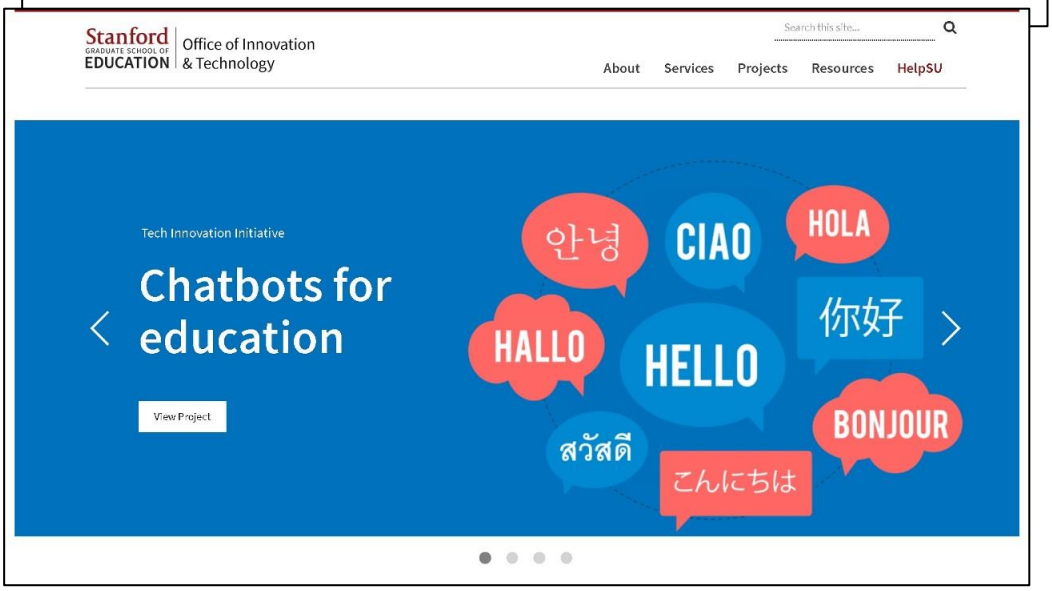
The Transforming Learning Accelerator leverages advances in neuroscience, data, and technology to create more effective and equitable learning solutions.


Virtual Field Site
May Lake (Yosemite NP)
A short hike to a classic Sierra lake. Offers striking views of the glaciated peaks of the Yosemite National Park, as well as metamorphosed sediments that were likely transported from the Mojave!
Possible topics: lodgepole pine forests, glaciation, granite batholiths, metamorphism, xenoliths, tectonics
Open May Lake VFS
Virtual Field Site
Gaylor Lakes (Yosemite NP)
Possible topics: glacial history, kettle ponds, metamorphic rocks, batholithic margin
Open Gaylor Lakes VFS


Stanford | GRADUATE SCHOOL OF EDUCATION StartX
The Digital Learning Challenge:
In response to the COVID-19 crisis, and as part of the university's long-range vision, The Digital Learning Challenge was developed to harness the creativity and problem-solving ability of student teams at Stanford and support their efforts to build community and promote learning and wellness in digital environments. Projects like TeachAids, Core, and Nooks were developed on the Stanford campus. If you have ideas for using digital technology to promote learning, wellness, and community, sign up for our information session on Friday, January 15, at 3:30 pm.
Sign up today!
Program:
✓ Workshops & Mentoring Series
Winter & Spring Quarter
Hands-On Skills Building and Support
✓ 1st Pitch Event
Winter Quarter
Up to $1,500 Award for Prototype Development
✓ 2nd Pitch event
Spring Quarter
Up to $9,000 Award for Product Development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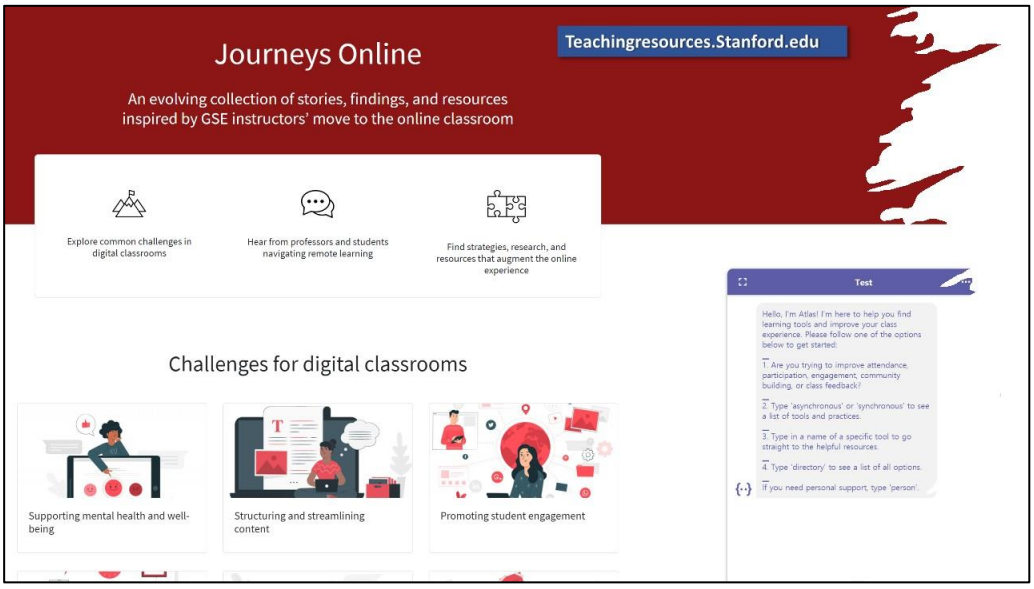
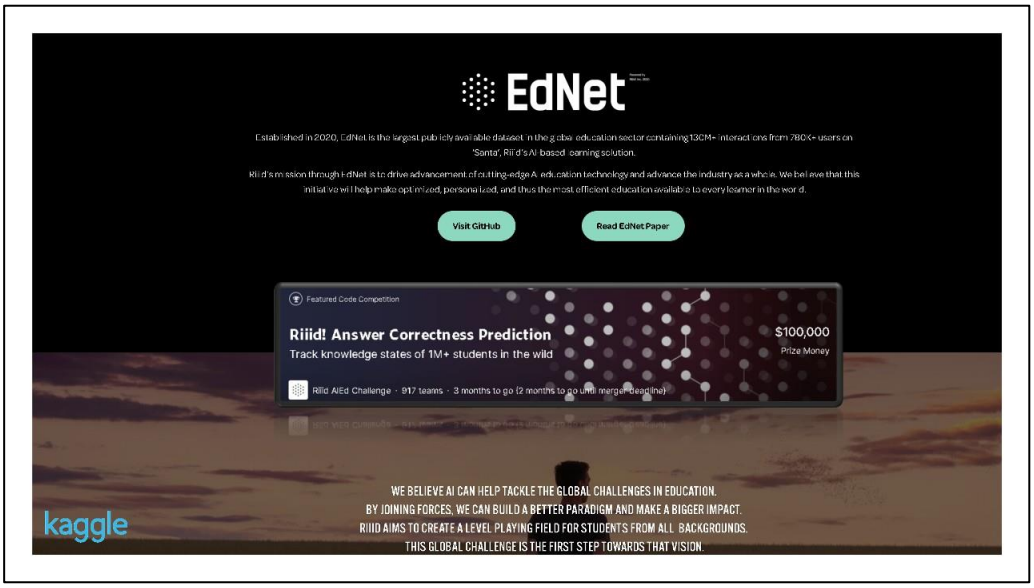

Journeys Online
Teachingresources.Stanford.edu
An evolving collection of stories, findings, and resources inspired by GSE instructors' move to the online classroom
Explore common challenges in digital classrooms
Hear from professors and students navigating remote learning
Find strategies, research, and resources that augment the online experience
Challenges for digital classrooms
Supporting mental health and well-being
Structuring and streamlining content
Promoting student engagement
Test
Hello, I'm Atlas! I'm here to help you find learning tools and improve your class experience. Please follow one of the options below to get started.
1. Are you trying to improve attendance, participation, engagement, community building, or class feedback?
2. Type 'asynchronous' or 'synchronous' to see a list of tools and practices.
3. Type in a name of a specific tool to go straight to the helpful resources.
4. Type 'directory' to see a list of all options.
If you need personal support, type 'person'.


EdNet
Established in 2020, EdNet is the largest publicly available dataset in the global education sector containing 13CM+ interactions from 780K+ users on 'Santa', Riid's AI based learning solution.
Riid's mission through EdNet is to drive advancement of cutting-edge AI education technology and advance the industry as a whole. We believe that this initiative will help make optimized, personalized, and thus the most efficient education available to every learner in the world.
Visit GitHub
Read EdNet Paper
Featured Code Competition
Riiid! Answer Correctness Prediction
Track knowledge states of 1M+ students in the wild
$100,000
Prize Money
Riid AIEd Challenge · 917 teams · 3 months to go (2 months to go until merger deadline)
kaggle
WE BELIEVE AI CAN HELP TACKLE THE GLOBAL CHALLENGES IN EDUCATION.
BY JOINING FORCES, WE CAN BUILD A BETTER PARADIGM AND MAKE A BIGGER IMPACT.
RIIID AIMS TO CREATE A LEVEL PLAYING FIELD FOR STUDENTS FROM ALL BACKGROUNDS.
THIS GLOBAL CHALLENGE IS THE FIRST STEP TOWARDS THAT VISION.

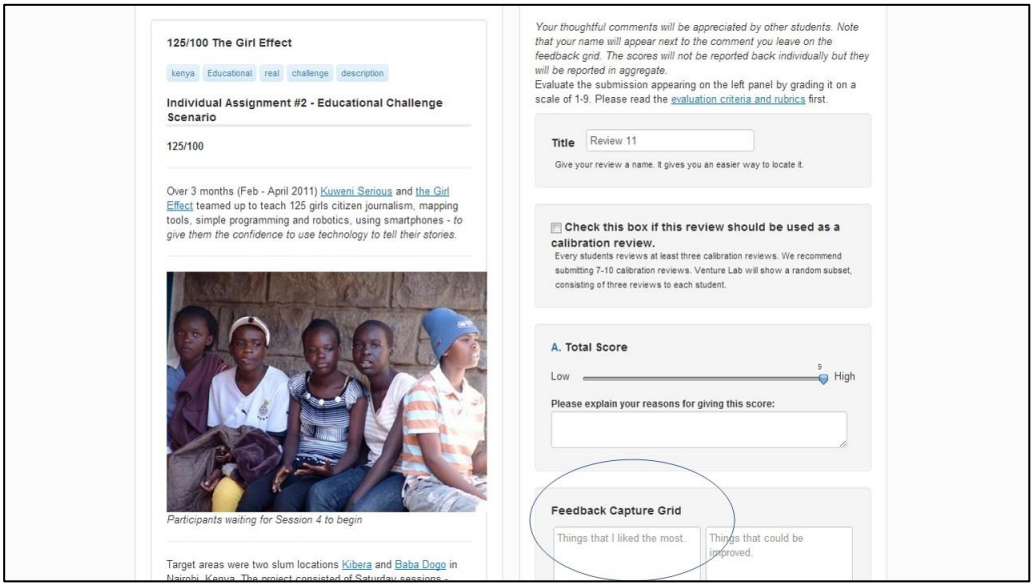
AI in Education Challenge 2022

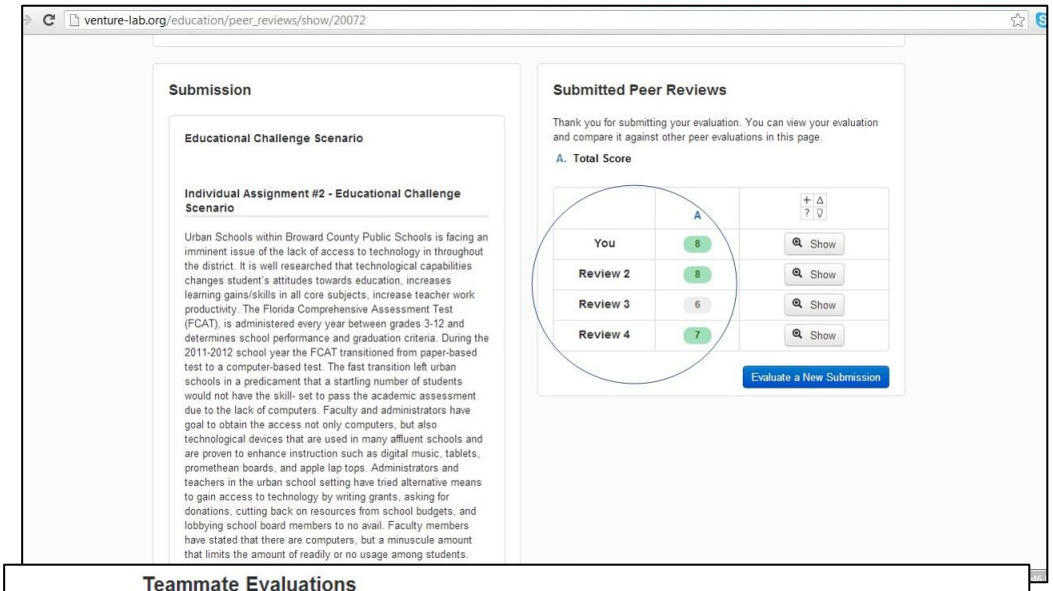
STANFORD UNIVERSITY
Stanford ONLINE
Designing a New Learning Environment
Notify Me!
The Course
What constitutes learning in the 21st century? Should reading, watching, memorizing facts, and then taking exams be the only way to learn? Or could technology (used effectively) make learning more interactive, collaborative, and constructive?

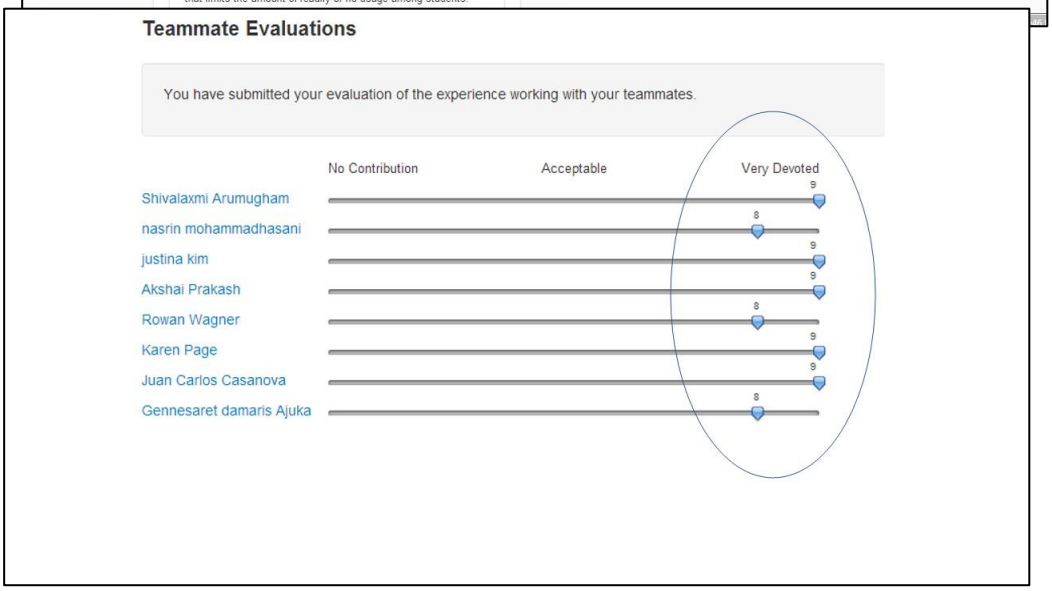
MOOC

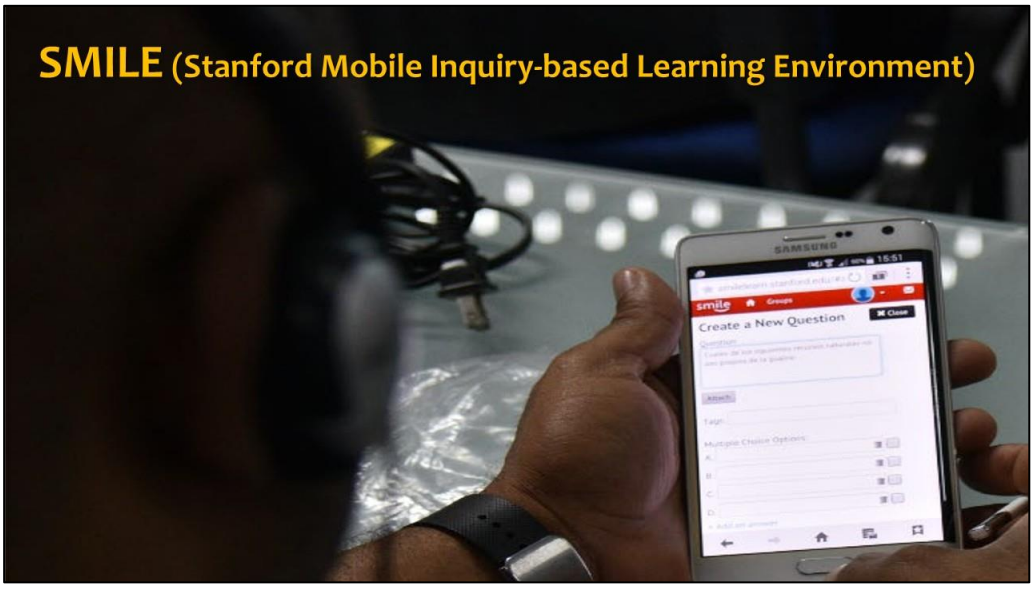
- Course title - “Designing a New Learning Environment”
- After the intro video – over 18,800 students signed up
- Global perspectives / Global participation – close to 170 countries / Global teams
- Lecture videos, articles, hands-on project assignments, & lots of discussions and idea sharing

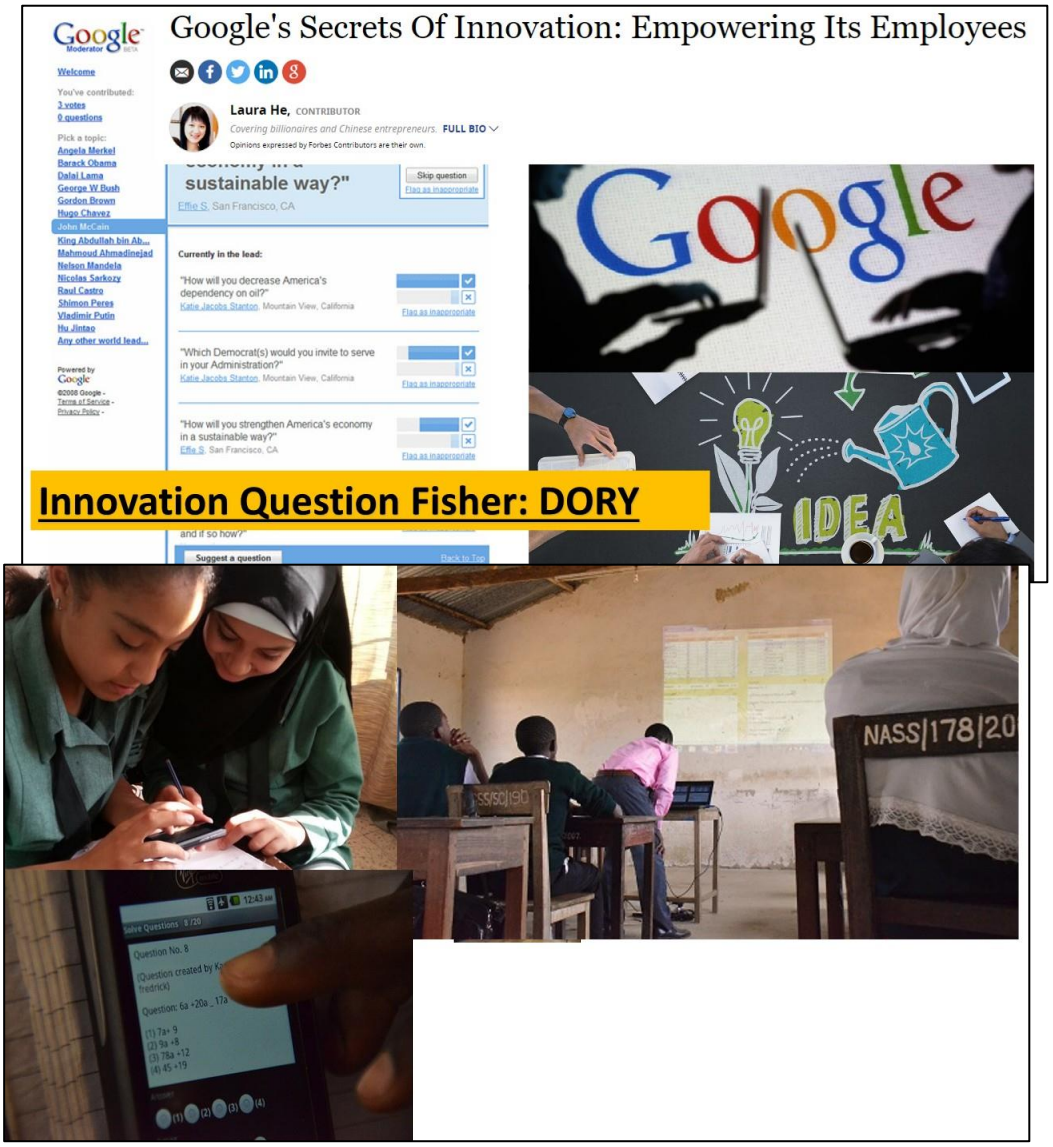
- **Team project** – students present themselves and share insights for two weeks and start to form teams and they can switch teams.
- **Pre-evaluation training –** based on data analytics
- **Peer individual and team evaluation** – 5 random assignments




venture-lab.org/education/peer_reviews/show/20072
Submission
Educational Challenge Scenario
Individual Assignment #2 - Educational Challenge Scenario
Urban Schools within Broward County Public Schools is facing an imminent issue of the lack of access to technology in throughout the district. It is well researched that technological capabilities changes student's attitudes towards education, increases learning gains/skills in all core subjects, increase teacher work productivity. The Florida Comprehensive Assessment Test (FCAT), is administered every year between grades 3-12 and determines school performance and graduation criteria. During the 2011-2012 school year the FCAT transitioned from paper-based test to a computer-based test. The fast transition left urban schools in a predicament that a startling number of students would not have the skill- set to pass the academic assessment due to the lack of computers. Faculty and administrators have goal to obtain the access not only computers, but also technological devices that are used in many affluent schools and are proven to enhance instruction such as digital music, tablets, promethean boards, and apple lap tops. Administrators and teachers in the urban school setting have tried alternative means to gain access to technology by writing grants, asking for donations, cutting back on resources from school budgets, and lobbying school board members to no avail. Faculty members have stated that there are computers, but a minuscule amount that limits the amount of readily or no usage among students.
Submitted Peer Reviews
Thank you for submitting your evaluation. You can view your evaluation and compare it against other peer evaluations in this page.
A. Total Score
A
You 8 Show
Review 2 8 Show
Review 3 6 Show
Review 4 7 Show
Evaluate a New Submission

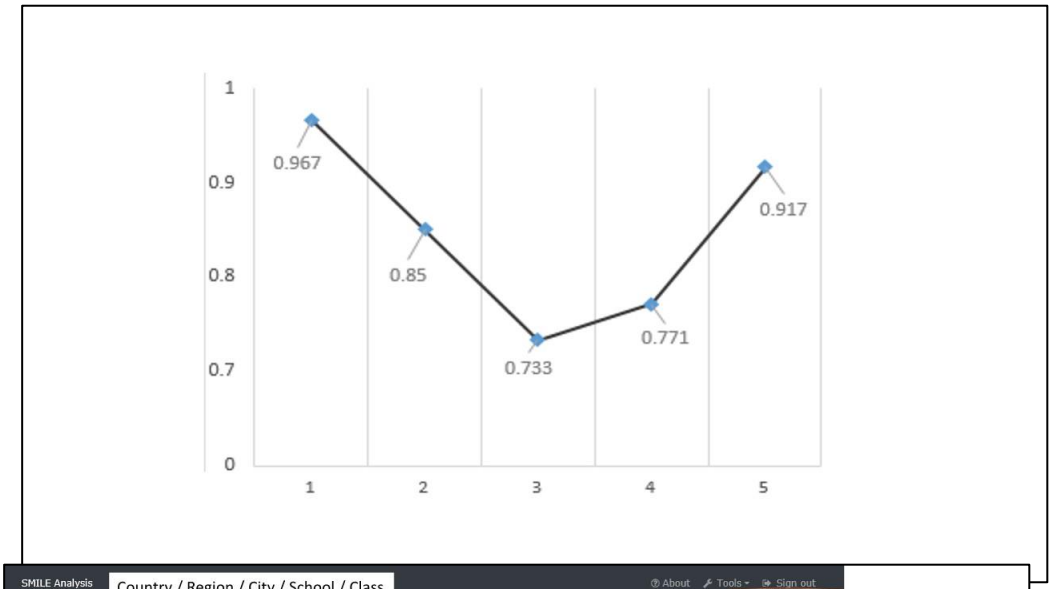

Teammate Evaluations
You have submitted your evaluation of the experience working with your teammates.
No Contribution
Acceptable
Very Devoted
Shivalaxmi Arumugham 9
nasrin mohammadhasani 8
justina kim 9
Akshai Prakash 9
Rowan Wagner 8
Karen Page 9
Juan Carlos Casanova 9
Gennesaret damaris Ajuka 8


SMILE (Stanford Mobile Inquiry-based Learning Environment)
Create a New Question



Higher Order Learning

Behavioral & Cognitive	Perceptual
Evaluation	Sense of Achievement
Creation	Sense of Ownership
Analysis	Sense of Self-Efficacy
Synthesis	
Presentation	


1
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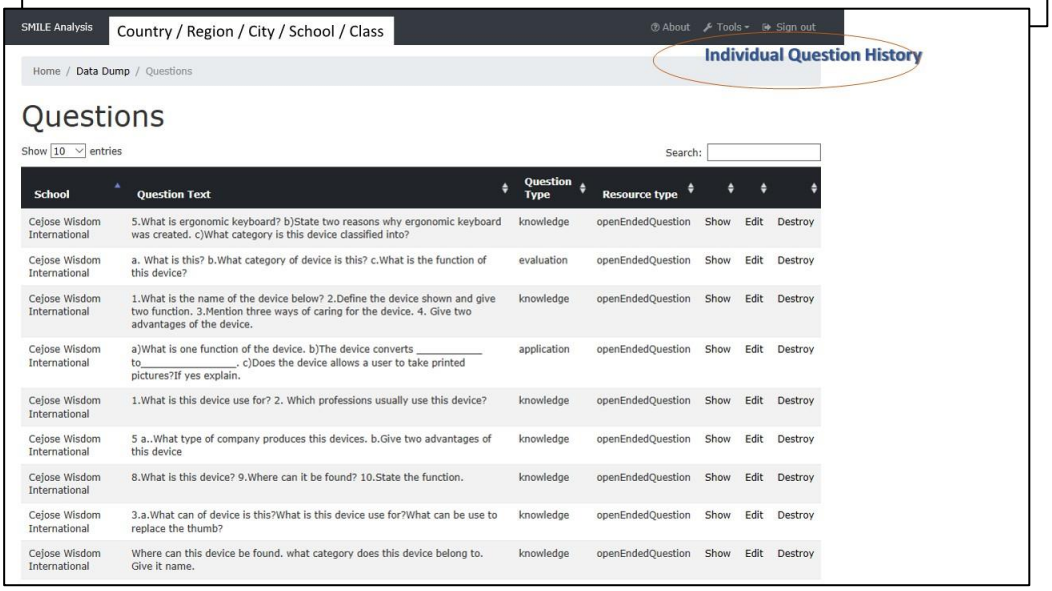
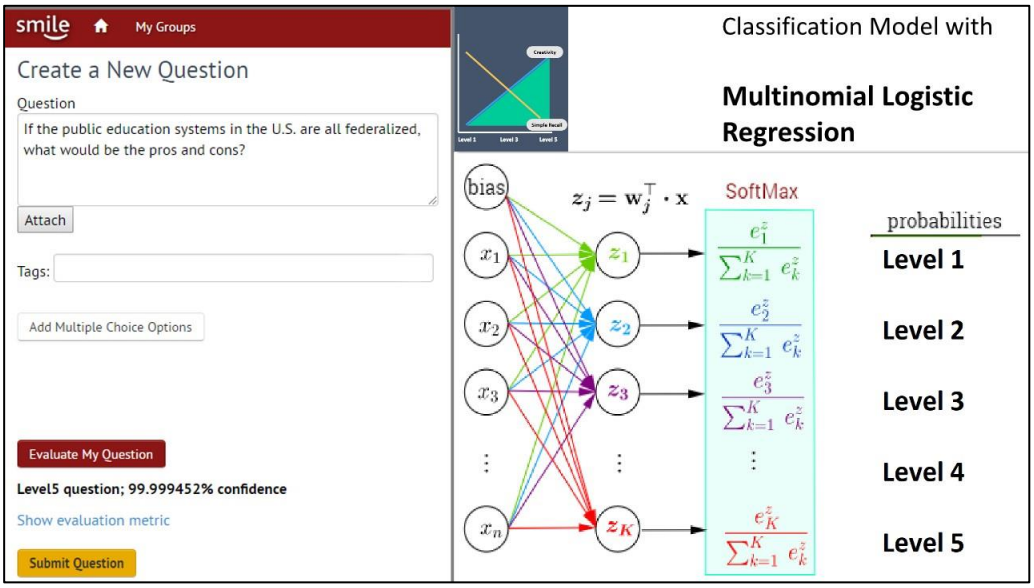
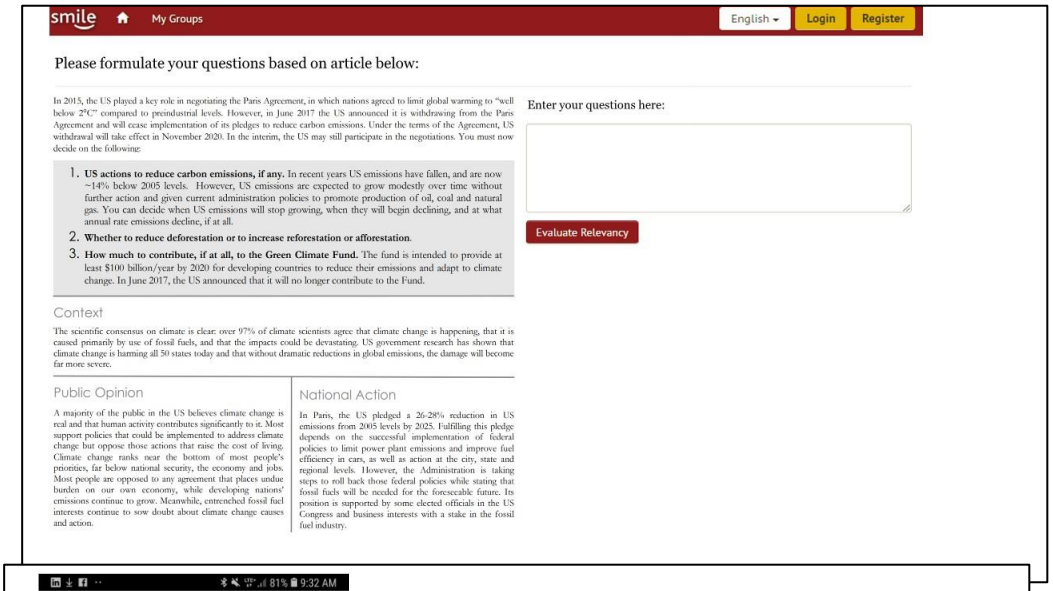
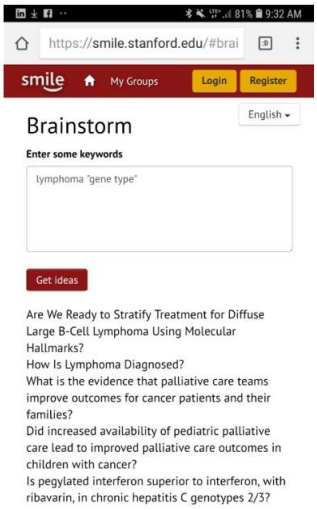

SMILE Analysis
Country / Region / City / School / Class
About
Tools
Sign out
Individual Question History
Home / Data Dump / Questions
Questions
Show 10 entries
Search:
School
Question Text
Question Type
Resource type
Cejose Wisdom International
5.What is ergonomic keyboard? b)State two reasons why ergonomic keyboard was created. c)What category is this device classified into?
knowledge
openEndedQuestion
Show
Edit
Destroy
Cejose Wisdom International
a. What is this? b.What category of device is this? c.What is the function of this device?
evaluation
openEndedQuestion
Show
Edit
Destroy
Cejose Wisdom International
1.What is the name of the device below? 2.Define the device shown and give two function. 3.Mention three ways of caring for the device. 4. Give two advantages of the device.
knowledge
openEndedQuestion
Show
Edit
Destroy
Cejose Wisdom International
a)What is one function of the device. b)The device converts _____ to_____. c)Does the device allows a user to take printed pictures?If yes explain.
application
openEndedQuestion
Show
Edit
Destroy
Cejose Wisdom International
1.What is this device use for? 2. Which professions usually use this device?
knowledge
openEndedQuestion
Show
Edit
Destroy
Cejose Wisdom International
5 a..What type of company produces this devices. b.Give two advantages of this device
knowledge
openEndedQuestion
Show
Edit
Destroy
Cejose Wisdom International
8.What is this device? 9.Where can it be found? 10.State the function.
knowledge
openEndedQuestion
Show
Edit
Destroy
Cejose Wisdom International
3.a.What can of device is this?What is this device use for?What can be use to replace the thumb?
knowledge
openEndedQuestion
Show
Edit
Destroy
Cejose Wisdom International
Where can this device be found. what category does this device belong to. Give it name.
knowledge
openEndedQuestion
Show
Edit
Destroy


smile
My Groups
Create a New Question
Question
If the public education systems in the U.S. are all federalized, what would be the pros and cons?
Attach
Tags:
Add Multiple Choice Options
Evaluate My Question
Level5 question; 99.999452% confidence
Show evaluation metric
Submit Question
Classification Model with
Multinomial Logistic Regression
bias
$z_j = \mathbf{w}_j^\top \cdot \mathbf{x}$
SoftMax
probabilities
Level 1
Level 2
Level 3
Level 4
Level 5

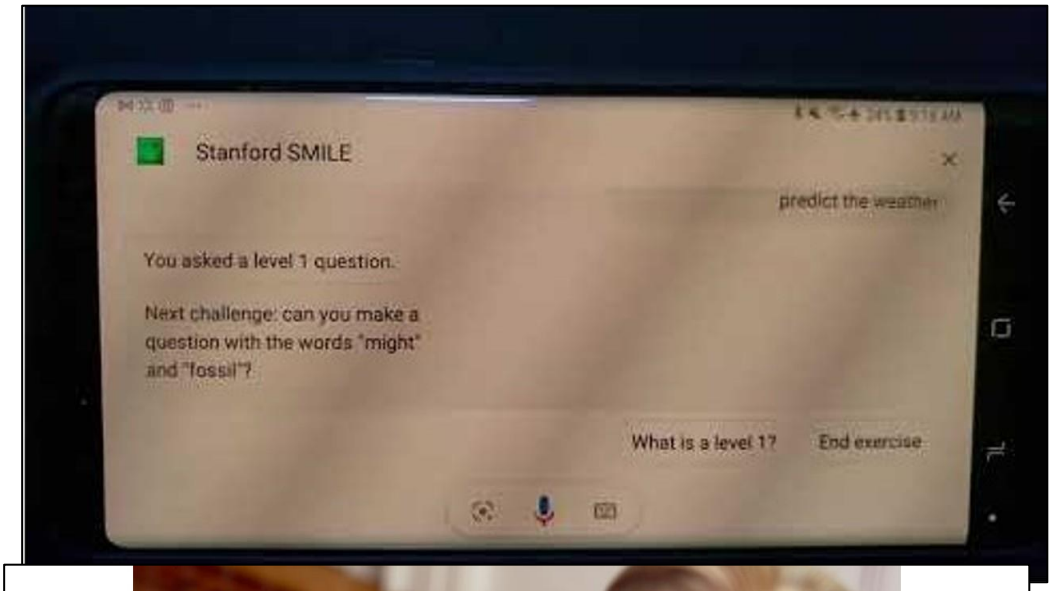




#lymphoma #gene type

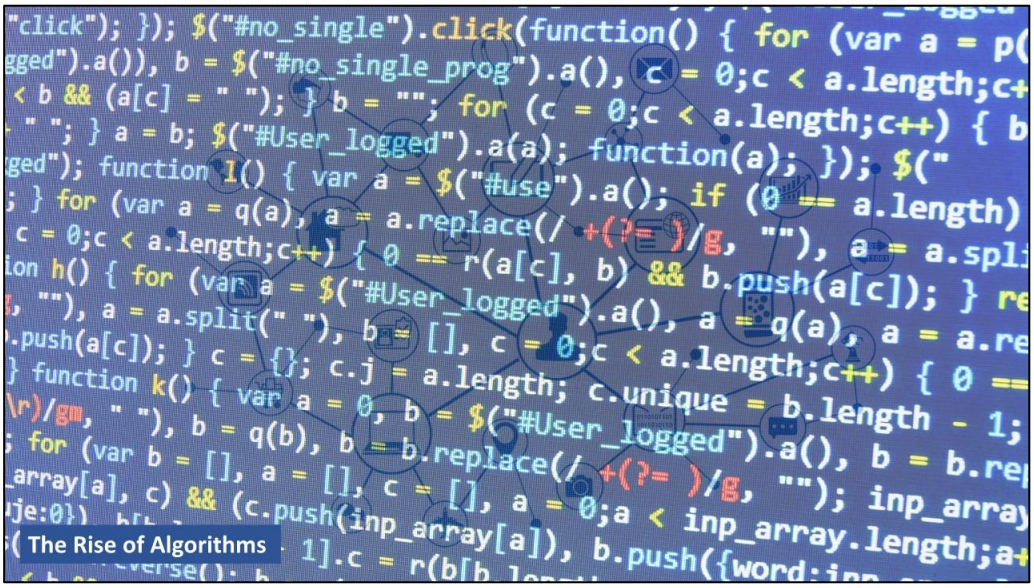
"Are we ready to stratify treatment for diffuse Large B-cell lymphoma using molecular hallmarks?"

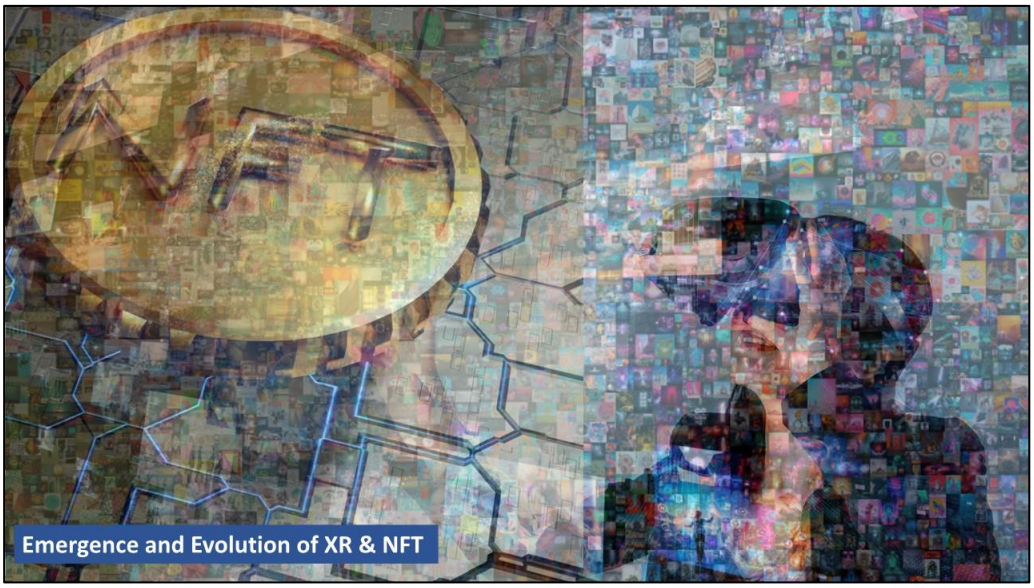
Talk to "Stanford SMILE"

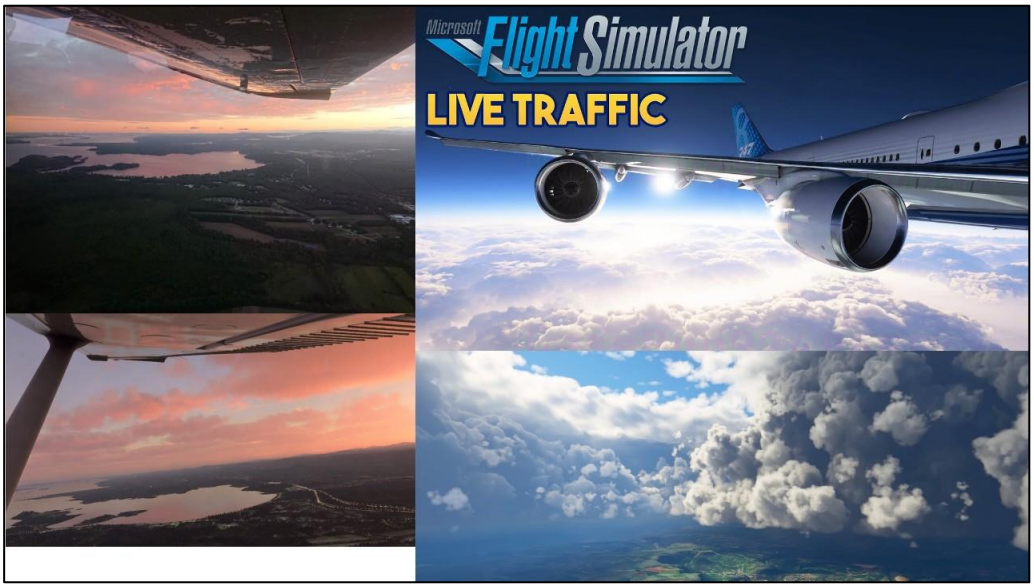

Stanford SMILE
predict the weather
You asked a level 1 question.
Next challenge: can you make a question with the words "might" and "fossil"?
What is a level 1?
End exercise

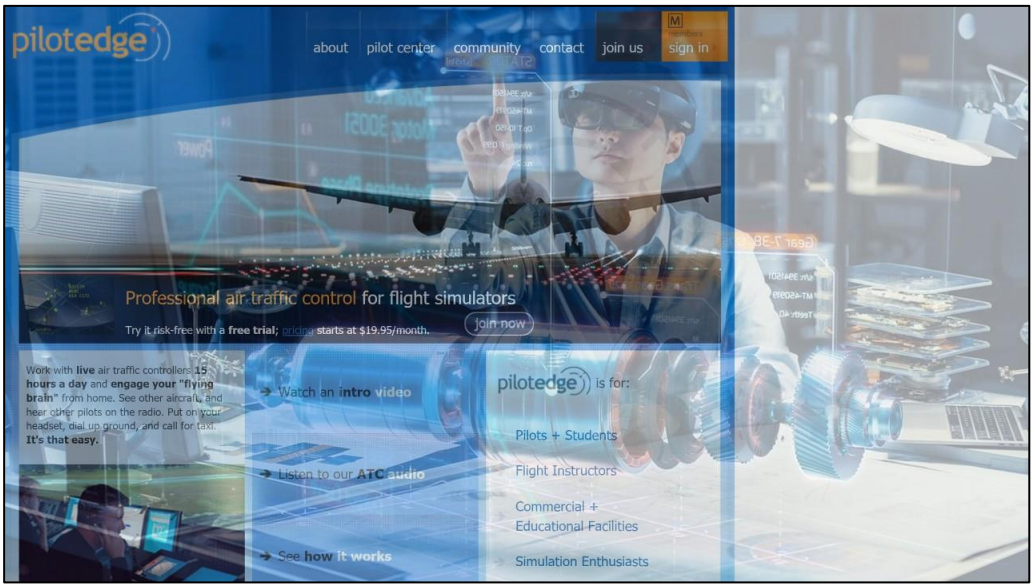
Can AI be a new assistant coach?
AI avatar w/ your favorite coach's look and voice

Notable Changes


The Rise of Algorithms


Emergence and Evolution of XR & NFT


Microsoft Flight Simulator
LIVE TRAFFIC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pilotedge is for:
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Flight Instructors
Commercial + Educational Facilities
Simulation Enthusiasts

1916

"The cinema is little more than a fad. It's canned drama. What audiences really want to see is flesh and blood on the stage."

Charlie Chaplin, actor, producer, director, and studio founder

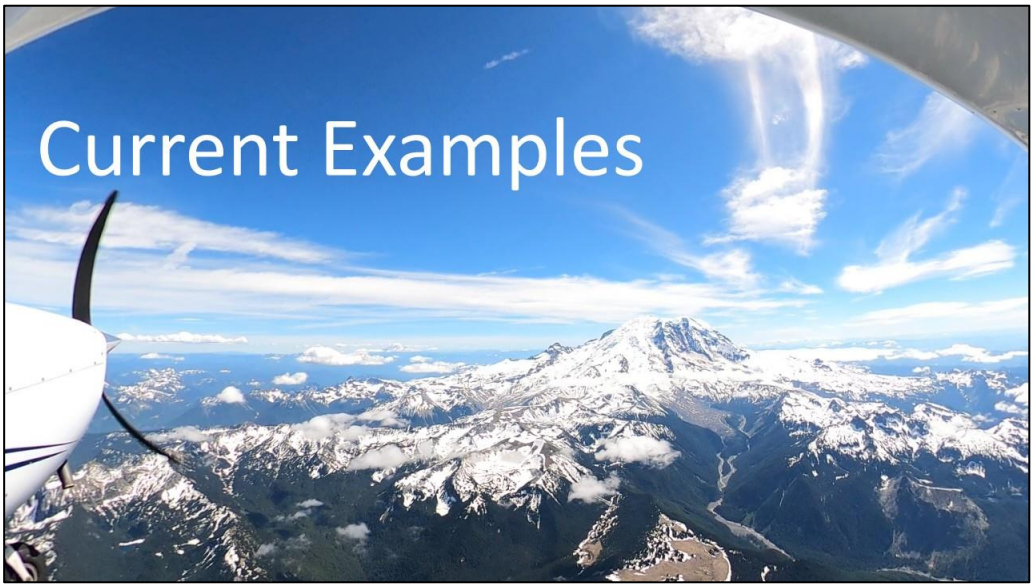
1977

"There is no reason for any individual to have a computer in his home."

Ken Olson, president, chairman and founder of Digital Equipment Corporation

2021

"The idea that current public schools and teachers will be replaced by virtual reality and artificial intelligence trained by experts is just nonsense, if not wrong..."


Current Examples

CONUNDRUMS

THE BLUE COMET
CONUNDRUM

THE TREASURE
CONUNDRUM

THE CHOCOLATE
CONUNDRUM

ASTRANOVA
SCHOOL

THE PIZZA
CONUNDRUM

THE MARTIAN
CONUNDRUM

What have you learned so far?
don't give up
ENTREPRENEURSHIP: MUCH MORE THAN BUSINESS
At SCH Academy, entrepreneurship is an approach to problem solving. CEL experiences equip our students to be resilient and resourceful, with the mindset and drive to overcome obstacles and create new possibilities.

Inspiring young leaders to make the world a better place!

Have A Global Vision

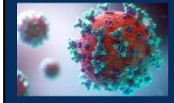
Ask Creatical Questions

Learn to Make Changes

Open Up Full Potentials

Topic 1

COVID-19



HALO-Fi

▶ Topic Background: UN SDG Goal 6 Clean water and sanitation

- Facts 1: The COVID-19 pandemic has demonstrated the critical importance of sanitation, hygiene and adequate access to clean water for preventing and containing diseases.
- Goal 6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all.

▶ Learning Objectives

- Discover global issues — COVID-19, understand the basic concepts of virus, and investigate the global impact of COVID-19.
- Explore current solutions to prevent and track COVID-19 and learn technologies used in the solutions for individual and public well-being.
- Ideate and create your own solution to reduce the impact of COVID-19.

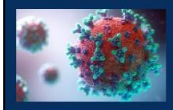
▶ Final product(s)

- Prototype for untact (non-contact) lifestyle with AI features

▶ Related Subjects and STEAM Skills

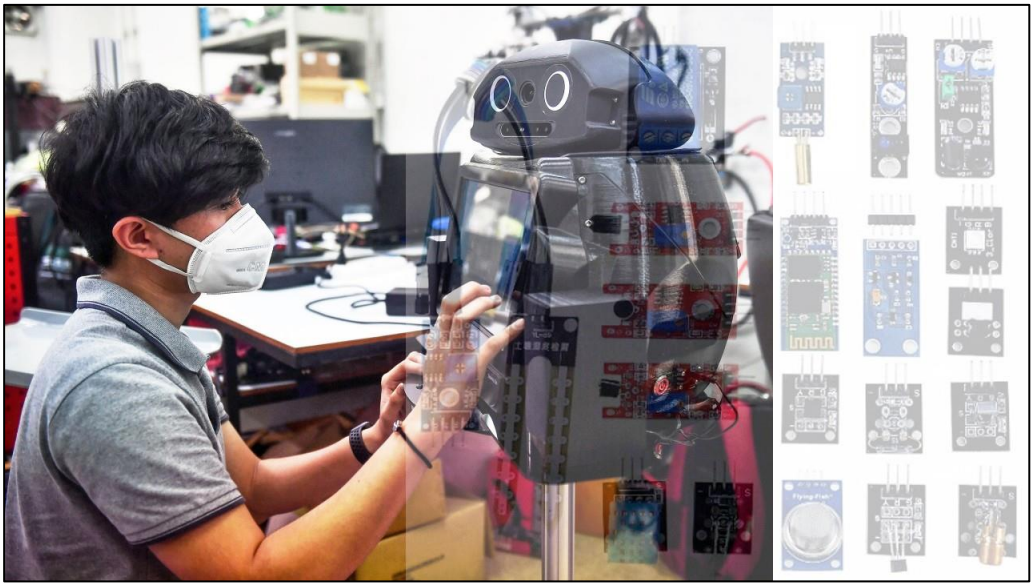
Science	Technology	Engineering & Art	Math	Language Art
• Biology (Viruses and infection)	• Sensor technology • AI and machine learning • Robotics	• Engineering design process • Design and create prototype	• Represent and interpret data and graph • Shape, dimensions and measurement	• Comprehension and collaboration • Presentation of knowledge and ideas

Topic 1
COVID-19

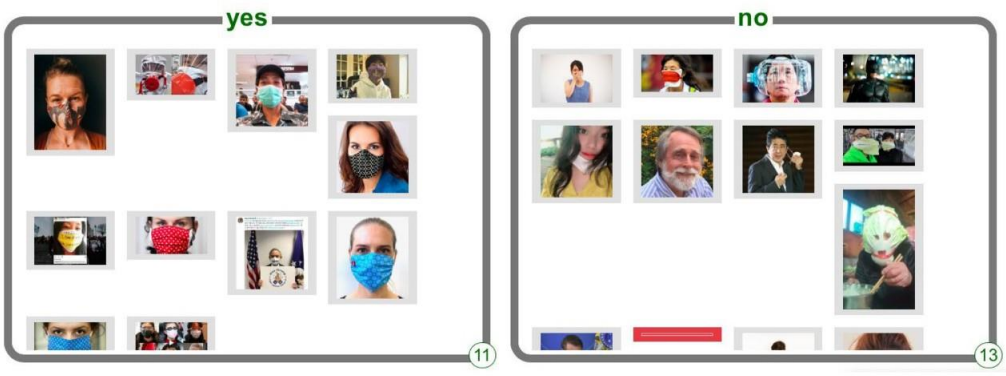


HALO-Fi

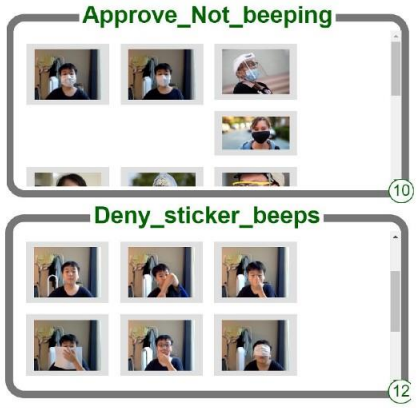
Lesson 7 – 8	**Ideate Solution (60 minute x 2 lessons)** 1. Understand the steps of the engineering design process. 2. Imagine, brainstorm and discuss ideas to create own solutions: Combining multiple technologies to design innovative solution for COVID-19. 3. Plan how to make prototype and the way to apply learned technology.
Lesson 9 - 11	**Create Prototype (60 minute x 3 lessons)** 1. Create prototype using raw materials and learned technology (AI, App making). 2. Ask questions to improve prototype using SMILE. 3. Test, evaluate and improve the prototype.
Lesson 12	**Presentation (60 minute)** 1. Create pitch deck with prototype description. 2. Present the pitch deck and prototype to the class and parents. 3. Explore other groups' prototype and provide feedback.



데이터를 선택할 때 뭐가 중요할까요?

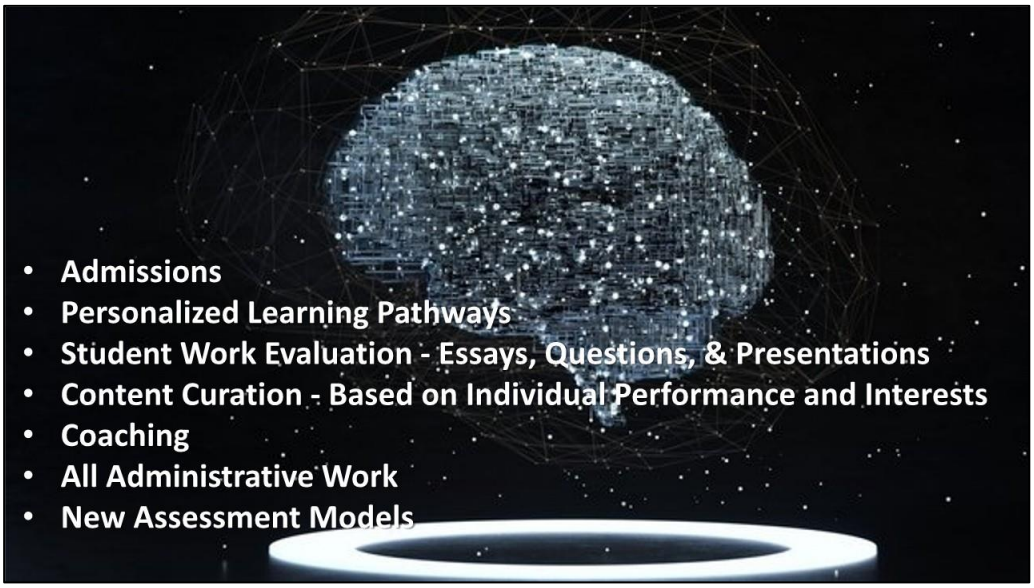


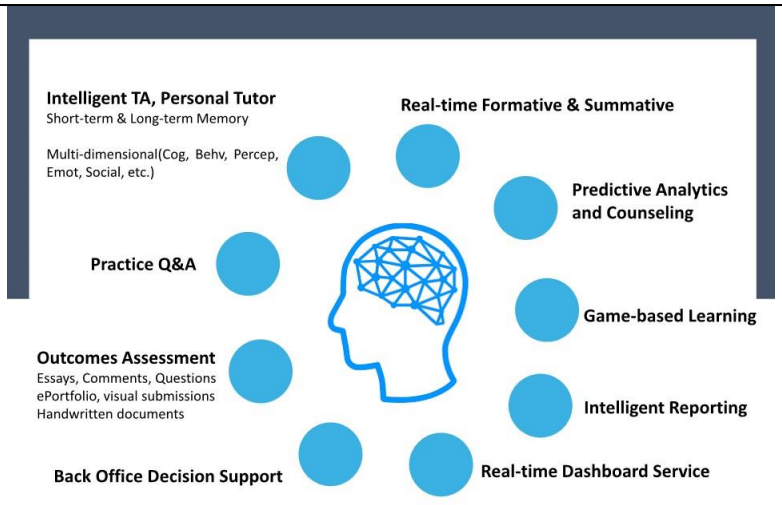
프로토타입 이름_ AI (멤버 2)



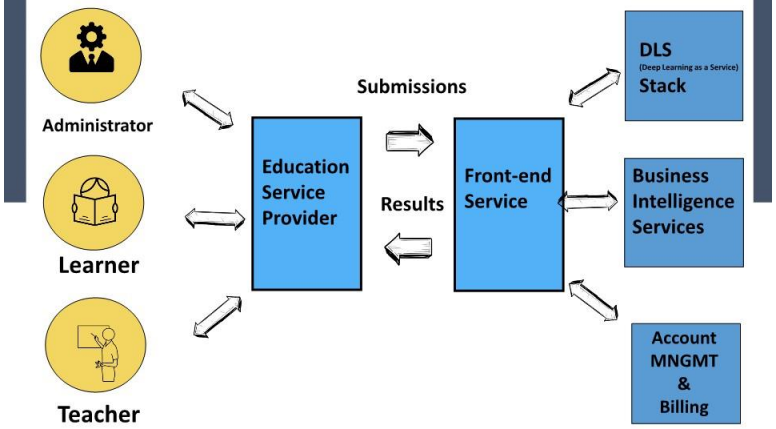
테스트 결과 보고서를 쓰세요.

1. **테스트 횟수:** 5회
2. **가장 높은 %:** 97%
3. **가장 낮은 %:** 82%
4. **%를 올리기위해 어떤것을 했나요? 그리고 결과가 어떻게 달라졌나요?**
   이미지를 추가했더니 Confidence 가 91% 로 올라감.



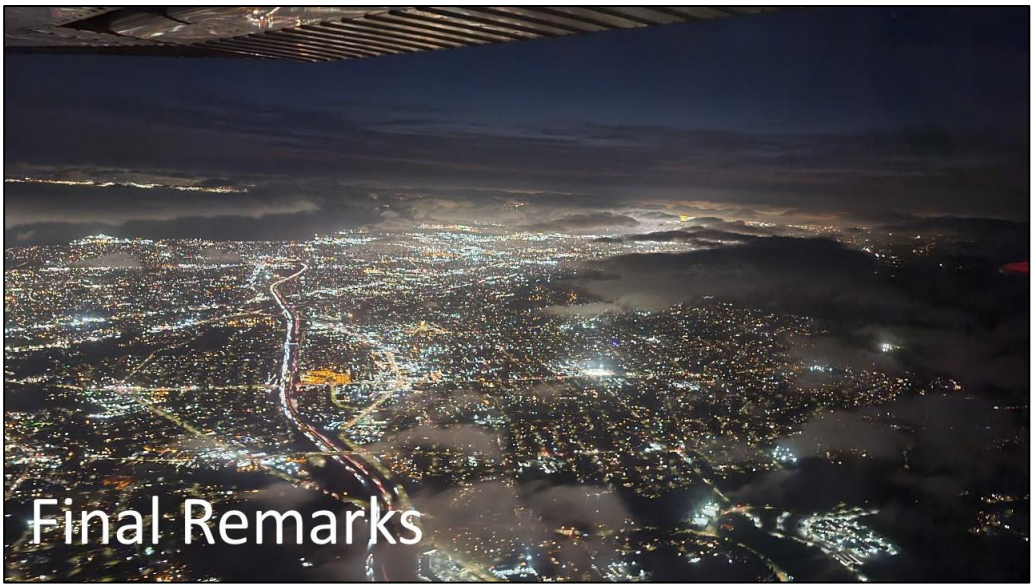


| API Service Model (Simplified)



AI is as good as its training data

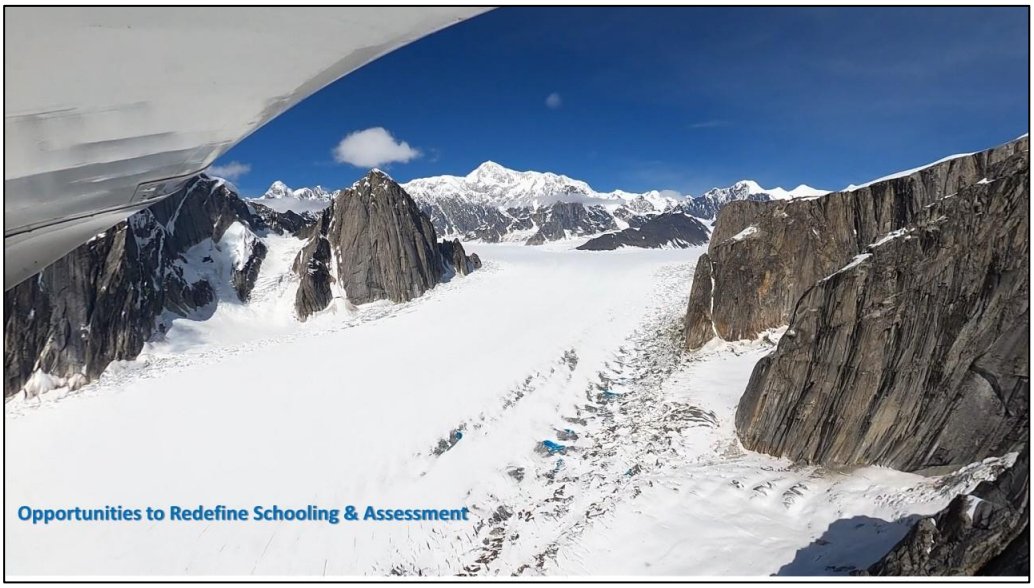
Whose consent will you need?
What if everyone opted-out?
What if algorithms and data models are biased? (Gender, Race, Disability, etc.)



Independent Learner
More with Less
Learn to Create
Create to Learn
One-way Teaching to
Personalized Coaching
Discrete Subjects to
Experiential Challenges

Developing competencies for the future society

- Lifelong independent learning strategies in highly algorithmic online spaces.
- Generative learning and creator experience models.
- Leverage AI and XR in creating and learning.



What is your life changing question?

Paul Kim
digitalschema@gmail.com
phkim@stanford.edu

Keynote 2

Auditorium

Keynote 2, 10:30-12:00, August 20, 2021

The present and future of Metaverse in Education

Gabriel BAKER

Product Manager for FRAME, USA

Abstract

Gabe is a former teacher and education researcher who got his Masters Degree in Education Technology from the University of California, Santa Barbara, where he studied the way teachers and students interact in 3D online environments. He has since worked at a variety of education and immersive technology companies. Currently, he is the Product Manager for FRAME, a 3D communications platform used for online classes, meetings, and events around the world.

Education in the Metaverse

Gabe Baker

FRAME Product Manager

What is the metaverse?

Meta - with	Verse - transform, turn
Greek	Latin

FORTNITE, VIRBELA, ROBLOX, VSTORY, ALTSPACE, FRAME....ANYTHING IN A 3D SPACE THAT PEOPLE CAN EXPLORE TOGETHER.....all of them part of the Metaverse. But to really be meta (with), they need to be **connected.**

What is the metaverse?

What is a tool that connects multiple different experiences that people can explore together today?

The web browser.

The web has been a metaverse for a long time.

Why education and the metaverse?

What is traditional video conferencing bad at?

- Sense of togetherness
- Sense of presence
- Any mode of interaction besides webcam
- Breaking into small groups
- Someone walking to the “front of the room”
- Fun, playfulness

SPACE MATTERS

What are the things teachers take advantage of every day in physical classrooms?

Why education and the metaverse?

What are metaverses good at?

- Sense of togetherness
- Sense of presence
- Mode of interaction besides webcam
- Breaking into small groups
- Someone walking to the “front of the room”
- Fun, playfulness

Why education and the metaverse?

- VR possibilities
- Students are familiar with them
- Immense content viewing possibilities (3d models, 360 content)
- Superpowers
- Each part of the metaverse offers a whole other word - new features, designs, capabilities

Why education and the metaverse?

Superpowers

- In the metaverse, you don't need to be limited by the laws of physics and other real world constraints.
- Muting, moving others
- Meeting in any place, real or fantastical
- Flying
- Rearranging learning spaces with a click
- Anything that can be coded

Superpowers can be abused.
How much control should a teacher have?

Why avatars?

Avatars are how many people are used to interacting online outside of education: games, communities, etc.

Avatars vs. web cams?

Depends on the context. Also - it's not one or the other. Use both.

Why avatars?

Requiring webcams can be challenging.

Forcing students to display their living surroundings is not ideal.

Avatars provide the way to move in space and visualize the teacher and peers.

Opens up opportunities for role playing (a student with an avatar of a doctor, role-playing as a doctor).

Avatars + realism

Do avatars need to be realistic?

No.

Can that be effective? Yes. (metahumans)

Fundamentally - avatars just need to be SOMETHING.

Research shows that people will identify with their avatars even if they are simple shapes with eyes.

Customizability is key in larger scale environments...and fun.

How to choose which virtual world?

Depends on your goals. Teachers have successfully used hundreds of different virtual world platforms.

Very few of them are actually purpose-built for education.

Also, just because something is “built for education” doesn’t necessarily mean it will be effective.

Furthermore - what is effective for teachers is not always effective for students.

How to choose which virtual world?

Depends on your goals. Teachers have successfully used hundreds of different virtual world platforms.

Very few of them are actually purpose-built for education.

Also, just because something is “built for education” doesn’t necessarily mean it will be effective.

Furthermore - what is effective for teachers is not always effective for students.

Why not ed + metaverse?

Lots of problems with physical classrooms can be amplified or made earlier in virtual worlds:

- Behavior problems
- Bullying
- Distractions
- Technology problems
- Cheating
- Lack of Control

WHAT I DO: FRAME

Cross platform - on the web.

DIGITAL TWINS

COVID IMPACT

More schools will be coming back "in person".

But the macro-trend of online educations still rising.

More schools will also want solid digital backup plans.

Virtual worlds for education will

THE FUTURE

Bringing the "meta" to the metaverse - making it easy to move between different virtual worlds. From Fortnite to Frame to anything.

VR is going to get A LOT better. Graphics are getting better.

Game virtual worlds like Fortnite will get have more non-game aspects (concerts, events)

Non-game worlds will get more game aspects

INVITED SESSION

Invited Session 1-1

Board room1

Invited Session 1, 13:00-13:40, August 19, 2021

Teaching and learning in the age of advanced digital citizenship

Zizung YOON

Technical University of Berlin, GERMANY

Keywords

AI empowered education, Acceptance Issues, Role of Educator, Hybrid Talk: Learning, Design, Development and Dissemination of New Musical Instruments(3DMIN), Flipped Classroom in Aerospace Engineering, Immersion and Simulation for STEM Education

Education in AI ERA

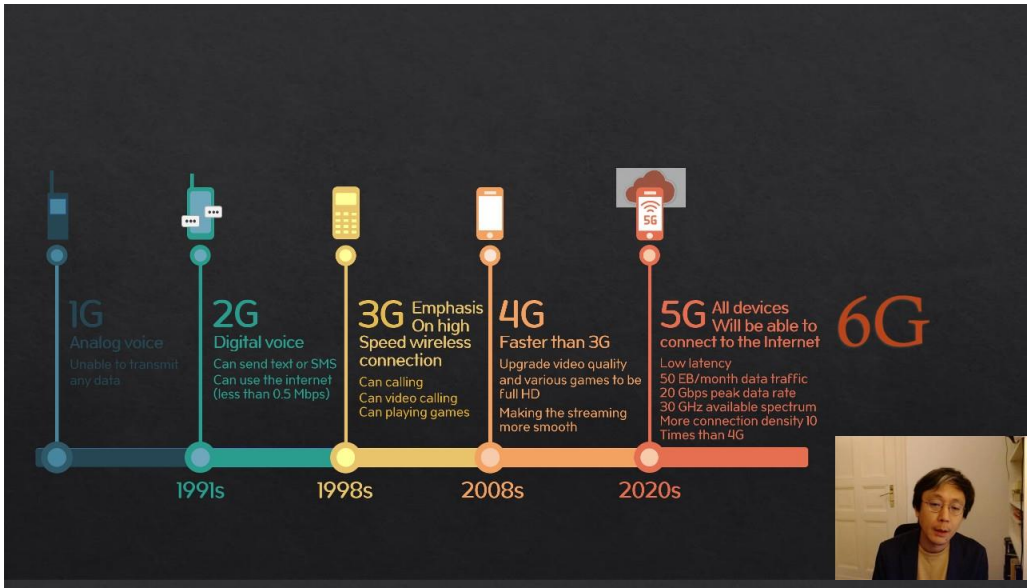
Dr.-Ing. Zizung Yoon

Chair of Space Technology @TU Berlin

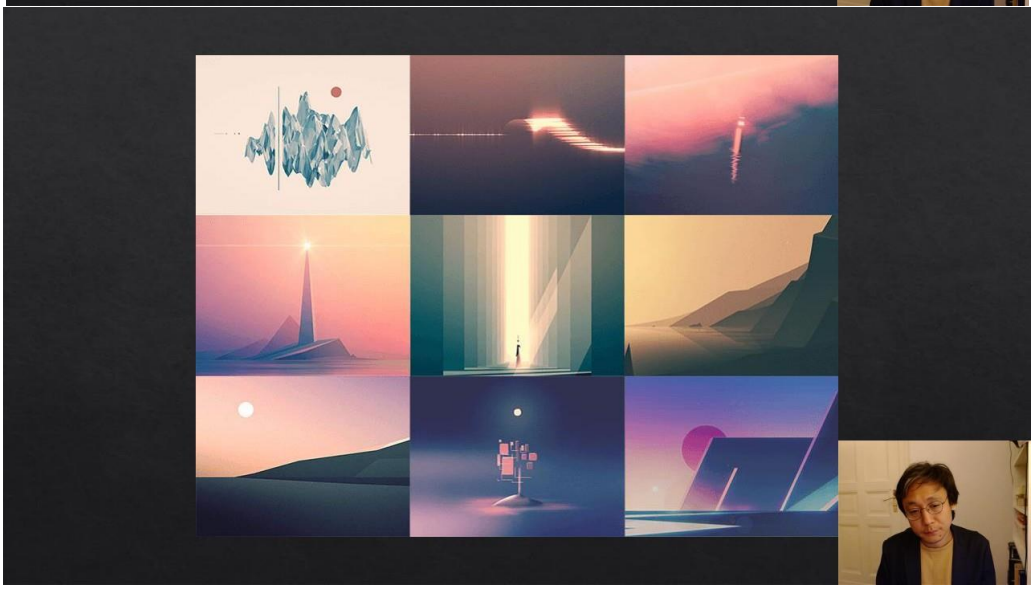
Research focus

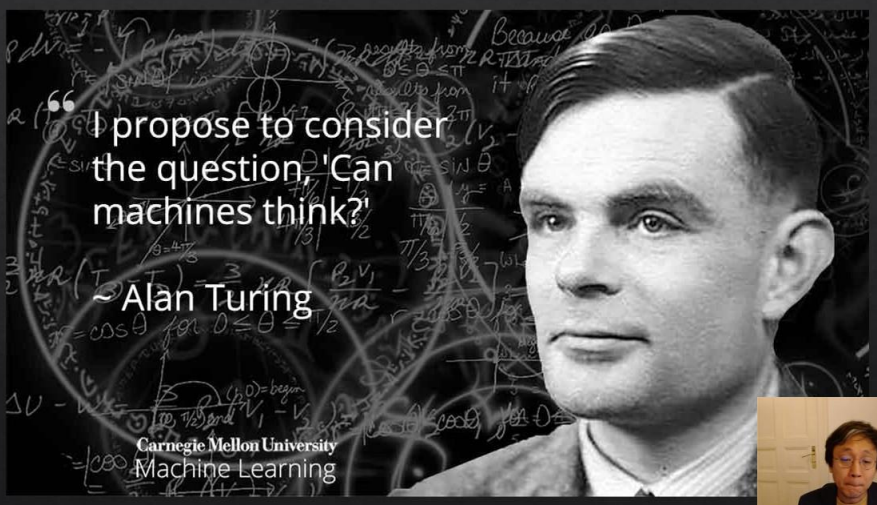
- Distributed satellite systems
- Satellite communication
- Internet of Things
- Remote sensing for environmental monitoring
- Spacecraft dynamics and control

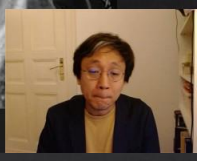
Seite 2


1G
Analog voice
Unable to transmit any data
2G
Digital voice
Can send text or SMS
Can use the internet (less than 0.5 Mbps)
3G Emphasis On high Speed wireless connection
Can calling
Can video calling
Can playing games
4G
Faster than 3G
Upgrade video quality and various games to be full HD
Making the streaming more smooth
5G All devices Will be able to connect to the Internet
Low latency
50 EB/month data traffic
20 Gbps peak data rate
30 GHz available spectrum
More connection density 10 Times than 4G
6G
1991s
1998s
2008s
2020s

ALPHAGO







Quantum Supremacy

nature

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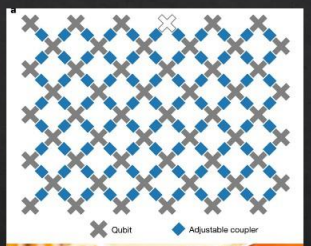
Article | Published: 23 October 2019

Quantum supremacy using a programmable superconducting processor

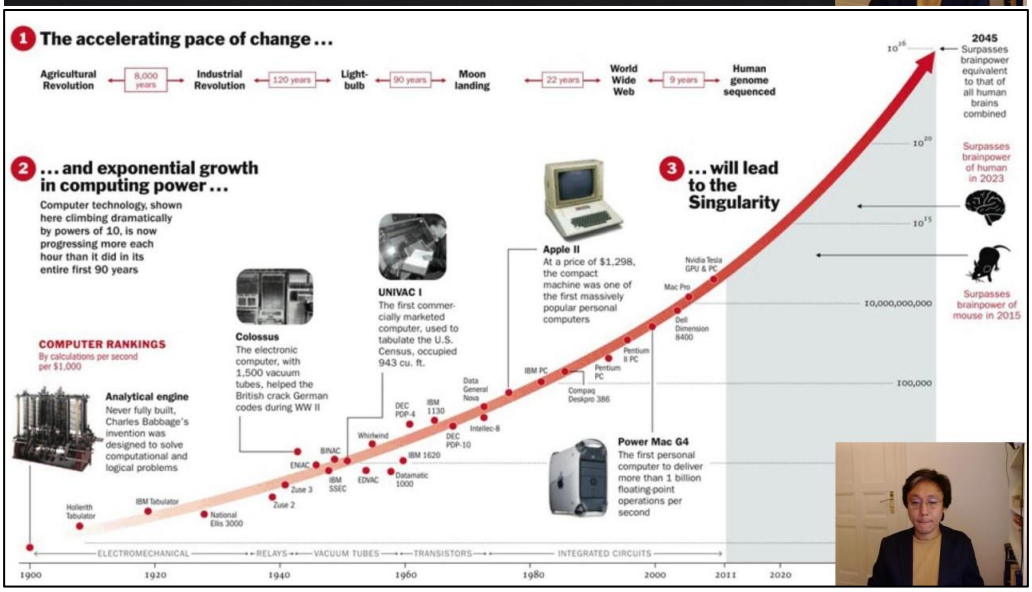
Frank Arute, Kunal Arya, [...] John M. Martinis

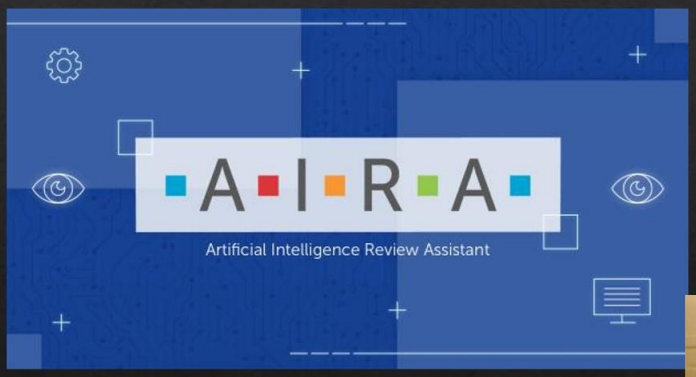
Nature **574**, 505-510(2019) | Cite this article

809k Accesses | 790 Citations | 6018 Altmetric | Metrics



Sycamore quantum processor with 54 qubits, each made of superc… by Goo…



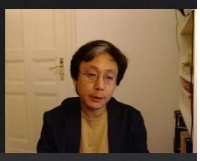


AI empowered education

- Providing personalized problems
- AI powered real time feedback and lessons
  - Essay grading SW e.g. Knowledge Analysis Technologies (KAT) by Pearson
- Plagiarism detection

Acceptance Issues

- Educators afraid of being replaced
  - From learning supplement to stand alone instructor???
- Ethical: under what circumstance should AI be given the lead role in class room?



Role of Educator

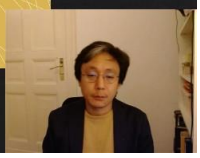
- Creativity
- Collaboration
- Critical Thinking

hybrid plattform

SCHERING STIFTUNG

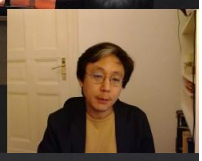
Technische Universität Berlin

Universität der Künste Berlin

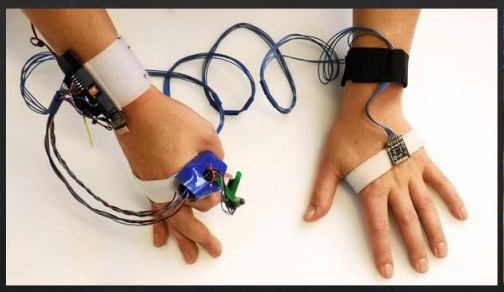


Hybrid TALK: Learning

- »Simulation for vocational education of electrician«
  - Prof. Dr. Tanja Mansfeld
  - bbw Hochschule | vocational education studies
- »BYOD or not BYOD in elementary school«
  - Prof. Dr. Daniel Hromada
  - UdK Berlin | Digital education
- »To educate and/or learn?«
  - Prof. Dr. Ute Pinkert
  - UdK Berlin | Theatre pedagogy
- »Robotics and diverse learning«
  - Nadine Klein
  - TU Berlin | Robotics
- »Learning space«
  - Prof. Dr. Kirsten Winderlich
  - UdK Berlin | Asthetic learning

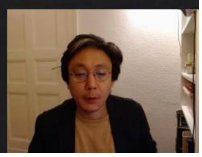


Design, Development and Dissemination of New Musical Instruments (3DMIN)



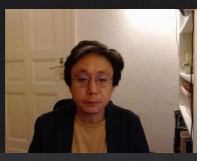
Design, Development and Dissemination of New Musical Instruments (3DMIN)

https://youtu.be/kaY-BJyvVzU?t=73

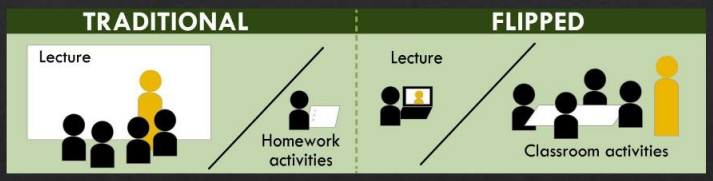


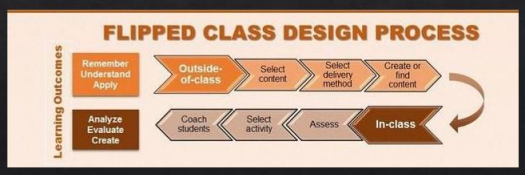
Making in Mixed Reality

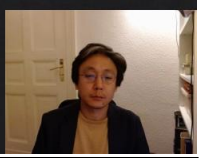
https://youtu.be/_LIXKEJKfQ4?t=26

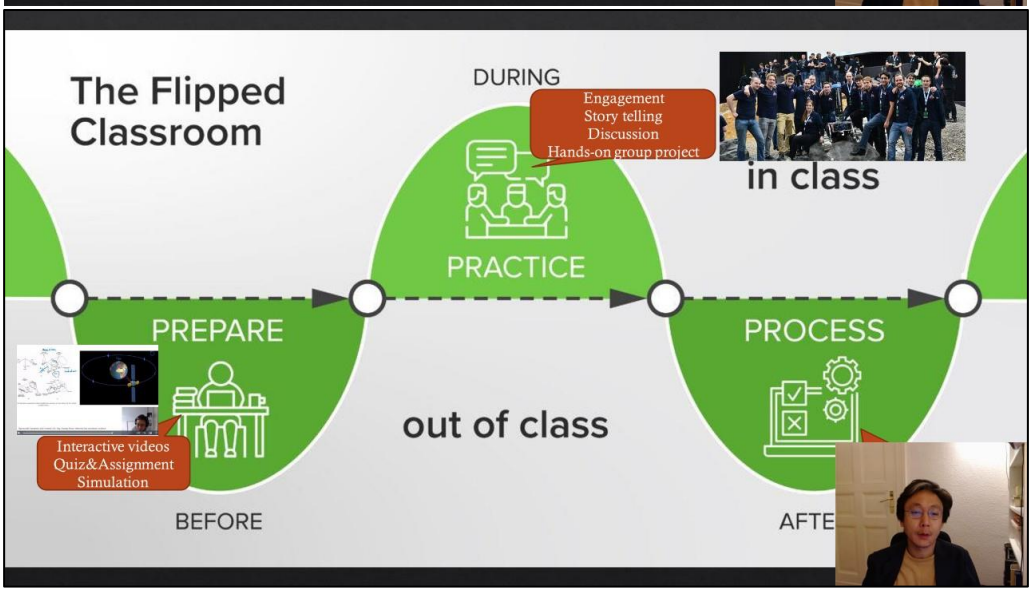


Flipped Classroom in Aerospace Engineering

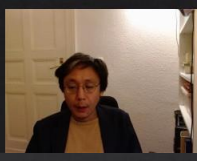






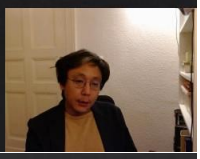


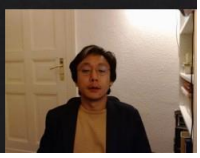
- STEM e.g. Aerospace Engineering
  - Problem solving creativity
  - Immersion: AR/VR
  - Simulation:



Immersion and Simulation for STEM Education

- https://youtu.be/jTZ96uHGDEw?t=114





Vielen
Dank
Zizung.yoon@tu-berlin.de

Invited Session 1-2

Board room 2

Invited Session 2, 13:00-13:40, August 19, 2021

Beyond the Programs at USF Digital Learning

Christie NICHOLAS
Associate Director, Digital Learning at USF Innovative Education, University of South Florida, USA

Abstract
This presentation will highlight some of the innovative programs that support online faculty at the University of South Florida (USF). Participants will learn about Digital Learning's collaborative approach to online course development, faculty support, and creative solutions implemented during the COVID-19 pandemic.

BEYOND THE PROGRAMS AT USF DIGITAL LEARNING

INNOVATIVE EDUCATION

Dr. Christie Nicholas

DIGITAL LEARNING EXPERTISE

LEARNING DESIGN

Partner with faculty to develop fully high-quality online courses and programs.

MULTIMEDIA DESIGN

Partner with faculty to develop graphics, interactive assets, and animations.

VIDEO PRODUCTION

Partner with faculty to develop custom video packages for online courses and broader USF.

FACULTY SUPPORT

Partner with faculty to support and assist with online course technology and delivery before and after development.

1,122

ONLINE COURSES DEVELOPED SINCE 2013

1,838

FACULTY CERTIFIED TO TEACH ONLINE ACROSS ALL USF CAMPUSES

78

AWARDS FOR VIDEO PRODUCTION, LEARNING DESIGN, AND FACULTY SUPPORT

OUR APPROACH TO FACULTY SUPPORT

- Live workshops
  Skills and teaching strategies
- Instructor Guides and Tutorials
  PDF & Video Tutorials
- Live Support & Email
  Virtual consultation center (chat, meet, screenshare)
- Online Instructor Certification (OIC)
  Instructor presence, active learning

canvas

Kaltura

OUR APPROACH TO MULTIMEDIA DESIGN

- Creating Engaging Online Course Content
  Innovative custom multimedia to support online courses
- Supporting Faculty During COVID-19
  Instructor lectures, labs, 360 tours, interactive media, training on self-produced videos
- Continuing University Partnerships
  Videos and campaigns that help to keep USF moving forward

50+ University Partner Collaborations

450+ Completed Multimedia Projects

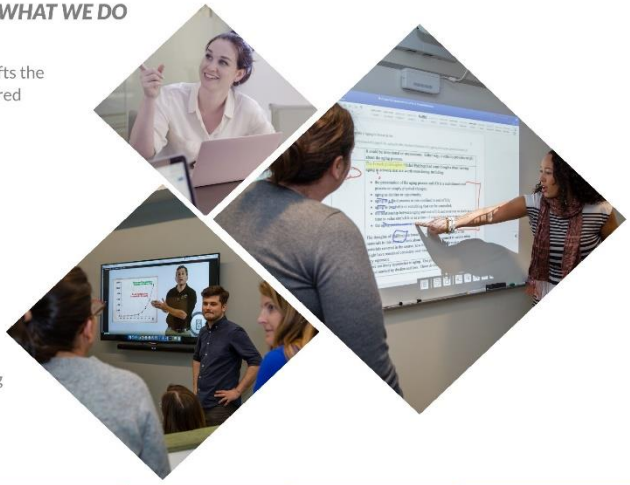
60 Ongoing or Proposed Projects

OUR APPROACH TO LEARNING DESIGN

COLLABORATION IS AT THE HEART OF WHAT WE DO

> Intentional, human-centered process that shifts the focus from content delivery to student-centered learning experiences.

- Highly collaborative
- Rooted in quality standard research and practice
- Informed by ADDIE, Design Thinking, collaborative problem solving, and sound pedagogical practices
- Evolved based on faculty feedback, new technology, online pedagogies, emerging research, and statewide initiatives



LEARNING DESIGN MODEL

- Planning & Analysis
- Design & Prototype
- Development
- Evaluation & Close-Out

WHAT CAN FACULTY EXPECT?

- Weekly or bi-weekly collaborative brainstorming sessions
- Mapping and planning resources to assist with content organization and creation
- Online resources and just-in-time support with technology
- Project management and pacing reminders to help keep you on track

- Custom multimedia development to support student learning outcomes
- Design strategies to facilitate student-to-student, student-to-content, and student-to-instructor interaction
- Learning design and online best practices and principles
- Branded, cohesive, and accessible instructional materials that meet the needs of *all* your students

DESIGNING YOUR ONLINE COURSE

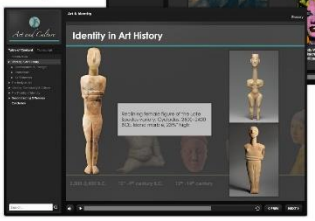
AN ONLINE COMPANION COURSE

VISUAL IDENTITIES

CARRIED THROUGHOUT ALL COURSES/INSTRUCTIONAL MATERIALS

CANVAS HOME PAGE

INTERACTIVE LECTURES



STUDENT SUPPORT RESOURCES

DESIGNING WITH QUALITY IN MIND

COURSE DEVELOPMENTS CULMINATE IN A QUALITY REVIEW

- Designers use the research-based quality standards as a roadmap during development
- Quality reviews focus on the *design* of the course
- Quality review process aligns with statewide quality initiatives
- Iterative and collaborative process that empowers faculty to conduct an abridged self-review
- Online and just-in-time resources to assist with creative ideas for meeting quality standards

OUR RESPONSE TO COVID-19

PROGRAM EVALUATION

Digital Learning Collaborative (DLC) is a unique program that pairs faculty course developers with experienced learning designers to reimagine and optimize learning in a digital space.

- Few studies have evaluated collaborative models of course design
- Even fewer have considered learning transfer to other contexts
- Anecdotal evidence supports learning, although the factors that lead to these changes are unknown

RESEARCH PURPOSE AND QUESTIONS

The purpose of this study was to evaluate the DLC program utilizing the first three levels of Kirkpatrick's training evaluation model.

RQ1: How do faculty participants **perceive** the DLC program?

RQ2: What do faculty participants **learn** as a result of the DLC program?

RQ3: How do faculty participants **transfer** their learning to other teaching contexts?

EVALUATIVE MODELS

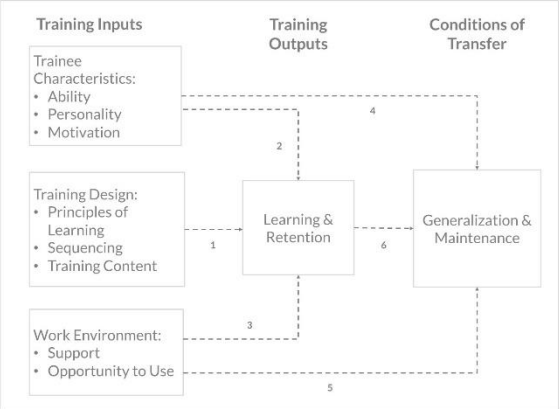
KIRKPATRICK'S TRAINING EVALUATION MODEL

Level 4: Results	The degree to which targeted outcomes occur as a result of the training and support and accountability package.	
Level 3: Behavior (Transfer)	The degree to which participants apply what they learned during training when they are back on the job.	RQ3: How do faculty participants transfer their learning to other teaching contexts?
Level 2: Learning	The degree to which participants acquire the intended knowledge, skills, attitude, confidence and commitment based on their participation in the training.	RQ2: What do faculty participants learn as a result of the DLC program?
Level 1: Reaction (Perception)	The degree to which participants find the training favorable, engaging and relevant to their jobs.	RQ1: How do faculty perceive the DLC program?

Kirkpatrick, 1996

EVALUATIVE MODELS

TRANSFER PROCESS MODEL



DATA SOURCES AND ANALYSES METHODS

RESEARCH QUESTIONS	DATA COLLECTION METHODS	ANALYSIS PROCEDURES
Perception (Level 1) **RQ1:** How do faculty participants perceive the DLC program?	• Online Experience Questionnaire • DLC Participant Questionnaire • Semi-Structured Interviews	• Quantitative – Likert scale rating perceptions of program characteristics and general satisfaction • Qualitative – Constant comparative method to identify patterns and codes in relation to perception
Learning (Level 2) **RQ2:** What do faculty participants learn as a result of the DLC program?	• Design Activity Assessments • DLC Participant Questionnaire • Semi-Structured Interviews	• Quantitative – Analysis of knowledge check and quality evaluation scores • Qualitative – Constant comparative method to identify patterns and codes in relation to learning
Learning Transfer (Level 3) **RQ3:** How do faculty participants apply what they have learned to other teaching contexts?	• DLC Participant Questionnaire • Semi-Structured Interviews	• Qualitative – Constant comparative method to identify patterns and codes in relation to learning transfer

STUDY PARTICIPANTS

VARIABLE	*n*	%
Gender		
Male	7	46.7%
Female	8	53.3%

VARIABLE	*n*	%
Age		
35-44	5	33.3%
45-54	8	53.3%
Over 55	2	13.3%

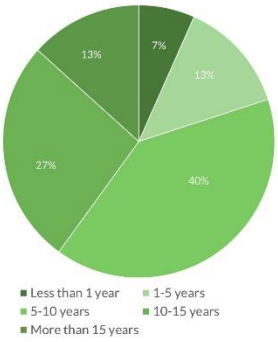
Note. N = 15

VARIABLE	*n*	%
Rank		
Tenured	6	40.0%
Not Tenured But On A Tenure Track	1	6.7%
Not On A Tenure Track (Ongoing Appointment)	7	47.7%
Note On A Tenure Track (Temporary/Fixed Appointment)	1	6.7%

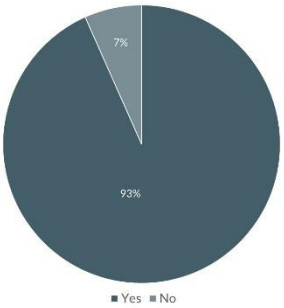
VARIABLE	*n*	%
College		
Arts And Sciences	3	20.0%
Behavioral and Community Sciences	5	33.3%
Education	2	13.3%
Business	4	26.7%
Other	1	6.7%

STUDY PARTICIPANTS

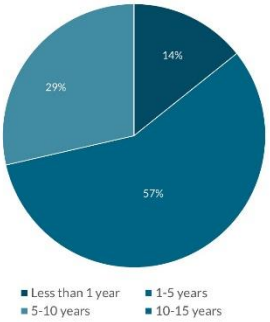
YEARS TEACHING AT USF



TAUGHT ONLINE



YEARS TEACHING ONLINE



RESEARCH FINDINGS

Participants had positive perceptions of the design and development process and highly valued the collaborative learning design support.

Participants learned new learning design and online best practices and principles while participating in the process.

Participants were able to transfer their learning to other courses they were teaching, regardless of modality, by applying the course design framework.

Learning Design Support	Ability to Learn/Apply	Plan for Time Needed	Approach with Open Mind
Learning Design Best Practices and Principles	Course Design Framework		Use of Technology
Apply Design Framework	Use of Technology to Enhance Experience		Informed teaching practices

EXAMPLES OF LEARNING TRANSFER

*"**My communication is richer** because of the suggested idea of having an email go out to summarize what's going on that week. I also added introductory videos to all my modules, which **I do for all my courses now**".*

*"I don't lecture for very long anymore. I used to go in with a deck of 25 slides and now it's more like six or seven. It's much more **interactive** and I would say that my approach is heavily influenced by the online courses I've developed. Your department **fundamentally changed the way I teach and the way I think about teaching**. That mindset has changed."*

*"I've taken **elements from this experience and applied them to the forefront of my approach**. While some things might seem fundamental like ensuring students come away with the intended outcomes, I think sometimes those things fly under the radar."*

*"I used **the fundamentals of how this course was developed and applied it to another course I was teaching**. If you reverse engineered that course, you could see the course map in the framework of how I developed it."*

*"That wouldn't have even been on my radar so it was **invaluable to have people who can see other possibilities for what you're trying to do**."*

RECOMMENDATIONS

LEADERS IN HIGHER EDUCATION

- Recognize institutional challenges that prevent faculty from being innovative in their teaching
- Provide appropriate incentives and opportunities for online course development, online teaching, and contributions made to digital pedagogy.
- Recognize that collaborative course design provides a practical mechanism for learning and transferring new knowledge, strategies, and approaches to faculty teaching practices.

FACULTY

- Embrace the spirit of collaborative design.
- Plan for the time needed to develop a high-quality online course (and address any potential learning curves).
- Recognize that collaborative course design provides a practical mechanism for learning and transferring new knowledge, strategies, and approaches to faculty teaching practices.

LEARNING DESIGN STAFF

- Do not underestimate the value of collaborative learning design support.
- Recognize the expertise of all members of the course development team.
- Acknowledge that the design of collaborative online course development programs has the most far-reaching impact on faculty learning transfer.

QUESTIONS?

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SCAN ME

Invited Session 2

Conference Hall

Invited Session 2, 13:00-13:40, August 20, 2021

Educational Use of AR/VR and teaching Simulation in the U.S

Sanghoon PARK
Professor, University of South Florida, USA

Keywords
Augmented and virtual reality, Virtual Reality in Education, AR/VR applications for learning, Marker-based, Markerless, Resource-based, Design studio-based, Benefits and Considerations, Teaching Simulation, virtual teaching simulation

Educational uses of AR/VR and teaching simulation in the U.S.

Sanghoon Park

ICoME 2021

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AR/VR in Education

Important Developments in Educational Technology for K–12 Education

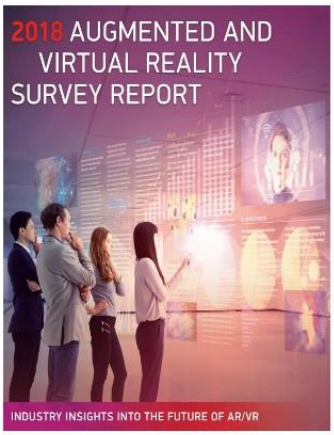
- Time-to-Adoption of One Year or Less
  - Makerspaces
  - Robotics
- Time-to-Adoption of Two to Three Years
  - Analytics Technologies
  - Virtual Reality
- Time-to-Adoption of Four to Five Years
  - Artificial Intelligence
  - Internet of Things

2020 EDUCAUSE Horizon Report™
Teaching and Learning Edition

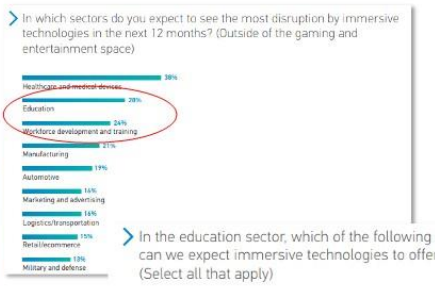
Emerging Technologies & Practices

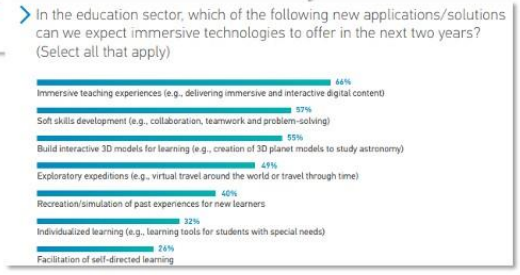
- Adaptive Learning Technologies
- AI/Machine Learning Education Applications
- Analytics for Student Success
- Elevation of Instructional Design, Learning Engineering, and UX Design
- Open Educational Resources
- XR (AR, VR, MR, Haptic) Technologies

https://library.educause.edu/resources/2020/3/2020-educause-horizon-report-teaching-and-learning-edition

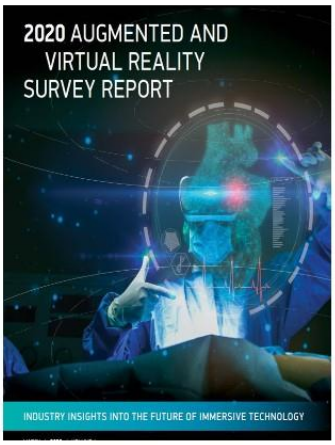


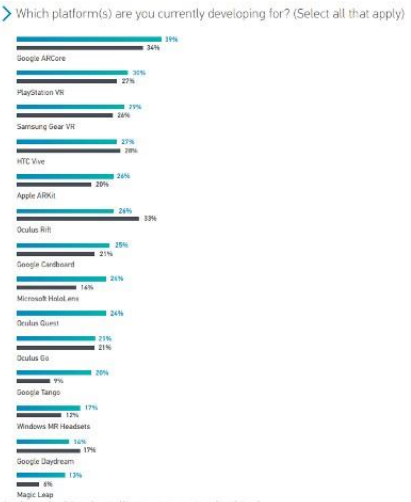
https://www.perkinscoie.com/images/content/1/8/v2/187785/2018-VR-AR-Survey-Digital.pdf





https://www.perkinscoie.com/en/ar-vr-survey-results/2020-augmented-and-virtual-reality-survey-results.html





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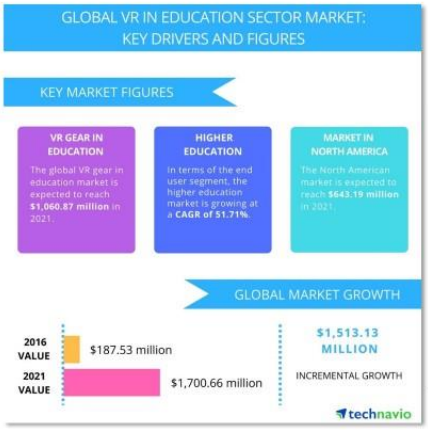
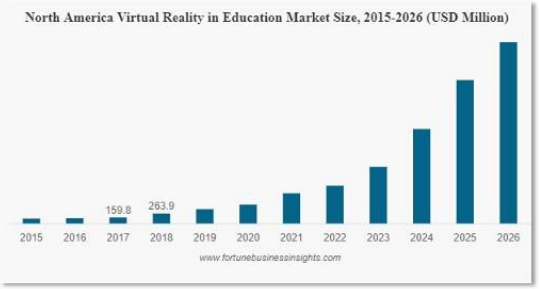
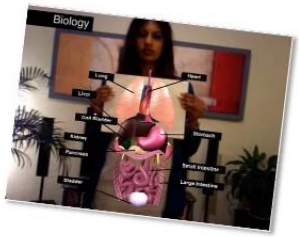


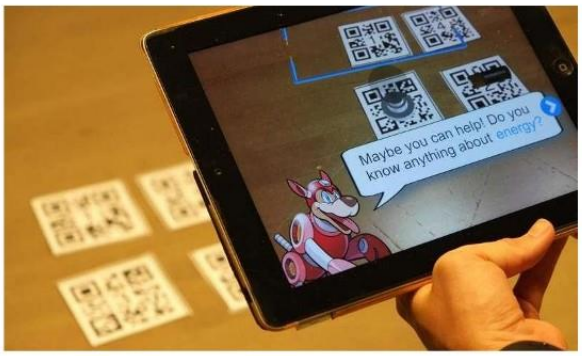


AR / VR applications for learning

AR / VR applications for Learning



Marker-based (print)



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Marker-based (object)

Marker-based (image)

https://www.curiscope.com/

AR / VR applications for Learning

General characteristics of augmented reality applications.

Primary author (year of publication)	Building tools	AR Features	Type	Assets
Akçayır et al. (2016)	Metaio	Image-based (markers)	Simulator	Text, video, animations
Burszтyn et al. (2017)	Native app. (Android, iOS)	Location-based	Game	Text, images, videos
Cai et al. (2017)	Native app. (3D modeling tool 3DS Max and graphics engine Java 3D)	Image-based (Kinect RGB camera)	Simulator	Animations
Cascales-Martínez et al. (2017)	Native app. (TUIO protocol)	Image-based (video projector and two cameras)	Game	Text
Chen et al. (2016)	Not specified	Image based	Exploration	Text, image, 3D model
Chen and Wang (2015)	Not specified	Image-based (turntable, PC, webcam)	Simulator	Image
Chiang et al. (2014)	Native app. (iOS)	Location-based	Exploration	Image, text, websites
Cuendet et al. (2013)	Not specified	Image-based (markers)	Simulator	Image
Dünser et al. (2012)	Native app.	Image-based	Exploration	Text, video, animations
Enyedy et al. (2015)	Not specified	Image-based (markers)	Simulator	Video
Estapa and Nadolny (2015)	Layar Creator	Location-based	Exploration	Video, websites, audio, image
Frank and Kapila (2017)	Native app. (iOS)	Image-based (markers)	Exploration	Video, text
Gopalan et al. (2015)	Not specified	Image-based	Exploration	Text, image, video
Gutiérrez de Ravé et al. (2016)	Vuforia	Image-based	Exploration	3D model
Huang et al. (2016)	Not specified	Location-based	Exploration	Text, image
Ibáñez et al. (2014)	Unity 3D, Vuforia	Image-based	Simulator	Text, image, animation
Ibáñez et al. (2016)	Unity 3D, Vuforia	Image-based	Simulator	Text, image, animation
Kamarainen et al. (2013)	FreshAIR, Vuforia	Location-based	Exploration	Text, image, audio, video
Lin et al. (2015)	Not specified	Image-based (markers)	Exploration	3D object
Liou et al. (2016)	Unity 3D, Vuforia	Image-based (markers)	Exploration	3D object, animation, video, audio
Martín Gutiérrez et al. (2010)	Native app.	Image based	Exploration	3D object
Salmi et al. (2017)	Not specified	Not specified	Simulator	Not specified
Sommerauer and Müller (2014)	Aurasma	Image-based	Exploration	Video
Tarng et al. (2015)	Native app. (Android)	Location-based	Simulator	3D model, animation
Tarng et al. (2016)	Native app. (Android)	Location-based	Simulator	3D model, animation
Wang et al. (2014)	Native app.	Image-based (markers)	Simulator	Text, 3D model, animation
Yoon et al. (2017)	Native app.	Image-based	Simulator	Animation
Zimmerman et al. (2016)	Native app.	Image-based	Exploration	Text, images

Ibáñez, M., & Delgado-Kloos, C. (2018). Augmented reality for STEM learning: A systematic review. *Computers and Education, 123*. 109-123. https://doi.org/10.1016/j.compedu.2018.05.002

AR / VR applications for Learning

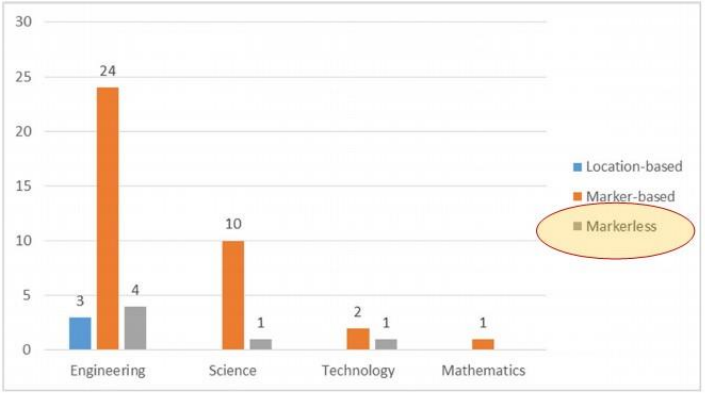


Fig. 8 AR type in each STEM field

Mystakidis, S., Christopoulos, A. & Pellas, N. A. (2021). systematic mapping review of augmented reality applications to support STEM learning in higher education. *Education and Information Technologies*. https://doi.org/10.1007/s10639-021-10682-1

Markerless

- Places virtual 3D objects in the physical environment (i.e., floor) rather than on identifying markers
- Eliminates the need for object tracking systems
- Improved mobility

https://www.marxentlabs.com/what-is-markerless-augmented-reality-dead-reckoning/ https://wonderscope.com/

AR / VR applications for Learning

Resource-based

nearpod

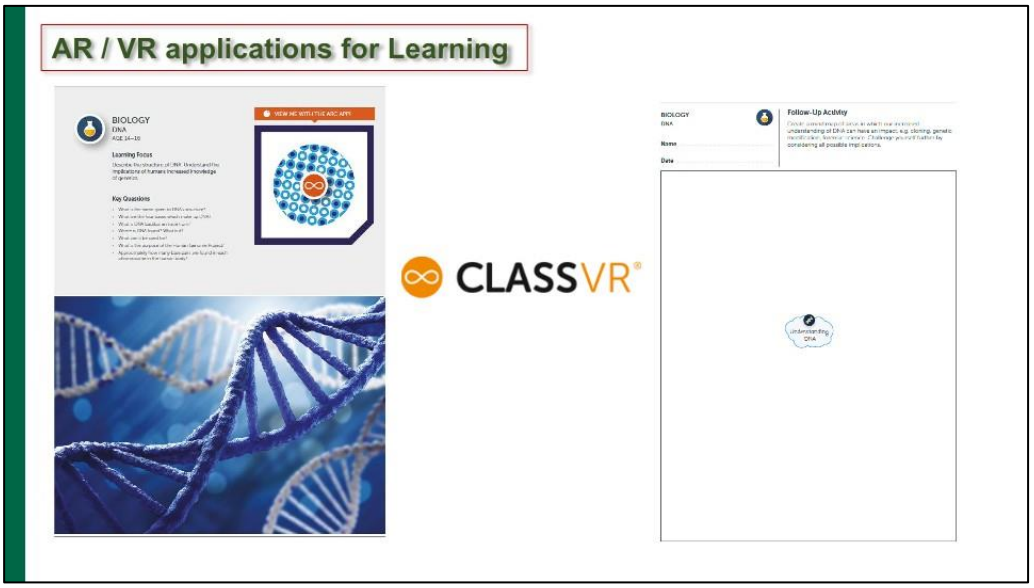
CLASSVR

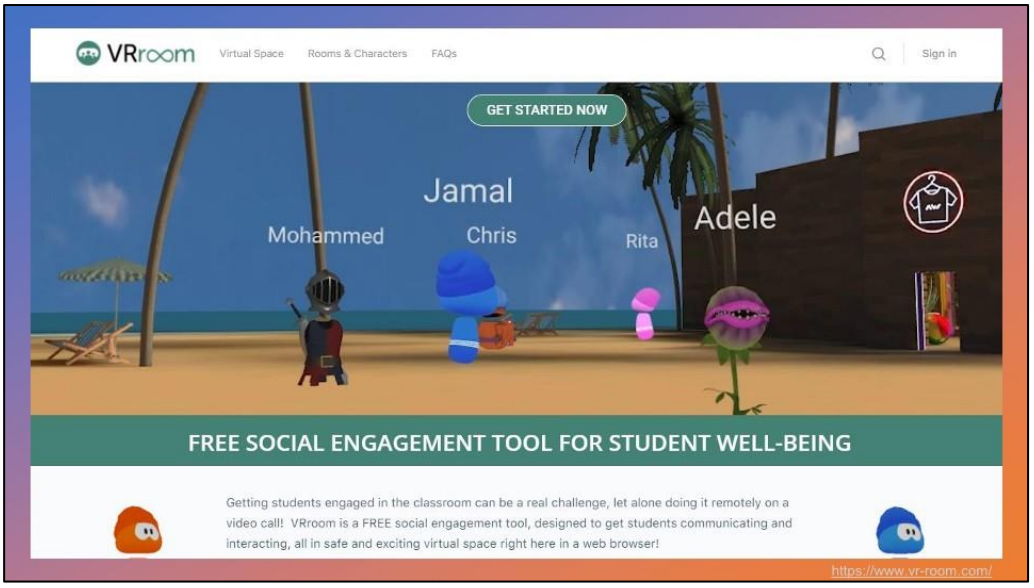
AR / VR applications for Learning

Source: 30 creative ways to use ClassVR: Sharing best practices

Source: The ClassVR Headset Interface

https://www.classvr.com/school-virtual-reality-news/media-headlines/


AR / VR applications for Learning
BIOLOGY
DNA
CLASSVR
Follow-Up Activity

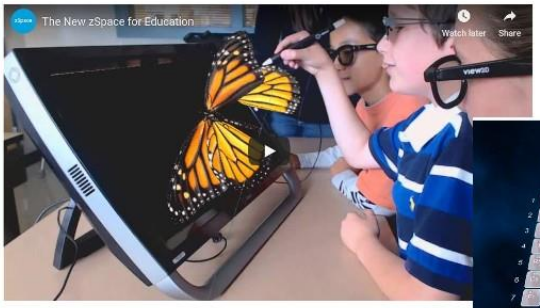

VRroom
Virtual Space
Rooms & Characters
FAQs
Sign in
GET STARTED NOW
Jamal
Mohammed
Chris
Rita
Adele
FREE SOCIAL ENGAGEMENT TOOL FOR STUDENT WELL-BEING
Getting students engaged in the classroom can be a real challenge, let alone doing it remotely on a video call! VRroom is a FREE social engagement tool, designed to get students communicating and interacting, all in safe and exciting virtual space right here in a web browser!
https://www.vr-room.com/

AR / VR applications for Learning

MEL Science

Labster

AR / VR applications for Learning

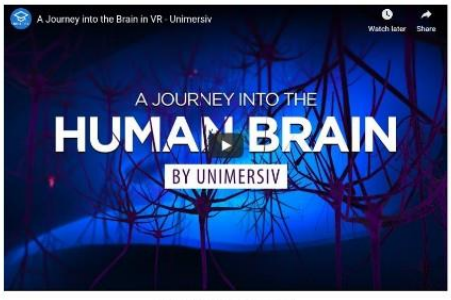


zSpace

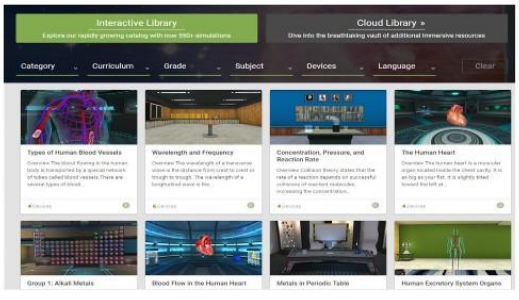
AR / VR applications for Learning

UNIMERSIV

VEATIVE



https://unimersiv.com/



https://www.veative.com/learn/public/browse/type/module

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‹ Multimedia Augmented Reality Vocabulary Learning ›

MARVL

MARVL is an augmented reality (AR) application that teaches vocabulary words in a new language.

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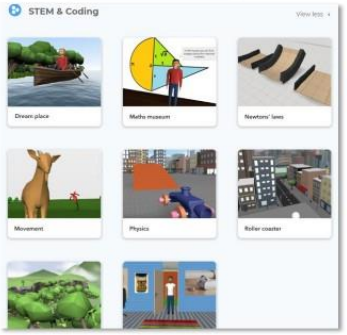
AR / VR applications for Learning

Design studio-based

metaverse

CoSPACES EDU



AR / VR applications for Learning

Benefits and Considerations

- Replace paper textbooks
- Better engagement
- Full Immersion
- Visualization
- Interest
- Safety
- Interaction

- Large volume of information
- High cost
- Complex
- Content development
- Time to integration

Teaching Simulations

Teaching Simulation

- Essential to improve prospective teachers' complex teaching skills
- Important to enhance the quality of school education for students
- Requires preservice teachers to go through extensive practices in delivering high-quality instruction and managing students' behavior.

Field experience provides authentic practice opportunities in the complexity and diversity of classroom teaching

Immersive teaching simulation can enable preservice teachers to experience high-quality authentic teaching in a realistic classroom environment with simulated virtual students (Badiee & Kaufman, 2014).

Virtual teaching simulation

- Supports preservice teacher training and classroom management skills.
- Allows users to interact with virtual student characters using authentic human–computer interface (Bradley & Kendall, 2014; Kaufman & Ireland, 2016).
- Offers more practice time and various simulated scenarios
- Does not negatively influence vulnerable students (Carrington, Kervin, & Ferry, 2011)

Bradley, E. G., & Kendall, B. (2014). A review of computer simulations in teacher education. *Journal of Educational Technology Systems, 43*(1), 3–12. doi:10.2190/ET.43.1.b
Kaufman, D., & Ireland, A. (2016). Enhancing teacher education with simulations. *Technical Trends, 60*, 260–267. doi:10.1007/s11528-016-0049-0
Carrington, L., Kervin, L. K., & Ferry, B. (2011). Enhancing the development of pre-service teacher professional identity via an online classroom simulation. *Journal of Technology and Teacher Education, 19*(3), 351–368.

SIMSCHOOL

Mursion

SIMSCHOOL

https://simschool.org/home/onboarding#

SIMSCHOOL

A web-based virtual classroom environment populated with “SimStudents" that have artificial emotional intelligence. They smile, cry, become frustrated, raise their hands, seek attention, and show signs of stress.

SIMSCHOOL

Virtual students respond in very individual ways to tasks assigned through facial expressions, body positions, and distracted behavior.

- Executive function
- Subject matter capabilities
- Emotions
- Reasoning
- Etc.

SIMSCHOOL

How can this help me in a real classroom?

Practice new strategies

Observe impact on authentic students

Reflect on how you may use knowledge gained in courses and the experience playing in simSchool to **improve your effectiveness in the classroom**

SIMSCHOOL

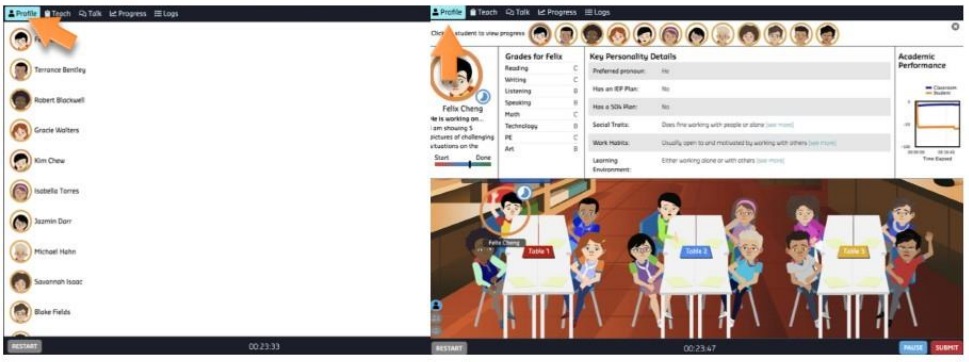
Customized to reflect local demographics, social relationships, language, class setting, appearance etc.

SIMSCHOOL

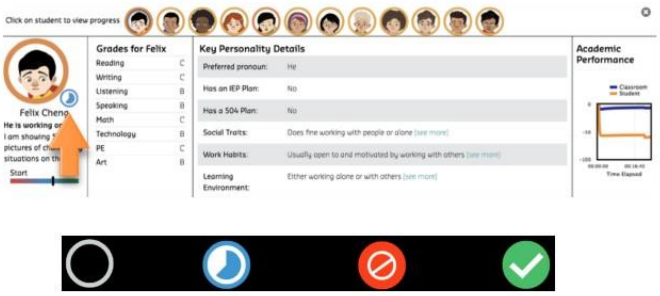
SIMSCHOOL

[Profile] tab contains a list of students.

Select a student and click **[Profile]** to view the student's file.



SIMSCHOOL



SIMSCHOOL

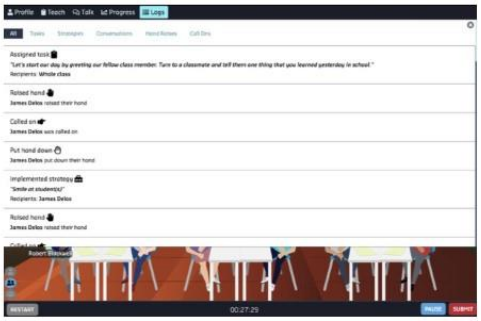
[Teach] to the tasks and strategies you may use.

[Talk] to communicate with students(prewritten or type your own).

SIMSCHOOL

[Progress] to see how students are doing.

[Logs] to see a record of everything happened.



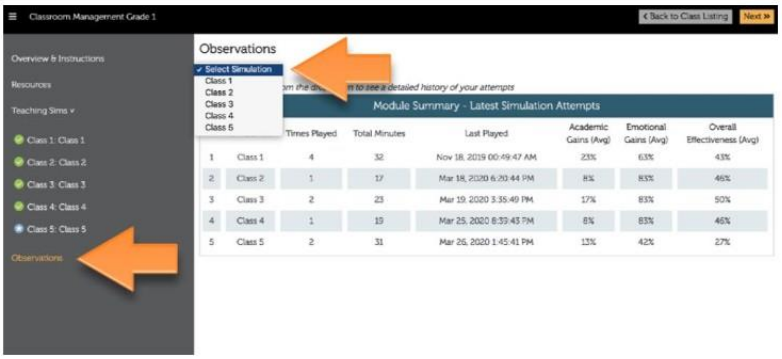
SIMSCHOOL

Individual assignment

Group assignment

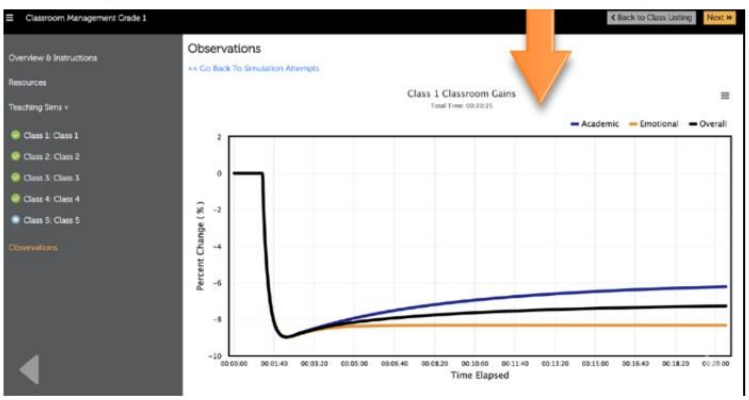
SIMSCHOOL

Progress is recorded into an observation form and report.



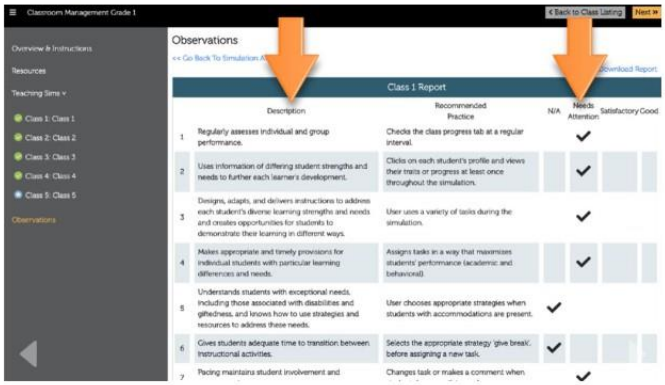
SIMSCHOOL

Progress is recorded into an observation form and report.



SIMSCHOOL

Progress is recorded into an observation form and report.



SIMSCHOOL

Studies

SIMSCHOOL

Content Catalog

FALL 2018

Mursion

A mixed reality-based learning environment that offers teaching practice experiences (Dieker et al. 2014)

Mursion

TEACHER PREPARATION

A virtual realty-based simulator, including managing classrooms, working with children with special needs, and practicing specific instructional routines relevant to a particular subject area. Mursion is being used at more than 85 campuses in the United States.

Mursion

AACTE
AMERICAN ASSOCIATION OF COLLEGES FOR TEACHER EDUCATION

AACTE and Mursion collaborate to support teacher preparation through coronavirus

New partnership offers virtual reality classrooms to advance learning for future teachers

(May 7, 2020, Washington, D.C.) – The **American Association of Colleges for Teacher Education** (AACTE), the leading voice on educator preparation, and **Mursion**, the global leader in virtual reality (VR) training, are partnering to offer educators and students world-class experiential learning through simulations. The collaboration provides teacher candidates an opportunity to complete clinical

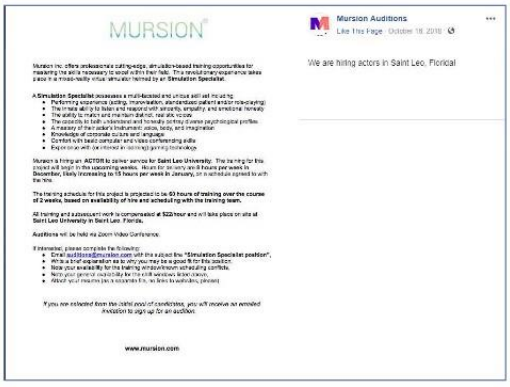
Mursion

Studies

VIRTUAL REALITY SIMULATIONS FOR ELEVATING EDUCATOR PERFORMANCE

Mursion

UWGLive Scenario Options & Design



MURSION

Mursion Auditions
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A **Simulation Specialist** possesses a multi-faceted and unique skill set including:

- Performing experience (acting, improvisation, standardized patient and/or role-playing)
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- The ability to multi-task and maintain distinct, real life scripts
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All training and subsequent work is compensated at **$22/hour** and will take place on site at Saint Leo University in Saint Leo, Florida.

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- Write a brief explanation as to why you may be a good fit for this position.
- Note your availability for the training and environment scheduling conflicts.
- Verify your general availability for the shift windows listed above.
- Attach your resume (as a separate file, no links to websites, please).

If you are selected from the initial pool of candidates, you will receive an emailed invitation to sign up for an audition.

www.mursion.com

Mursion Auditions
February 12, 2018

Want to know the benefits of being a Mursion interactor? Here are a few testimonies from some current interactors. Hear what they have to say!!

ICoME 2021 19th International Conference for Media in Education

Q&A

park2@usf.edu

Roundtable 1

The Effects of Digital Thinking Tools in Writing at Elementary School

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Key words: Thinking tools, Digital thinking tools, Thinking skills, Revision

ABSTRACT

INTRODUCTION: The purpose of this study is to examine the effects of thinking tools on the process of writing by analyzing the essays written by elementary school students in the practice of utilizing thinking tools. It is widely considered that thinking skills should be cultivated at school. In Japan, Kurokami (2017) points out that each thinking skill which mentioned by MEXT (2017) is corresponds to a specific thinking tool. Many studies have used thinking tools in a wide range of subjects, and positive conclusions have been drowned. (Ikeda 2013, Kawada 2016, Yoshida, Sato & Tamura 2020) Recently applications to handle thinking tools were developed and it began easy for students to use thinking tools. Digital thinking tools are digitalized versions of thinking tools, and their functions are basically the same. However, the digital one is more convenient for organizing information and students can communicate effectively based on the organized information (Kimura, Kurokami & Horida, 2016)

A research is carried out in an elementary school on a practice that utilizing thinking tools to revise essays. Students are required to write an essay before and after practicing using one of the thinking tools. This practice has been cycled four times until the end of June 2021. The model of cognitive process in writing which is "planning, sentence generation and evaluation" has developed by Flower & Hayes (1986). On this basis, Scardamalia & Bereiter (1983) proposed the cycle of evaluation procedures, which is "Comparison, Diagnose and Operate"(CDO). In the practice mentioned above, the process of revising essays with thinking tools, is the visualization of evaluation procedures. I assume that the visualization has positive effects in revising their essays.

METHODS: The growth of students is measured in two dimensions: (1) Using the same criteria to evaluate their essays before and after introduction in the four times of practices. These criteria target at the thinking skills which is encouraged by thinking tools; (2) Taking pyramid chart as an example to clarify whether thinking tools works or not on the process of "the first draft to pyramid chart to the final draft".

RESULTS: The evaluation of final drafts of the four practices continuously improved, with percentages of 48%, 65%, 54%, 68% (in chronological order). This result suggests that when students revising their essays, the effect of the thinking skills that thinking tools encourages were revealed.

There are 3 steps of revision process in the case of pyramid chart. Step 1, Students arrange the idea at the first draft without pyramid chart. Step 2, they add ideas into pyramid chart or remove ideas from it, which make it complete in structure. Step 3, they finish their final draft base on pyramid chart.

There are 4 types of the student's works. (1) Most of them finish the 3 steps of the revision perfectly. The structure of the pyramid chart helps them add ideas or remove ideas which are not relevant; (2) Some of them does not add enough ideas into the pyramid chart in step 2. This has a direct impact on the next steps which also do not have enough idea. In this case, they may have been confused about the structure of the pyramid chart. (3) Some of them increase contents in detail but do not have change in the structure. They arrange ideas with pyramid chart successfully but may need help in how to transform from pyramid chart to the essay; (4) One of them did not seem to correlate the three steps, and there was no direct correspondence between the content of the three steps, except that the theme.

In summary, thinking tools may not be suitable for all students, but it is no denying that it had positive impacts on most of students' writing, and although it did not have any impacts on results, thinking tools helped students organize their ideas, in which their process perspective has a positive impact.

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Suggestions for Improving High School Students' Mathematical Explanation Skills

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Key words: Collaborative Learning, Communication, Explanation Skills, Mathematical Representation

ABSTRACT

In Japan, the National Curriculum Standard shows the development of representing everyday events and mathematical events concisely, clearly, and accurately using mathematical representations is one of the goals of high school mathematics (MEXT 2018). Also, teachers should provide more opportunities for students to explain the thinking and the basis for their solution decisions using mathematical representations. One of such opportunities is a form of collaborative learning in which students teach each other. Some studies report the effects of activities where students teach each other on mathematics performances (e.g. Alegre et al., 2019). However, no study focuses on supporting both of the following points in collaborative learning: (1) the students' appropriate use of mathematical representations and (2) improving the collaboration quality.

The first point is to choose and correctly use effective mathematical representations for each mathematical problem and everyday problem that is solved using mathematics. Mathematical representations include drawings (sketch), diagrams, graphs, and symbols to help students communicate their mathematical ideas (Fitrianna et al., 2018). In teaching, it is essential to help students choose appropriate mathematical representations (MEXT, 2018).

The second point is to make collaborative learning more effective for each student. In activities where one student teaches another one-on-one, they should explain and ask questions to build knowledge, not just tell it (Roscoe & Chi, 2007). Furthermore, the learning model in which students study some materials, discuss the results in groups, and write again in their own words individually to absorb ideas

from the discussion is effective for mathematical representation skills (Supandi et al., 2018). Support for this point may include encouraging effective interaction and devising a form of activity.

Based on the above, this presentation suggests that supports are needed to use mathematical representations appropriately and improve collaboration quality. With those supports, it is expected that students will improve their mathematical explanation skills more in collaborative learning. Further studies should make these supports specific and work on instructional strategies and materials to provide these supports.

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Teaching and Learning about Covariational Reasoning: Focused on Causal Relationship and Difficulties in Using Technology

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Key words: Covariational reasoning, Causal Relationship, Programming, Statistics education

INTRODUCTION

With advancing statistical education, the development of covariational reasoning is focused on. This reasoning concerns the relationship between bivariate data (Garfield et al. 2008). In addition, the use of technology can help enhance students' covariational reasoning (e.g., Biehler et al. 2018). However, covariational reasoning is difficult to understand (e.g., Zieffler & Garfield 2009) and there are few studies on how to produce progressive changes in students' covariational reasoning (Medina et al. 2019). Previous studies have included practices that dealt with scatter plots and single regression analysis for bivariate data by using technology. However, the difficulties in using technology remain unidentified and understanding covariational reasoning may not be fostered because of insufficient consideration of the third variable. Here, the following research questions were formulated based on these issues:

RQ1: *What are the difficulties of using technology in developing students' covariational reasoning?*

RQ2: *Can students' covariational reasoning be developed through examining the relationships among a third variable from the perspective of the causal relationship?*

METHODS

Eight Lessons were conducted with 40 first-year Japanese high school students and the effects of introducing causal relationships and students' difficulties in these Lessons were examined. In these Lessons, the students analyzed data using Python. In Lessons 4 and 5, students worked on making bivariate selections from SSDSE (a data set of prefectures in Japan) and reported on the relationships among them. In Lesson 6, students learned the difference between causal and correlational relationships by considering a third variable, and multiple regression analysis. In the last Lessons 7 and 8, the students worked on picking up the third variable and considering the relationship to the Lesson 5 bivariate data reports, creating a diagram describing similar DAG (directed acyclic graphs), and finally, reporting on the reexamination of the relationship between the bivariate data through those relationships.

RESULTS & CONCLUSION

At the end of Lesson 5, most students reported the results of utilizing Python to create scatter plots and conduct single regression analysis. However, the use of technology may have prevented deeper understanding of covariational reasoning, as the analyses' results were easily derived and many results were produced. Thus, few students were able to mention the difference between correlation and causation. With instruction in subsequent lessons to consider the third variable and relevant review activities, some students were able to consider causality and revisit the original bivariate relationship in Lesson 8.

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Cross-Cultural Adaption of International Students at Elementary School in Japan

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Key words: Cross-cultural adaption, Learning problem, International students, Japan elementary, school

ABSTRACT

According to the Ministry of Education, Culture, Sports, Science and Technology the number of international students who need Japanese language support increased from 25,411 in 2007 to 40,755 in 2018. In addition, some of the international students are struggling with their subjects such as social studies, because their cultural background is different from Japanese students, and others dropped out of schools because they were not able to adjust to new school setting. Thus, the purpose of this paper is to clarify the reasons which caused cross-cultural adaption problems of international students at elementary schools in Japan. For this purpose, the interview was conducted with the teachers and volunteers who have experiences of teaching international students. Based on this research, I would like to propose a way to help the international students to adjust to new school setting, in order to help them to have a wonderful school life and obtain skills to live in Japan.

INTRODUCTION

School adaption can be identified as experiencing self-confidence problems and feel inadequate in overcoming problems (Kayahan Cokuk, 2020). To help international students adapt to new school setting and host country, Japanese government provides Japanese Language support for international students. However, some of the international students are still struggling with their subjects and life in schools. I assume the reasons that led international students having difficult times in school are learning problems and adjustment of new culture.

Forbush & Foucault-Welles found even international students are fluent in host country's language, they may have difficult to adjust to other types of instruction (Forbush & Foucault-Welles, 2016). Additionally, during Corona pandemic in 2020, Japanese elementary school closed several months to prevent the virus explored in the country. As a result, students have to study at home. However, Ashahi News reported a number of international students at elementary were found that they have trouble in studying at home because they do not understand the subjects and materials as well as their parents have few knowledges to tutor them. Some of the international students whose parents are not able to speak Japanese fluently were found that they had forgot the Japanese language that learned at schools. (KOGAWA, S & OTAKI, T. 2020) Thus, it is not surprised the international students could not study at home because they could not understand the subjects and materials as well as their parents are not fluent in Japanese.

RESEARCH DESIGN&METHODS

To understand and comprehend my understanding of international students' learning problems, a meeting with Ms. Y, a retired mathematics teacher in university who is now teaching math to international students as a volunteer was conducted. The Interview with Ms. Y was held in April 2021for an hour.

RESULTS

According to Ms. Y, some problems that international students are facing in schools are the followings,

1. Language problem. Some of the international students have problem on written language.
2. Isolated from Japanese society led to lack of common sense.
3. The number of teachers with multicultural education skills and experience are not enough.
4. Immigrant families have few knowledges about Japanese education system. Parents have no close connection with school.
5. The gap of education system between Japan and other countries. For instant, two sisters from Pakistan are graduated from junior high school in their country, however, Ms. Y found they calculated with fingers.

Base on my research, I realized some of the international students at elementary school and their parents have language problems. On the other hand, immigrant family need someone to connect them with host society. In my opinion, teacher shall play an important role on it. However, it is a pity that the number of teachers with multicultural education skills and experience are not enough. Because my study is merely based on interview with Ms. Y, further

research is needed to interview more teachers or volunteers who have experiences of teaching international students, or interview with their parents, obtaining more information of their studying and living situation in elementary school and generate them to clarify the reasons that create their cross-cultural adaption in elementary school in Japan.

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The Factors of Emotional Development of Adolescents in Djibouti
-Focus on the interaction with an outsider -

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Key words: International Cooperation, Social-Emotional Development, JICA-JOCV Djibouti

ABSTRACT

The purpose of this research is to illustrate the factors of social-emotional development（OECD, 2018）of Djiboutian French teacher "X" living in Djibouti, one of the developing countries, by focusing on interaction with a Japan Overseas Cooperation Volunteer of the Japan International Cooperation Agency (JICA-JOCV) (the 1st author）.

Achieving sustainable development is one of the most critical challenges in the field of international cooperation. Kubota (2021) points out that many projects have not continued the activities after funding had stopped and taken the subject back to its original state for many reasons, such as the entrenched relationship between the donor and the recipient. Moreover, local people have few opportunities to plan and create activities since donors already do so before the project starts. Therefore, the local community itself must initiate the changes proactively. In this context, the authors conducted research focusing on social-emotional skills.

This research studies a case of SOS Children's Village, an international NGO in the Republic of Djibouti, where the author worked as a JICA-JOCV from June 2018 to April 2020. Many of the Djiboutian youth studying in the relevant NGO appeared at first to be in a state of 'resignation'. However, the 1st author observed that they had been developing socially and emotionally by creating new activities with me- as an outsider. The authors have been observed similar phenomena in the field. Once they get developed socially and emotionally, they get the confidence to put action by themselves. Therefore, the authors in this research focus on social-emotional development in order to identify under what situation people inthe field have developed socially and emotionally.

The authors employed a semi-structured interview with a French teacher named "X" and analyzed it. X has worked and created activities even I -the first author- left Djibouti and showed how he had developed emotionally through activities while I -the first author- worked with him.

As a result of data analysis, the authors found three factors; firstly, interactions with an outsider lead to the creation of new activities, thereby creating an atmosphere where new activities can be easily generated. Secondly, through it is work on new activities, X learned how to utilize the methods and tools necessary for the subsequent activities. and finally, through the activities, the local people involved were able to share specific images of what they wanted to do and what challenge they wanted

to address. Such sharing of images can further initiate the creation of new activities.

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Pre-Service Teachers' Instructional Design Motivation Factors

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Key words: Instructional Design, motivation, pre-service teachers, teaching experience

ABSTRACT

Choi (2020) has surveyed mathematics pre-service teachers' (PSTs') instructional design (ID) changes by restructuring the PSTs' lesson plans. Here, the percentage of restructuring from the teaching and learning methods aspect remains to be 26.3%. Thus, PSTs cannot design instructions considering ID theories and models through just learning ID theories (Nakamura et al., 2020). Several studies have been made on Technological Pedagogical Content Knowledge (TPACK) related to the PSTs' instructional quality (e.g., Foulger et al., 2012). Also, general pedagogical knowledge and classroom management expertise predict instructional quality (König et al., 2020). However, there has been no study that focused on the PSTs' instructional design motivation.

The overall instructional quality of the lesson plans PSTs design is lower than those in-service teachers (ISTs) design (Backfisch et al., 2020). These findings imply PSTs have fewer opportunities to experience the practical educational occasion than ISTs, depending on what teachers have experienced, like Learning Experience (LX) theory (Parrish & Wilson, 2008). Therefore, in this research, we define TX as teachers' engagement in designing instructions; The purpose of this research is to examine the instructional design motivation factors that predict PSTs' TX level and the relationship between ID theories in PSTs' ID.

Qualitative and Quantitative data (lesson plans and the questionnaire) were gathered from the 133 PSTs who took the IDT course at University A in the first semester of 2020. Analysis was conducted on the 100 PSTs who submitted questionnaires and the lesson plan.

To divide factors of instructional design motivation, we conducted factor analysis using pro-max rotation. As a result, PSTs instructional design motivation could be divided into three factors as follows:

1. Interest such as “Designing instructions are interesting,” $\alpha = .83$.
2. Relation such as “The other specific courses I take are useful to design instructions,” $\alpha = .74$.
3. Ingenuity such as “I change my teaching methods depending on the learning contents,” $\alpha = .58$.

Then, we conducted Kendall rank correlation analysis to TX level, the three factors of instructional design motivation and the two ID theories of the PSTs' lesson plans. As a result, there were positive correlations between TX level and Interest ($\tau = .51$, $p < .001$), Relatio ($\tau = .32$, $p < .001$), Ingenuity ($\tau = .26$, $p < .010$), and the ARCS model ($\tau = .21$, $p < .100$). However, there was no significant correlation between TX level and Gagné’s nine events of instruction ($\tau = .09$, n.s.).

In conclusion, PSTs’ instructional design motivation can be divided into three factors: Interest, Relation, and Ingenuity. From the instructional design motivation perspective, these results suggest that the PSTs' interests towards ID, the relation between the teacher’s future, and the ingenuity to IDs may contribute to the teacher’s TX level. Also, from the ID theory perspective, designing lessons considering the students’ motivation may contribute to the TX level of PSTs. However, designing well-structured lesson plans may not contribute to the PSTs’ TX level regarding Gagné’s Nine Events of Instruction. It may be hard for PSTs to imagine a real classroom through only lesson plans. Further research on the TX level of PSTs and ISTs would clarify the relationship between TX level and motivation.

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How to Enhance the Teaching of Students with Intellectual Disability in Regular Class: A Case Study Focusing on a Teachers' Use of ICT in a Japanese Elementary School

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Key words: Intellectual Disability, Elementary School, In-Service Training, Visualization

ABSTRACT

In Japan, ICT has been used to support students with intellectual disabilities in regular classes. For example, Enda et al. (2017) reported that through visualization, sharing, and structuring using ICT, teachers improved the learning environment, increased students' motivation to learn, and help them retain what they learned. The Sapporo Tondenkita Elementary School (2014) has also claimed that they have been able to move closer to teaching based on universal design by using ICT. However, another school as an issue the need to deal with some students who have difficulty understanding oral instructions and explanations and who are not able to fully utilize ICT (Tsuwano Elementary School 2012).

This study aims to identify how teachers can use ICT to enhance the motivation to learn among elementary school students that have intellectual disabilities.

The authors interviewed a teacher, Y, who has experience in special needs education, practical research on ICT-based classes, and the production of school broadcast programs. The interview last approximately two hours and was conducted on May 30th, 2021. The interview was recorded with the collaborators' permission, and the speech was transcribed as text data.

The recorded interview was transcribed verbatim and then organized using the KJ method (Kawakita, 1967). The KJ method is a recognized way of organizing and bringing together for analysis.

As a result of the data analysis, it became clear that there were three processes being used by Teacher Y to enhance motivation to learn and to conduct classes that all students could understand: initiatives for all students(Category A), individual support for students with intellectual delays(Category B), and a class that everyone can understand based on taking a medium- to long-term perspective(Category C) (Figure 1).

There are five elements in Category A. For example, one of them was “the YouTube game” utilized in a Grade 2 unit teaching addition. The students make the videos of their study for next year's students using tablet device, large monitor and so on. The students who appeared in the videos used student's (words that students use every day), with the audience in mind, and created a video that the audience could easily understand. In addition, although all groups dealt with the same learning content, different students appeared in the explanatory videos, which meant that the audience will gain a deeper understanding without becoming bored. Thus, by targeting all the students, the teacher tried to increase the target students’ motivation to learn.

There were two key elements in Category B. For example, one of them was for the teacher to provide an applications that is easy to understand visually in PC tailored to the student characteristics. This element is necessary to understand each student's characteristics and provide appropriate support for each. In this way, by providing individualized support for all students with learning difficulties, Teacher Y was trying to develop their ability to use ICT and employ it within their learning.

Considering the similarities between Categories A and B, it can be said that the teacher was able to “visualize” all the students to grasp them visually. In other words, it can be said that ICT is helpful for visual support.

There were four key elements in Category C that Teacher Y was making efforts to realize a class that everyone can understand based on taking a medium- to long-term perspective into account. There is a limit to what a teacher can do in one hour of class. We found out that Teacher Y is trying to create a learning environment that allows students to learn freely, to foster a sense of partnership, and to share information with other teachers.

A potential future direction for this line of research would be to seek to clarify the relationship between that lack of comfort with ICT and a student's individual personality and characteristics. It could also be useful to consider various practical approaches that might be taken to improve classes.

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Research Trends on the Use of 360-degree Videos in Teacher Education

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Key words: 360-degree Video, Teacher Education

ABSTRACT

Class video is being used for reflection in the field of teacher education and educational research in Japan and abroad. It is easy for us to use 360-degree cameras in recent years. 360-degree cameras can capture the entire classroom at the same time. Therefore, research is being conducted to use 360-degree videos in teacher education and educational research. The purpose of this paper is to clarify research trends on the use of 360-degree videos in teacher education.

The investigation is conducted using the following method with reference to OYANAGI (2020). First, in early May 2021, I use ERIC (Education Resources Information Center) database to investigate international trends. At that time, I use keywords "360 video" and "teacher education". Next, I use CiNii (Scholarly and Academic Information Navigator) database to investigate research trends in Japan by using key words "360 video" and "teacher education". It is a database service which can search of information on academic articles published in academic society journals, university research bulletins or articles included in the National Diet Library's Japanese Periodicals Index Database. Finally, I use ERIC and CiNii to read abstracts of research that focused on 360-degree videos and teacher education in Japan and other countries. If I couldn't analyze enough contents of abstracts, I read the full text. Finally, I summarize recent research trends, focusing on research subjects and purpose.

In this paper, recent research trends in Japan and other countries are summarized with focusing on research subjects and purpose. Research in Japan is focused on not only the training of preservice teacher but also the professional development and learning among in-service teachers. Then, the research on this topic in Japan use 360 cameras for practicum and lesson study in schools. This is related to the fact that the research in Japan is conducted in schools as a place of research. This is because teacher education in Japan has had a culture of classroom research as a tradition. Compared to research in Japan, many of research in other countries focus on the teacher training at university. Analyzing from of purpose of the research, research in both Japan and other countries has focused on comparing regular videos with

360-degree videos and analyzing methods of viewing 360-degree videos. However, it is still in its early stage that they research the conditions for recording and viewing methods tailored to the form of the class.

Research on the use of 360-degree videos in teacher education is its early stage. So, experiences of research on the use of 360-degree videos in teacher education are not enough. When utilizing video recorded of the entire classroom for practicum and lesson study, etc., the question is to investigate what differences there are between video recorded by placing multiple cameras in the classroom and video recorded by 360-degree cameras.

Table1 A Study on 360 Degree Video in Teacher education

Research	Country	Research Subject	School	Purpose of the Research
MORISHITA (2016)	JPN	Lesson of teaching practice	elementary school	Effectiveness of 360-degree video as a classroom video.
ONO & KITAZAWA(2017)	JPN	Lesson of teaching practice	elementary school	The impact of different types of videos on the perception of reflection. (Comparing the impact of traditional and 360-degree videos)
MIYAZAKI et al.(2019)	JPN	Teacher training	university	Development of system which instruct preservice teacher to view points
IKUTA (2019)	JPN	In-service teacer's lesson	elementary school	Analysis on reflection by VR On-Going Method
ONODERA (2020)	JPN	Research class	junior high school	Analysis of 360-degree camera's conditions for recording and viewing methods Effectiveness of Analysis of 360-degree camera's conditions for recording and viewing methods
Walshe,N. & Driver,P. (2019)	GB-E	Teacher training	university	Effectiveness of 360-degree video as a classroom video.
Theenlen,H., Van den Beemt,A. & Den Brok,P. (2019)	NLD	Teacher training	university	The Effectiveness of University Teacher Training Programs. Analysis of technological and educational affordances of 360-degree video.
Ferdig,R.E. & Kosko,K.W. (2020)	USA	Teacher training	university	Effectiveness of 360-degree video as a classroom video.
Gold,B. & Windscheid,J. (2020)	DEU	Teacher training	university	Effectiveness of 360-degree video as a classroom video. (Comparing the impact of traditional and 360-degree videos)
Gandolf,E., Kosko,K.W. & Ferdig,R.E. (2021)	USA	Teacher training	university	Validation of Evaluation Tool (XRPS) for 360 Degree Classroom.

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A consideration of the experiment lecture with Zoom

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Key words: Experimental classrooms, online lessons, educational effects

ABSTRACT

In March 2020, due to the global epidemic of the new coronavirus, the government issued a request to close educational institutions in several prefectures including Tokyo.

However, it is urgent to provide children with learning opportunities because of this situation. Therefore, the authors decided to try and verify the remote implementation of a science experiment classroom that they could participate in at home. An "online conference system" was used as a means of remote implementation.

But how will online science experiment classrooms be accepted by children? Therefore, the authors recorded the efforts of the children in the online course and analyzed what kind of consciousness they had by taking a questionnaire.

In order to compare face-to-face lessons and online science experiment lessons, we decided to conduct face-to-face and online lessons with the same content and compare the educational effects.

Before the epidemic of the new coronavirus, the authors regularly conducted on-site lessons at the Science Museum in Kanagawa to measure the educational effect of the lessons.

Among them, we selected the experiments that had the highest educational effect and decided to conduct an online experiment class. At that time, the same instructor gave a lecture using the same PowerPoint and materials, and the experiment content was the same so that there would be as little difference as possible in the content taught during the previous face-to-face class. However, when it was carried out at the science museum, all the materials were prepared here, but as mentioned above, in the case of online, we decided to substitute the ones at home as much as possible.

The selected experimental title is "Thinking about solubility from storm glass". Storm glass is a weather forecasting tool used mainly in Europe in the 19th century. In this course, we made a storm glass

and soaked it in hot water and ice water at 40 ° C to create pseudo summer and winter, and had them observe the changes in the storm glass.

Although the mechanism of storm glass has not been clarified yet, the lecture focused on the so-called "solubility", in which the number of crystals decreases as the temperature rises and the number of crystals increases as the temperature drops. Also, in the online lectures, I tried to allow the instructor to check the work and reactions of all the students in the gallery view using multiple PCs. Questions were accepted at any time, as in the case of face-to-face meetings.

Pre- and post-questionnaire surveys were conducted for students at the beginning and end of the class. During the face-to-face class, we conducted a paper questionnaire. In the online class, we conducted a questionnaire using Google Forms.

In the questionnaire, it was found that there is no difference between online lessons and face-to-face lessons for many items. Regarding "Did you succeed in the experiment?", The average was 4.8 points in the face-to-face course and 4.7 points in the online course. It can be seen that both classes were highly satisfying.

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How to avoid making online courses boring: Students' Suggestions for Professors

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Key words: Live Online Classes, Online recorded classes, Online live assessment, Online recorded assessment

INTRODUCTION

The impact of Covid-19 in 2020 has made huge differences in the education setting. E-learning has now become an inevitable choice in addressing the educational process in the COVID-19 pandemic (Gupta & Khairina, 2020).

This pandemic has forced all students and instructors across all levels of education to rapidly adapt to and engage in online learning. According to Lee (2020), Eighty percent of the students said they felt uncomfortable with online classes during Covid pandemic. The underlying cause of this situation may be that large-scale introduction of online education was conducted in a short time without sufficient preparation.

Moreover, Aslanian and Cline (2012) revealed that among the setbacks of online learning, 37% of the study participants pointed out that lack of direct interactions with instructors and fellow students, 25% complained about poor communication with the instructor, and 20% reported the issue of attention, lack of motivation and challenges in virtual learning environment. Other difficulty on non-face-to-face

education included lack of communication, decreased interpersonal satisfaction and interaction anxiety, difficulty, lack of practicality, lack of variety of data, excessive learning, quality of lectures, system instability, and lack of institutional support (Kim, 2020).

Based on the previous discussions, this report seeks to identify the problems of online education from the student's point of view, and then present a feasible and effective solution to them.

DATA ANALYSIS

The survey was conducted to gather students' opinion on how they felt about online classes and course assessment method. Forty-seven students responded to the survey. The questionnaire was composed using Likert scale and open-ended questions.

1. Online live classes

Fifty-eight percent (58%) of students answered concentrating in online live classes was so difficult, and that the most urgent thing to implement is 'instruction to increase concentration on online classes (58.3%).'

2. Online recorded classes

Students answered that the reasons for the difficulty in online recorded classes were because no one is watching and, students felt they can study again later (through recorded video). Most of all, students felt that online class is long and boring. To the question on what should be improved first, the most frequent response was 'class and learning strategies can increase concentration (59.1%)', followed by 'systems that provide real-time answer to questions (27.3%).'

3. Online live assessment

Students replied 'appropriateness of the assessment method', 'strengthening supervision to prevent cheating' and 'fairness of assessment (Strengthening punishment for cheating).' should be improved first in online live assessment.

4. Online asynchronous assessment and Calculation Method

Over 50% of students thought the most urgent problems that should be solved in an online asynchronous test was 'appropriateness of the assessment method', followed by 'fairness of assessment (Strengthening punishment for cheating).'

SUGGESTIONS

1. Online live class

In order to solve students' concentration problem, professors should use quizzes, discussions, or assignments during class so that students can get acquainted with the online platforms and try to figure it out after class and waste time.

Xie (2020) proposed an efficient online learning strategy based on flipped learning and constructivist theory. First of all, professors need to have students acquire knowledge on their own, and teachers help them to do this well. They also should determine the level of students' preparation for classes through quizzes and reflect them on their grades.

Mahmood suggested 10 effective online teaching strategies for post-Covid era. First, teachers should develop interactive online classes and share class materials and make collaborations with telecommunication industries to overcome Internet-related issues. Most of all, professor must give students feedbacks during and after class.

2. Online recorded class

In order to solve students' postponement of online classes, limiting students to watch lectures within a certain period of time, having have students form study groups to share each other's learning stages, and applying peer group assessment method were suggested. In addition, adopting summary paper to write down core contents of the class into their own words and writes newly learned contents or questions was recommended.

3. Online assessment and calculation method

Online live assessment had problems with the appropriateness and fairness of the assessment method based on the survey. The need to strengthen supervision to prevent cheating has been emphasized. Furthermore, criteria-based assessment was proposed as an appropriate assessment method than grading on a curve. Tests should be conducted for the purpose of verifying knowledge, not for setting an intense competition.

4. Appropriateness and fairness of assessment methods

In order to improve the adequacy of the assessment method, professors should present logical and high-dimensional problems, not problems that can be solved through textbooks or simply by Internet searches. Also, the assessment should be done in a way that is appropriate for the contents of the class. For example, if a course stress some kind of theory, not an application, it should be tested in an open book and constructed to solve many multiple-choice questions in a short time. Otherwise, if the course emphasize application than theory, each student's theoretical application ability should be evaluated by an essay test.

One way to prevent cheating is to supervise a student's test behavior with a camera recording. In addition, when testing is conducted using an e-learning system, the system should be able to prohibit users from referring to other sources, and to use an online non-face-to-face test supervision service, such as *Monito*. Lastly, a procedure, criterion and the results on whole classes need to be open to students.

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The Dynamic Change of Student's Motives and LearningExperiences during Extra-curricular Activity

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ABSTRACT

In this paper, the authors identify how a student's motives changed while interacting with others during an extra-curricular activity and how the motives affected her learning experiences. It is essential to investigate students' motives since they are closely related to their learning experiences. The researchers such as Mizokami (2009) and Yamada (2010) reported the educational effects of extra-curricular activities. Those studies showed the outcome of extra-curricular activities from the perspective of what students acquired: communication, problem-solving, and relationship-building skills. However, students' learning experiences, especially in extra-curricular activities, vary and dynamically transform according to their motives. Students join extra-curricular activities based on their interests and desires, and they choose and create what and how they learn (Kato 2014). Hence, it is essential to focus on students' motives which influence their learning experiences. The unique perspective of this research is to consider motives as to be generated relationally to the social environments and constantly changing. Since the researchers such as Akase (2018) indicated that motives change while students learn, it is thus necessary to investigate various factors which influence motives from multiple perspectives. Therefore, the authors clarify the interactively changeable motives of a student and what affected the changes and her learning experiences. This research employed a semi-structured interview with one of the students who participated in an online extra-curricular activity to determine the process of motives shift, what caused the change in her motives, and how that affected her learning experiences. The online extra-curricular activity was conducted for four days on March 2021 among the high school teachers in Kagoshima and university students from two universities in Tokyo. The purpose of the project was to develop game-based educational materials for SDGs. As a result of data analysis, the authors found the three factors: (1) the environment included no hierarchy relationship and the acceptance of opinions without denial, (2) the

other participants who actively worked to ensure that everyone enjoys themselves and work toward a common goal, and (3) tools and methods that influenced her to take on a new challenge to contribute to her team.

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How to Support Students in Implementation of Assignments

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Key words: Assignments, Mathematics Education, High school, Flipped classroom

ABSTRACT

In Japan, the Ministry of Education, Culture, Sports, Science, and Technology (MEXT) found that the idea behind the revision of the new courses of study is to improve the learning process from the perspective of active learning (MEXT, 2017). However, the new courses of study do not reduce the course content. Therefore, high school mathematics are required to plan their lessons with consideration for educational content and time allocation (MEXT, 2018). One possible way to improve such lessons is to use flipped classroom teaching.

A flipped classroom is a learning method in which students do basic learning, such as the content of explanatory lectures, before class as homework, and learning necessary for retention of knowledge and cultivation of applied skills, such as tutorials and project learning (Bergman & Sams, 2014). Abeysekera and Dawson (2015) found three critical components of flipped classroom teaching:

1. information-transmission teaching moves to outside of class time

2. lesson time used for learning activities

3. students require completing pre-and/or post-class activities to benefit from in-class activities fully This suggests that it is possible to incorporate active learning into class time by introducing flipped classroom instruction, even without reducing class content.

One of the main features of the flipped classroom is prior learning. Shibukawa (2021) points out two characteristics of prior learning in flipped classroom teaching: (1) the teachers' explanation of the learning content is included, and (2) prior learning and face-to-face teaching need to be designed as a single learning process. Therefore, prior learning in the flipped classroom requires the learner to learn

alone about the new learning content. It is essential to conduct prior learning to develop the content of prior learning in the class.

However, the implementation of prior learning has become an issue for the introduction of flipped classroom teaching. Yamamoto et al. (2017) have stated that a students' lack of prior learning is a factor that blocks the progress of in-class activities in high schools. Wei et al. (2020) have stated that teachers need to encourage students to conduct prior learning to make in-class activities more active in middle school mathematics. Therefore, it is desirable to have all participating students complete prior learning to conduct effective flipped classrooms.

Based on the above, this presentation will examine what factors influence the implementation of out-of-class assignments by high school students. Then, for each factor, this presentation aims to propose support methods that teachers can use to encourage implementation.

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Effectiveness of an Interface That Facilitates Nudge to Improve Note-Taking Strategies

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Key words: Note-taking, Nudge Theory, Real-time feedback system, Tablet

ABSTRACT

OECD (2019) proposed that students need to develop self-regulated learning (SRL) skills. Zimmerman et al. (1996) introduced note-taking as one of the effective strategies for developing SRL. However, while many students take notes in class, they make incomplete note-taking because of few opportunities to learn note-taking skills (Morehead et al., 2019). One way to support note-taking in class is to share notes among students and discuss their note-taking. Nevertheless, it is difficult to give feedback on note-taking in class because class time is limited (Nilson, 2013). Therefore, we hypothesized

that students who could not take notes would improve note-taking by assuming that many students' notes were correct and provided feedback. We developed NoTAS by applying the nudge theory (Thaler & Sunstein, 2009) to support note-taking among students through tablets in class (Yokoyama et al., 2020). NoTAS has the visualization function, and the approximate place of the notes and highlights written by other students on the class material displayed on the tablet is visualized on the same material in almost real-time. This study aimed to investigate the effect of the visualization function of NoTAS on students' awareness and motivation for note-taking in class.

The participants are 89 first-year high school students and have a tablet. The students took one class with and another class without the visualization function. We surveyed students about the community awareness (7 items) and the visualization contribution (6 items) using pre- and post- questionnaires.

For community awareness, we used the Wilcoxon signed-rank test to measure the effect of the visualization function on students' awareness in class. As a result, all items were significantly higher in the class with the visualization, for example, "Other learners helped me to understand the class content," $z = -4.03$, $p < .001$, $r = 0.44$.

For visualization contribution, we used the Wilcoxon one-sample test to measure the effect of using the visualization function on students. The results showed that the mean value was higher than the median (3.00) for five items, for example "I feel more confident when others' writing is visualized the same place as my writing," $w = 1432.00$, $p < .001$, $r = 0.23$.

In conclusion, students can comprehend others' learning behavior and share the essential parts of the course in a class by using the visualization function of NoTAS. Therefore, we suggest that students who use NoTAS can refer to others' note-taking and feel confident in their note-taking. Further consideration will need to analyze the note-taking contents from the learning log to investigate what kind of note-taking is promoted by the nudge theory.

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The Influential Factors on Teaching with Digital Textbooks in English Classes

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Key words: Digital textbooks, Conversational skills, Team teaching, English education, Interactive

ABSTRACT

The purpose of this study is to investigate the differences of the teachers' teaching behavior while using a digital textbook in English class and the team teaching using regular textbooks at Japanese elementary schools by focusing on developing English conversational skills. In this study, digital textbooks of Sanseido publishing company are used to analyze, because it is a large share of English digital textbooks for the elementary schools in Japan. First, the functions of digital textbook for fostering conversational skills will be analyzed in details, and secondly, the teaching behaviors of team teaching with and without digital textbooks are compared by focusing on teaching conversational skills in English classes. Although English becomes a compulsory subject in Japanese elementary schools, there are still few opportunities to use English in daily life. Teachers try to improve the learning motivation in English classes as much as possible. The diffusion of digital textbooks is one method to improve the students' motivation of learning English and may change the teachers' teaching behaviors in the classroom. Thus this study will discuss from this perspective.

INTRODUCTION

According to MEXT (2018), the audio spoken by native speakers of a foreign language is synchronized with the textbook, so that the specific parts of the text can be played back repeatedly according to the proficiency level of individual students. We can't guarantee whether students have learned simple English words before they started to learn English at school. So, the proficiency level of each student may be slightly different. Digital textbooks will play a significant role when students

suddenly forget how to read the words. Some digital textbook also has a speed multiplier function. Thus, students can freely adjust the speed of reading and review it. There are also many exercises in the digital textbook, some requiring the use of a brush tool to draw, and some requiring imitating the dialogue by watching videos. Of course, there are also many functions to help student to memorize, such as stickers or the note function.

As we all know English as a tool of communication, memorization of textbook conversations lacks the ability to improvise in actual conversations, so the teamteaching method has been deployed in English education in Japan, usually involves a Japanese teacher and a native English speaker. After learning the grammar or the words, the teachers will set up a dialogue scene to practice and ensure that they can use it. They can help the students to understand the language appropriately and promote Intercultural communication. However, Students can hear native English pronunciation either by using digital textbook or by communicating with foreign teachers. Finding the differences of teachers' teaching behavior while using a digital textbook in English class and the teamteaching using regular textbooks in Japanese elementary schools could be a way to make a better use of digital textbooks.

According to the Curriculum Guidelines (2019), English education reform has been initiated, in the fifth and sixth grades of elementary school, "reading" and "writing" will be added step by step to create a synthesis class as "foreign languages,". Okada (2010) suggested that with the growth of grades, intrinsic motivation is lower and extrinsic motivation is more apparent. To be better connect with learning in middle school, learning motivation becomes a challenge. Using digital textbook during the class will be a method which can improve students' motivation. If teachers choose to use digital textbooks, how to use it more effectively will become an issue of English learning.

METHODS

Now digital textbooks have been widely used in various teaching courses. This study will take the digital textbooks of Sanseido as an example to explore the changes of English teaching methods in Japanese primary schools by analyzing the layout, functions, and practice dialogue scenes of digital textbooks. Because English became a formal subject of Fifth and sixth grade, so Fifth and sixth grade digital textbook will be chosen to analyze. It is necessary to interview the teachers in the future and to investigate the current state of the class in details.

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The effect of gender matching and realism level of avatar in avatar interaction applied AI speaker on intimacy and intention to use.

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Key words: AI speaker, Avatar interaction, Gender matching, Intimacy, Intention to use

ABSTRACT

This study aimed to examine the effects of gender matching and realism level of avatars on the intimacy and intention to use in avatar interaction applied an artificial intelligence speaker. Suppose the user regards the avatar with the artificial intelligence voice recognition system as friendly and the avatar as a human-like communication object. In that case, the conversation with the avatar gives the feeling of talking with a human, enhancing the emotional interaction. Therefore, this study confirms the avatar's effective design method for intimacy and intention to use applied the voice recognition system of the AI speaker in avatar interaction. Forty college students (20 males and females respectively) participated in the experiment. We designed the avatars with two realism levels, realistic and cartoon-like, and two gender levels, male and female. In this study, an AI speaker, the Kakao Mini, was used. We developed an avatar using Daz3.0, an avatar authoring tool, and applied the pre-recorded voice of an AI speaker to the developed avatar. Just as the avatar reacts, the avatar's lips are synchronized according to the response from the pre-recorded AI speaker. Because of COVID-19, we applied ZOOM for the experiment. We applied the Wizard of Oz method that watching the recorded video of the conversation between the user and the avatar. This method is widely used in usability test studies as an experimental method in which participants feel as if they are talking to an avatar. Participants watched a video of an avatar in all conditions talking to the user and responded to questionnaires about each avatar's intimacy and intention

to use. Dependent variables were analyzed applied repeated measure-MANOVA according to the gender matching between the avatar and the participant (matching vs. non-matching) and the level of realism (high vs low). There were very significant differences between male and female participants, provided that participants and avatars were gender-matched. The intimacy of female participants toward female avatars was significantly higher than male participants' intimacy with male avatars. However, if the participant's gender and avatar did not match, there was no difference according to the participant's gender. There was also no significant difference in intention of use. This study is meaningful in identifying an avatar design method that can increase intimacy in conversations with avatars to which artificial intelligence speakers are applied.

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Effects of University Student's Academic Self-efficacy on Florishing: Latent Means Analysis Between Pre-2020 and Post-2020 Admissions Generation

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Key words: academic self-efficacy(ASE), flourishing, PERMA, latent means analysis(LMA)

ABSTRACT

In this study, we wanted to examine the effect of Academic Self-Efficacy(ASE) on flourishing in the context of COVID-19 on the differences in curriculum for incoming students before and after 2020. In a previous study (Shin, 2019), we directly examined the effect of ASE on flourishing for university students, and reported that if university students have ASE as part of positive psychological capital, they can experience flourishing. Based on these results, we wanted to determine the effect of ASE on flourishing, and furthermore, we wanted to confirm that there was no moderation effect study that looked at the level difference between groups by dividing the subjects enrolled before and after COVID-19. In short, this study is intended to verify the effect of university students' ASE on flourishing and conducted to test the moderation effect of between pre- and post-COVID-19 admissions groups.

Data of this study are collected an online survey of 593 university students in Gwangju, Korea. Measurement tools ASE (Jeong et al., 2021) and include PERMA-Profiler developed by flourishing (Butler & Kern, 2016), Sim & Kim (2019) used the Korean version of the Florish Scale (K-PERMA), which was translated into Korean and validation. The analysis used SPSS 22.0 and AMOS 22.0. The goodness-of-fit index for the structural model was shown as χ^2 (135, N = 593) = 611.06, p < .001, GIF = .89, TLI = .93, CFI = .94, and RMSEA = .08. As a result of structural model analysis, the main effect, ASE, had a statically significant effect on flourishing. Methods for verifying the adjustment effect of non-

metric variables in a structural equation model for validating adjustment effectiveness. Multi-group analysis can be utilized and there are largely methods by χ^2 differential tests and parametric difference test (Bea, 2018). In this case, we would like to examine the moderation effect between admissions groups in COVID-19 with a χ^2 differential test. Latent Means Analysis (LMA) requires measurement equality, shape equality, and intercept equality (Hong, Malik, & Lee, 2003). All three conditions for LMA have been established, but between admissions groups (first and second, third and fourth grade groups) in COVID-19 is no interaction effect. Comparisons of latent means showed no statistically significant differences in the subvariables of flourishing. We wanted to examine the effect of ASE on flourishing in the context of COVID-19 on the differences in curriculum for incoming students before and after 2020. It was verified that ASE consistent with the results of existing Shin (2019) has a positive effect on flourishing.

In other words, it is necessary to consider ways and interventions to improve ASE in order to enhance individual flourishing. Although there was expected to be a change in the university's teaching environment itself due to COVID-19, the distinction between groups according to the timing of admission was not significant in the relationship between ASE and flourishing. With a few limitations, the inner agreement between questions in engagement, a subvariable of flourishing, was first measured lower than the reporting index of Shim & Kim (2019). As a result, the failure to be adopted for main effect verification has somewhat limited the interpretation of overall flourishing. Next, the five-factor structure of flourishing may not have been suitable for the data (Shin, 2019). As an alternative to a five-factor model composed of PERMA, that a two-factor model composed of self-realization and hedonic well-being experiencing satisfaction (Shin, 2019; Umucu et al., 2019; Watanabe et al., 2018). In future studies, analysis with these two-factor models seems necessary.

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Design and development of virtual patients in medical simulation

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Key words: Nursing students, medical simulation, Virtual patient, Medical simulation

ABSTRACT

Medical universities are paying more and more attention to virtual simulation. Virtual medical simulation has the advantages of security and providing the same medical environment repeatedly. In the virtual medical simulation experiment, the virtual patient is an important factor in increasing the realism and immersion of the simulation(Zielke et al., 2017). The purpose of this research is to develop a virtual patient avatar based on the principle of avatar development.

In the development of virtual medical simulation, the research confirmed the principles required for the development of online virtual avatars in order to improve the authenticity, and developed a virtual patient based on this.

For this research, the principles required to develop a virtual avatar were first confirmed. In medical simulation, virtual patients should be relevant, realistic, engaging, challenging and instructional(Li et al., 2019). Based on this, the design was carried out in four aspects: 1) determination of virtual patient's basic information, 2) scenario design, 3) text pictures and audio files selecting, 4) the platform where the nursing students can participate freely.

In future research, it is necessary to conduct a factual study to evaluate the virtual patient.

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Roundtable 2

Transformation of Students: Problem-Solving Instruction Based on Engineering Design

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Key words: Problem Solving, Engineering Design, STEM/STEAM Education

ABSTRACT

Assessment and Teaching in 21st Century Skills (ATC21s, 2012) defined 21st century skills for children living in the 21st century. One of the skills is the ability to solve problems. The Organization for Economic Co-operation and Development (OECD, 2014) defines problem-solving skills as the ability to understand problems for which solutions are not immediately apparent, cognitive processing to generate a solution, and a proactive approach to solving them. In Japan, problem-solving skills are also one of the skills to develop (MEXT, 2018).

Developing problem-solving skills is more efficient to explicitly teach problem-solving skills (da Micheal & Mart, 2006). However, there are no common problem-solving skills (English & Sriraman, 2010). One of the reasons is that the term “problem-solving” is unclear (English & Juile, 2016). Schoenfeld (2013) stated that it is necessary to define problem-solving skills. Developing problem-solving requires specific instruction not only in the results of problem-solving but also in the process of solving the problem (M.matthee & M.Turpin, 2019). Therefore, Engineering design is expected to be a practical approach to problem-solving skills. (Mentzer et al., 2014). In The Next Generation Science Standards (NGSS, 2013), the process of problem-solving is presented as an action as Engineering Design. NGSS defined three steps in Engineering Design: (a) define problems, (b) develop solutions, and (c) optimize the solution. Atman et al. (2007) indicated that problem definition and information gathering differ between beginners and experts problem solver. Mentzer et al. (2015) indicated beginners in problem solving spend less time on defining the problem.

In Japan, one of the goals of “Information” is to develop problem-solving skills (MEXT 2018). Therefore, we did our practice in information class. This study investigated the change in problem-solving ability after learning Engineering Design to improve problem-solving ability.

We measured the problem-solving skills of high school students before and after they learned Engineering Design:

1. The learners performed a problem-solving activity.

2. The Teacher taught Engineering Design to students.

3. The learners performed the same problem-solving activity again. The problem-solving activity was carried out in four or five people using a chat application on a smartphone. The logs of the chats were recorded and analyzed.

As a result, some groups changed their problem-solving activities for the better after learning about Engineering Design. There was a similar chat trend in the group that changed for the better. First, define the problem before generating a solution. Second, gather information and use it in their solution. Third, think about the various effects that the generated solution will have. Fourth, the learner-generated solution became concretely realizable. Similar to Atman et al.’s (2007) results, it was found that information gathering is related to the outcome of problem-solving. Furthermore, similar to Mentzer et al. (2015), the results suggest the importance of performing definition problem-solving. These results show that Engineering Design has improved problem-solving activities. Therefore, Engineering Design can improve problem-solving ability. However, not all students improved in their problem-solving activities. This trend needs to be used to develop problem-solving skills. We will use the results to develop more effective lessons.

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The Learning Strategy Classification for Learning Goals in High School Mathematics

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Key words: Learning Strategy, Learning Goal, Classification, Instructional Design

ABSTRACT

High school students need to improve the quality of mathematics learning (MEXT, 2018). High school teachers, therefore, need to teach learning strategies (e.g. Donker et al., 2014). Learning strategies are actions or thoughts during learning to influence the encoding process of the learner (Weinstein & Mayer, 1985). Furthermore, they classify learning strategies into five categories: rehearsal, organization, elaboration, metacognition, and motivation strategies. We focus mainly on the rehearsal and elaboration strategies. Rehearsal strategies are repeating the same learning behavior. For example, these strategies are restudying and rereading. Elaboration strategies connect new knowledge to existing knowledge. For example, these strategies are retrieval practice and self-explanation.

We compare two learning strategies: restudying as the rehearsal strategy and retrieval practice as the elaboration strategy. Restudying is studying the material once and then studying the material again in the same way. Retrieval practice is reading, studying and self-testing the material. Learners often learn using more restudying than retrieval practice (Kirk-Johnson et al., 2019). Similarly, Agarwal et al. (2014) suggested that high school students tend to use rehearsal strategies rather than organization or elaboration strategies during learning. The learners perceive restudying to be more effective and less costly (Kirk-Johnson et al., 2019). Therefore, even if learners know effective learning strategies, the learners tend to use learning strategies that are easy to use. That's why teachers need to instruct so that learners can learn using more effective learning strategies.

Importantly, in teaching-learning strategies, teachers need to explicitly teach them to help students achieve their learning goals (Dunlosky et al., 2013). One of the frameworks for learning goals is Gagné's

five learning outcomes (Gagné et al., 2005). The learning outcomes have five categories: verbal information, intellectual skills, cognitive strategies, attitudes, and motor skills. Therefore, teachers need to select and guide appropriate learning strategies for these learning goals. For example, the rehearsal strategies, which involve restudying, effectively memorize words (Rawson, 2012). Still, the elaboration strategies, which involve retrieval practice, may be more likely to transfer learned knowledge (e.g. Barenberg et al., 2021). accordingly, identifying the optimal learning strategies to achieve given learning goals may be valuable in teaching-learning strategy.

Therefore, we aim to discuss the classification of learning strategies according to learning strategies. This study is expected to support teachers in selecting learning strategies according to learning goals when designing instructions.

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A Junior High School Science Teachers' Attitude Survey of Active Learning Classrooms in Science

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Key words: Active Learning, Learning Space, Science Education, Science Classroom

ABSTRACT

In Japan, Junior high school subject science aims to improve teaching from Active Learning (AL) view through observation and experimentation (MEXT, 2017). AL includes all kinds of learning beyond the more one-way transmission of knowledge in lecture-style classes. AL requires engagement in activities such as writing, discussion, and presentation and externalizing cognitive processes in the activities (Mizokami, 2016). MEXT (2019a) states that science and mathematics equipment and standards need to be improved from primary and secondary education. Specifically, it is necessary to promote the systematic and practical improvement of facilities. On the other hand, Pedagogy, Space, and Technology are interrelated (Radcliffe, 2009). It is necessary to promote AL from the space perspective, science classroom. This study aimed to design the Learning Space Rating System (LSRS) that promotes AL in junior high school science education (Educause, 2017).

The LSRS used for the learning space of higher education in the U.S. This is developed to promote AL initiatives in higher education and develop learning environments that utilize Information communication and technology (ICT).

The LSRS for this study consists of three items. 1. Integration with school objectives (4 questions) about whether the design of the space is consistent with the school's objectives. 2. Technology and Tools (13 questions) asks whether space can design ICT equipment and electrical outlets facilitate group work. 3. Layout and Furniture (22 questions) is an evaluation item to determine whether the layout design facilitates group work, such as movement within space and furniture movement. The LSRS Changed to the context of junior high school science education based on Future Science Education Equipment Assistance and Junior High School Equipment Guidelines (MEXT, 2019a; 2019b). Specific contents are in Table 1.

In this presentation, we modified and designed the LSRS for junior high school science education in Japan. We describe the method of this modification and the process before surveying junior high school science teachers.

Table 1. LSRS for Junior High School Science (Science Classroom Ver.)

1. Integration with school objectives	3. Layout and Furniture
・Alignment with Learning Goals	・Furniture is arranged in a way that is appropriate for discussion
・A purpose for the use of ICT in the science classroom	・Furniture is arranged in a way that is suitable for presentations
・Science Classroom research and tasks on the purpose	・Furniture is arranged in a way that is suitable for multipurpose learning
・Science Classroom to find ways to use it	・Easy to move around science classroom for discussion
2. Technology and Tools	・Easy to move around science classroom for presentations
・Proximities within Space	・Easy to move around science classroom for multi-purpose-learning
・Movement through Space	・Approximately 2.8 square meters per student for discussion
・Seating Density	・Approximately 2.8 square meters per student for presentations
・Furniture Configuration Flexibility	・Approximately 2.3 square meters per student for multi-purpose learning
・Work Surfaces	・Furniture is arranged for a variety of activities in each room type
・Seating Comfort	・Furniture can be easily moved
・Transparency	・Furniture is arranged to provide a variety of activities for a variety
・Access to Adjacent Informal Learning Areas	・There are built-in movable walls or movable panels
・Writable Surfaces	・Sliding doors or movable walls that can be linked to activities
・Physical Storage	・Have writable boards and displays for all to see
・Future Proofing	・Have boards and displays that can be used for a variety of purposes
・Proximities within Space	・Have a walk-in storage room (prep room)
・Movement through Space	・Lockable cabinets in the prep room
	・Easy to move around science classroom for discussion

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The Significance of Internship in Japan for A Chinese Student of Japanese-Major

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Abstract： The purpose of this study is to clarify the significance of internship held in Japan for a Chinese students of Japanese-major. While staying in Japan for about three months, Japanese-major students participate in some activities created by a university such as working at a hotel in Hokkaido and enjoying hot springs or going skiing during their rest days, in order to learn Japanese culture and society. This type of internship in Japan is usually held in the summer or winter vacation. Although it is held by the university, students can sign up for the internship if they wish, and it is not mandatory. The internship in Japan is very valuable because in China, Japanese-major students cannot interact with native Japanese speakers easily. The internship in Japan is beneficial not only to practice Japanese language but also to experience Japanese lifestyle. In order to achieve the purpose of this study, three Chinese students of Japanese-major who have had internship experiences in Japan are interviewed. The data is analyzed and discussed in terms of the effectiveness of the internship by paying attention to their interaction with Japanese at work.

Key words: internship, foreign language education, Japanese major, qualitative study, interview

INTRODUCTION

With the economic exchange and cultural communication between Japan and China, Japanese culture has become more and more popular in China. At the same time, since 1995, Japanese language has become the second most popular foreign language in China (Kiyama and Shinozaki, 1995). The number of people studying Japanese continues to increase every year, especially college students are numbered about 104,649 in 2014. Not only regular Japanese- major students, but also the students in other majors are interested in learning Japanese due to the influence of Japanese animation and Japanese dramas (Tang 2015).

According to Yu (2012), there were numbers of students who were not confident of living in Japan even if they study Japanese language hard in China. The reason is that the Japanese language education

currently being implemented in China, focused on only studying textbooks and preparing for exams. The skills and abilities to apply knowledge of the students' speaking are ignored.

To provide the opportunities of speaking Japanese language, universities created a kind of internship in Japan. Through the internship, students stay in Japan for about three months, and participate in some activities like working at a hotel in Hokkaido to learning Japanese culture and society. It is planned for not only to practice Japanese language but also to experience Japanese lifestyle.

METHODS

In order to achieve the purpose of this study, three Chinese of Japanese-major students who have had internship experiences in Japan are interviewed. Table 1 shows the profile of three students.

Table 1. Basic situation of three students

Name	G	T	K
Gender	Female	Female	Female
Years of Japanese language study	Two and a half years	Three and a half years	Three years
University	A university in Shanghai	A university in Zhejiang Province	A university in Shandong Province
Duration of internship	2017.12～2018.03	2017.12～2018.02	2018.07～2018.10

The content of the interview will be determined by September and the first interview will be completed by November. A second interview will be considered if there is something that is not understood after the analysis. However, due to the impact of COVID-19, if it is not possible to go to China, the interviews will be conducted online (using software such as WeChat or zoom).

The data is analyzed and discussed in terms of the effectiveness of the internship by paying attention to their interaction with Japanese at work, such as what kind of trouble they had in their work, or whether Japanese people had any misunderstandings about them or not.

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The Effect of Group Work in teaching of primary schools Comprehensive practice course in China

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Key words: Comprehensive practical activity course, group work, primary school in China, conversation

ABSTRACT

The purpose of this study is to clarify the problems occurred in groupwork in the comprehensive practical activity course of primary school in China. The Chinese Ministry of Education aims to strengthen the overall design of the lesson with the announcement of the "Guideline for Elementary and Junior High School Comprehensive Practical Activities course(2017)and emphasizes the active learning. However, there are problems. For example, the degree of participation among the students is not balanced. the purpose of the task given to the students during groupwork is not specific, the division of roles among students is not clear, and the interaction among the students is not active enough. Therefore, in this study the conversations of 2 groupwork of 5-6 students were recorded and analyzed to find problems. As a result, it was found that during the groupwork, students discussed that were unrelated topic, did not work collaboratively, Some students participated passively in the activities. One of the causes, the lack of a reasonable self-evaluation system. If the students could evaluate their own strengths and weakness by themselves by reflecting what they did in the activities, their performance will become much better. Thus, in the future, the proper self-evaluation system need to be developed.

INTRODUCTION

The aim of the Chinese education department is to publish the guidelines for the practical activities course of the elementary and junior high schools, and the teachers need to strengthen the skills of designing activities used in overall the comprehensive practical activities course. In addition, the evaluation of the class has a comprehensive evaluation and research of the multiple level, and emphasizes the growth of the ability of the student, and the diversity of the student activity method and the problem

solving strategy, and it is advocated to exchange the opinion and the experience with the friend in the group discussion. And, with the encouragement of the Chinese government, the Comprehensive practice course aims to develop independent learning habits among students. Teachers need to update their educational philosophy, teachers are the organizers, guides and collaborators of mathematics learning, assessment not only focuses on the results of learning, but also on the process of learning, helping students to build confidence in group activities. At the same time, the methods and means of evaluating the results of group activities and the content should also be changed. To solve this problem, students should clarify the meaning of group activities and objectively evaluate their own performance in group activities.

METHODS

The class consisted of 35 students and when the lesson was conducted as a group activity, the students were divided into seven groups with five members in each group. In this study, conversation analysis was used to analyze students' independent learning and identify the problems of group activities. The students' conversations were recorded with a tape recorder during the group activities with the permission of the school and the students themselves. The data from these recordings will be collected and used to analyze the group's activities. The subject of this study is one of 3 classes of grade 3 at Liuwei Road Primary School.

RESULTS

In this integrated practical activity course, the lesson time was 40 minutes. The first 15 minutes were for the teacher to guide the main content of the lesson and introduce the students the topic of the lesson. The next 20 minutes were spent for group discussion and the last five minutes were spent on the teacher's summary of the lesson and planning for the next lesson. According to the analysis of the recorded survey, certain problems did exist in the group activities of Chinese primary school comprehensive practice course. For example, some students were unable to express their opinions properly, or used group time to discuss topics unrelated to the subject with other students, or even played games For example, uneven participation in group activities resulted in some students speaking little or not at all during group activities. Other students will wasted time by doing something completely unrelated to the topic during the group activity time. Other students lacked a sense of group cooperation and argued with their group members during group discussions. Because the time was wasted, the topic time covered was not completed.

DISCUSSION

In our investigation of the actual group activities, we found that there were indeed problems such as low motivation to participate, intra-group quarrels, and unclear goals in group activities. We considered that these problems occurred because students were not given an objective of their classroom performance and learning as well as evaluation. To solve the problems of group activities, we consider two aspects of teacher education and student self-evaluation system to make changes. In the above two cases, we can find that in the group activities of the integrated practical activities course, there is an uneven participation of students, they cannot cooperate well and they do not listen to what others say.

In the future, we will focus on teacher guidance and education during group activities and try to introduce a new system of student self-evaluation so that students can achieve the goal of proper self-understanding and evaluation in the classroom.

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AI Intelligent Products for Children's English Micro-lecture

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Key words: AI scene recognition, 4-6 years old Chinese children, Enlightenment English,Micro-lecture

ABSTRACT

The presentation mode of this project is an AI teaching product of English micro-lecture for Chinese children aged 4-6 designed based on Mockplus platform.

The Mockplus prototype demo function is the main technical support, using online and offline, two- pronged sales model, the main online marketing. The product is divided into two parts: basic micro-lecture and extracurricular playground. This product is planned to be operated in a commercial form, and it will be considered to apply for patent or outsourcing when it is mature.

The advantage of this project is that the interaction mode is upgraded and rich: the traditional curriculum mode cannot fully grasp all the children's feedback and interaction and interaction. By means of technology, such as the application of intelligent robots, speech recognition and object recognition in the field of education, interactive learning can be carried out with children and timely feedback on learning can be conveyed. Scale replication of teaching resources: Domestic education in different regions, educational resources are very different. The project will enable the replication of a complete set of programes and services to provide educational resources and services as equitably as possible across geographical boundaries.

The project results will use the existing AI scene recognition technology, so that children can learn knowledge in real scenes and daily life, and make knowledge daily and daily life. And the use of AI intelligence to make the screen display and audio output combined to achieve knowledge visualization, audibility. At present, the preliminary research of the project has been completed, and the research results show that the market prospects are good. In addition, the material library and audio library required by the project have been established. Finally, the overall page design of the project has been completed, the

basic micro-lecture interaction has been completed, the overall interaction of the extracurricular playground has been completed, and the specific column interaction can be further improved.

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Development of an educational model for preservice teachers to improve online education competencies

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Key words: Distance education, Preservice teachers, Competencies

ABSTRACT

With rapid adoption of distance education, it is required to strengthen preservice teachers' online teaching capabilities. Preservice teacher need to design online class, teach online, and create material for online class. Therefore, it is necessary to develop an educational model for improving the competencies of preservice teachers.

Our research questions are as follows: (1) how the educational model for improving preservice teachers' distance education competencies is constructed, and (2) whether the model has an effect on the improvement of distance education capability of preservice teachers. This study was conducted based on the design development research methodology. Internal and external validation was conducted to develop the program.

The model has four parts. First, preservice teachers are provided with practical opportunities to develop teaching and learning guidance, PPT materials, and videos for distance classes. Second, preservice teachers observe inservice teacher's online class and discuss it with the inservice teachers. Third, preservice teachers teach secondary school students online through online mentoring. Preservice teachers develop educational programs and experience teaching students directly, thereby cultivating curriculum design, teaching-learning capabilities, and distance education capabilities as teachers. Fourth,

preservice teachers acquire an edutech knowledge that can be used for distance education. They can understand how to use edutech in distance education and the possibility of technological development.

Thirty-two preservice teachers participated in the programs. 5-point Likert scale was used to measure the satisfaction. Overall satisfaction with the program was high. The mean was 4.21 points. Preservice teachers also reported that distance education competencies were improved through the programs in the interview. The result suggests that it provides opportunities for preservice teachers to experience online education. Second, it was helpful in strengthening the online education capacity of pre-service teachers. However, the limitation of the research is that the number of preservice teachers who participated in the programs was. In order for these to proceed effectively, the continuous operation of the programs are needed.

The Emotional Reaction Comparison of In-Service Teachers′ Gender in Virtual Parent Meeting Simulation

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Key words: parental meeting, virtual simulation, emotion analysis, gender

INTRODUCTION

Parent meeting in the school is conducted to deliver students' problems to the parents, to discuss student's career after graduation. This kind of parental meeting could be a lot of mental burden to teachers. In particular, many teachers are suffering from mental stress and psychological exhaustion if the parents do not accept student's problematic behavior and blame it to the school management. Female teacher feel three times more psychological exhaustion and receive more dagame than the male teachers(Kim Dong-seok et al., 2020). Female workers are found to experience emotional exhaustion longer than male workers(half-term, 2009). However, some studies have shown that everyone was under similar stress regardless of gender (Kim Nuri, Ahn Do-hee, 2015). Teachers often fail to express the emotional difficulties that teachers face in parent meeting because they are supposed to accept parents' dissatisfaction and distrust.

Such emotional difficulties can be seen through teachers' facial expressions during the parent meeting process. Facial expressions are used as social clues to a person's emotional state. Valence could explain the overall emotions of a user in facial expressions. Emotional valence is indolent of emotional states that represent positive, neutral, and negative sentiments. Also, facial expressions confirm the four main emotional joys, sorrows, fears, and anger of humans. Based on this, we would like to identify the following research problems:

[Research Question 1] Is there a difference in the emotional valence of the in-service teachers according to the simulation stage in the parent counseling simulation?

[Research Question 1] Are there any differences in the four basic feelings (delighted, sad, afraid, and angry) of the current teacher according to the simulation stage in the parent counseling simulation?

RESEARCH DESIGN&METHODS

A. Parental counseling simulation and scenario

The study used a parent meeting simulation, one of the submodules in SimTEACHER (Simulation for Teaching Enhancement of Authentic Classroom beHavior EmulatoR) virtual class simulation. The parent meeting module was developed for the purpose of training how to cope with the parent counseling.

Parent meeting simulation consists of four stages. 1)greeting, 2)recognizing student's problem behavior, 3)asking parents' thoughts, empathizing, and exploring solutions and 4) meeting closing. The parent does not admit the student's problematic behavior and shows a non-cooperative attitude and distrust teachers.

In this study, the gender classification of in-service teachers was applied, and each group experienced steps 1 through 4. The dependent variables of this study are joy and emotional valence. Joy represents a feeling of pleasure, and emotional valence represents a degree of positive, neutral, and negative emotion. The AFFECTIVA module from iMotion was used to analyze facial expressions. The collected facial expression data were analyzed with repeated measurement ANOVA using SPSS 2.0.

RESULTS

1. emotional valence

We identified within-group differences by Emotional Valence (F=20.82 p=).000). In each simulation phase, the highest valence was shown in phase 1 and the valence value was significantly decreased in phase 2, 3, 4. The emotional valence by gender of the incumbent teacher was not significant (F(1,21)=1.91, p=.181). Overall, female teachers had higher valence than male teachers, but it was not a significant difference. In the interaction between the genders and the four steps, women fell sharply from the first level to the second level compared to male.

2. Joy, sadness, fear, anger.

In all four emotions, joy, sadness, fear, and anger, we identified the difference in simulation 4 steps. Joy was the highest in the first stage of greeting. Sadness was the highest in the second stage which start to talk about the student’s problem. Fear was the highest in the last four, and anger was the highest in the fourth stage. Gender-specific differences were identified in joy sentiments (F(1,21)=7.69, p=.011).

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Exploring the Emotional Experience of In-service Teachers through Facial Expression Analysis in a Teaching Simulation

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Key words: teaching simulation, facial expression, emotional experience, iMotions Affectiva

ABSTRACT

The purpose of this study is to derive design implications for teaching simulation by examining the emotional experiences of in-service teachers through facial expression recognition according to the gradual challenge stages of student behavior. In this study, changes in Engagement, Joy, Surprise, and Valence among emotional responses were analyzed using facial expression recognition. Teaching simulation can induce various emotional experiences while the users interact with student avatars. In the teaching simulation, the emotional design with student avatars (Choi & Kim, 2018) and the interaction design (Park & Ryu, 2019) significantly affect the user's emotional experiences. Teaching simulation must consider the users' emotional status that can influence their learning performance and engagement (Choi & Kim, 2018; Park & Ryu, 2019). However, studies on pre-service teachers' emotional experience in teaching simulation have not been comprehensively investigated. Further research is needed to find the factors that can influence the learners' emotions during interaction within the simulation classroom. Facial expression analysis has been used to study individuals' internal emotional states, but in particular, after Kaliouby and Robinson developed a computational model for facial affect inference in 2005, it has been extended and applied to various user emotion measurement studies. The facial expression analysis is more objective than the self-reported survey, does not interfere with the learner's performance, and does not relying on the learner's recall memory. Although facial expression analysis has received much attention in recent years, there is relatively little literature on the emotional experience of teaching simulation through facial recognition (Park & Ryu, 2019).

This study was conducted remotely via Zoom, and twenty-four (n=45) Korean in-service teachers participated. The research tool was Simulation for Teaching Enhancement of Authentic Classroom

beHavior Emulator (SimTEACHER). The virtual student avatar in SimTEACHER showed disruptive behaviors according to the progressively challenging scenario of five steps. The scenario was developed based on the Seven Phases of Acting-Out Bevior Model (Colvin & Scott, 2014) and the severity of disruptive student behavior perceived by teachers (Butler & Monda-Amaya, 2016), reviewed and corrected by three in-service teachers. The participants were asked to deal with the disruptive behavior of a virtual student avatar as a teacher for about five minutes; their facial expressions were recorded in real-time during the whole experiment sessions for further facial expression analysis. The dependent variables were Engagement, Joy, Surprise, and Valence. Engagement was analyzed because it has a significant influence on learners' cognitive processes and learning outcomes. Joy, Surprise, and Valence were found to be expressions of major influence on learning in the Dynamics of Affective States Model (Mudrick et al., 2017). Joy is highly correlated with learning outcomes, helping self-regulation and promoting learning engagement (Park & Ryu, 2019). Surprise is an emotion that induces attention to the learning content (Tyng, Amin, Saad, & Malik, 2017). Through iMotions' Affectiva AFFDEX software, the emotional state variables were measured by analyzing the learner's facial expressions during the teaching simulation.

As a result, significant changes in the emotions of in-service teachers were analyzed according to the stage of the scenario in Joy, Surprise, and Valence. These findings confirmed that the design of the scenario has a significant influence on the teachers' emotional experiences. On the other hand, since no significant difference was derived in Engagement, it was confirmed that the engagement did not change regardless of the scenario's seriousness. This study provided implications for developing a compelling teaching simulation scenario to enhance the user's emotional experience.

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The Motivation of University Students in the New Normal: An Online Exchange Program

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INTRODUCTION

Ever since the outbreak of the Novel Coronavirus or otherwise known as the Covid-19, last December 2019, the world has shifted dramatically (Li et al., 2020). The sudden changes have caused the students to feel unmotivated. In addition, a recent quantitative study conducted in selected universities in Japan and the Philippines by Lopez, Pescadero, and Barte (2021) regarding the academic stress of university students during the pandemic revealed that stress in academics is very prevalent among students. Due to the sudden changes experienced by university students during the pandemic, their motivation and willingness to learn have declined.

With that being said, this enabled the researchers to conduct a virtual exchange class

between Nihon Fukushi University in Japan and Mindanao Kokusai Daigaku in the Philippines. Through this, the emergence of technology will enable Japanese students to know the necessary skills needed for facilitating an exchange program; thus, the experience can help them gain the necessary skills to implement more which can broaden their horizons. On the other hand, Filipino students can potentially gain back their concentration and motivation in online classes, ultimately redefining the mood during classes. This will allow the participants to meet new individuals and share knowledge about their own cultures and also allow them to learn languages.

Thus, this study aims to obtain knowledge that will be valuable during the pandemic and will also be valuable in the future, particularly in today's period of globalization and technological innovation.

METHODS

To meet the study's aim of enforcing the online exchange program to improve motivation for online classes throughout the pandemic. Following the implementation, the authors provided a questionnaire to all students who took part in the exchange program in order to assess the motivation experienced throughout the program. Then, the authors conducted an interview survey of the students who offered indicative responses to gain a deeper picture of their condition. Finally, the authors determined the achievement and task based on the findings of the questionnaire.

RESULTS AND DISCUSSIONS

The online exchange program was able to progress in a positive environment. Students from the Philippines and Japan did better in communication and discussion. In light of this, the authors created and administered an online exchange program questionnaire. As a result, virtually every student's motivation for online lessons increased. Philippine students, in particular, responded in this manner since they have been barred from attending school since last year. In addition, the majority of students stated that they would want to hold the online exchange program again.

Students saw the online exchange program as a successful and excellent method to provide a new flavor to the school system during the pandemic and in the years ahead. According to the findings of the brief survey performed, the majority of individuals who took

part expressed a great deal of inspiration and satisfaction as a consequence of the exchange program's execution. Furthermore, it was discovered that this online exchange program had assisted students in becoming more motivated in their online education as well as gaining important experience; such as language learning and exposure. They also had so much fun with the exchange program that they have agreed to do it again in the future, with additional twists and exciting events, allowing them to extend their network of people and allow other nations to join. This may help students broaden their knowledge of the world, apply the language that they are learning and become more culturally aware. Thus, international collaboration has been made possible through the internet due to the Covid-19 situation. The future challenge will be an instructional design to incorporate such learning in the curriculum in a sustainable way.

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Online Support of Japanese Language Class in the Philippines from Japan

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INTRODUCTION

In recent years, COVID-19 has become a huge issue all over the world. Moreover, it caused many changes in the learning environment. For example, university students in Japan were restricted from entering the campus, and the students in the Philippines have never been allowed to enter the campus since March 2020. As a result, many students seem to have a hard time managing their learning. Under such circumstances, we planned international collaborative activities online to bring stimulation to our daily classes. Japanese students provide support at the Japanese Language class in the Philippines. We observe the class by regularly participating in the class in the Philippines. Then we describe the realities of learning under the COVID-19 and discuss the effects of our activities and better learning in the future, mainly focusing on students' motivation. There is a merit that online activities can be carried out regardless of location. However, online university classes have weakened the relationships between students. Therefore, it is meaningful to clarify what kind of support can be provided to keep students motivated in class through this study.

METHOD

In this study, we participated in a Japanese language class at Mindanao International College (or Mindanao Kokusai Daigaku: MKD) as a Teaching Assistant (TA) and observed it. During the lesson, we recorded the students' remarks and actions and considered their motivation. We also interviewed the teacher and several students.

RESULTS AND DISCUSSIONS

Classes were conducted using a web conferencing service called Zoom. The class was basically started with the previous review and the contents of the textbook, and the students practiced conversation. Japanese students assisted the classroom teacher. The main role was to play a role in conversation practice and to answer questions. The teacher mainly taught in Japanese and sometimes gave supplementary explanations in English. In addition, we were sometimes asked to explain what it was like in Japan. Many students attended classes with their cameras off. Some students turned on the camera when practicing conversations and asking questions, but only 3-5 people turned the camera on all the time.

Third graders often asked questions and had conversations in Japanese. The questions were more about grammar than words. However, there were fewer responses than in the first grade class. In the first grade class, there were many reactions and questions to the teacher and Japanese students. Many students turned on the video, which showed their positive attitude toward the lesson.

When many Japanese students joined the class and students were allowed to ask questions about hobbies, they were even more active. This is also the case for third graders, and the magnitude of the reaction varied depending on the number of students in a central position during class.

We also observed the situation for some students to give up asking questions by caring about core students. The teacher mentioned that students' interest in the class seemed to be lost in about two weeks. However, students who do not appear often turn on the camera when talking about topics other than social gatherings and lesson content. When I asked Japanese students questions during class, I often actively spoke about the topic. Therefore, by having a native speaker (Japanese) participate, it may be possible to maintain that interest and maintain a positive attitude toward the lesson.

It was a topic outside the content of the class that showed the most active appearance during the class. Therefore, it seems that the students were not interested in Japanese as a language but in Japanese as a daily conversation. There are also opinions that they want to talk with Japanese people and learn things that are useful when they come to Japan, and I think that it is effective for native speakers to participate in classes to maintain their interests and learning motivations.

Support from native speakers online has been found to have the effect of significantly increasing learners' interests and motivations. However, since this support is short-term support, it is considered that repeated surveys will be an issue in the future.

Development of Structural Models for Cooperative Learning in an Online Environment Based on Kagan's Cooperative Learning Theory

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Key words: Cooperative Learning, Online Learning, Spence Kagan, Structural Model

ABSTRACT

Humans, which are social beings, live within the community that consists of numerous interdependent relationships. However, since we are all born differently bearing diverse talents and characteristics, learning how to live together by respecting others and embracing the differences is an important cornerstone of building a healthy society. School is not only a place where children learn new skills and knowledge, but also a place where they learn social norms and prepare themselves to become members of a healthy community through acquiring and experiencing valuable social skills. In order to achieve such class goals, appropriate teaching and learning activities should be selected and class should be conducted accordingly. The teaching and learning activities can be broadly classified into three categories: competitive learning, individual learning, and cooperative learning. This study mainly focuses on the importance of cooperative learning and the construction of learning structures that guide students to engage in meaningful learning activities in a cooperative environment. Individual learning and competitive learning have shaped the classroom environment in South Korea for a long time. This led to some positive results of Korean students demonstrating high rates of academic success and securing high scores on standardized tests. However, questions have been raised over whether competitive learning and individual learning where instructors unilaterally deliver knowledge is able to foster children's capability needed as future members of society. Instead, cooperative learning not only includes the act of helping peer students, but also includes the process of solving common tasks that are given by the instructor. In the process, joint achievements are accomplished through active interaction with teachers and peers.

Numerous research results show when classes are organized based on cooperative learning instruction methods, learners demonstrate improved creative thinking skills and academic performance.

The need for collaborative learning is becoming more imperative in the current situation of children not being able to go to schools to engage with their peers. Online learning already seems to be settled as a new normal for school as an unwelcomed aftermath of the COVID pandemic. While online learning environment certainly has its benefit of being more time efficient, it definitely limits peer interaction and student-teacher interaction. Also, due to the current situation of learning environments restricting face to face meetings between students and teachers, it is likely that teacher-centered classes where teachers unilaterally deliver class content and students passively receiving information will be widely conducted. This is because it is difficult for teachers to arrange students into small groups to start group discussions, or encourage students to actively participate in presentations and feedback with their peers if conversation is only possible through an online learning platform. Teacher presence and learner presence decreases as well when students engage in learning remotely, causing even more difficulties in students' motivation and their ability to be immerse themselves in the learning process.

Thus, this study aims to develop a structure for cooperative learning in an online environment with the aim of providing valuable strategies for constructing a cooperative classroom to teachers. Even though teachers intend to organize remotely conducted classes around collaborative activities, there is a lack of specific practice guidelines to support guide the teaches through the instruction process. Thus, this study will provide specific guidelines of designing collaborative classroom settings. The guidelines will be developed on the ground of the cooperative learning structure developed by Spencer Kagan. According to Kagan, cooperative learning activity entails four major elements, referred as PIES: 'Positive interdependence', 'Individual Accountability', 'Equal Participation', and 'Simultaneous Interaction'. Prior to developing learning structures for cooperative learning, the four basic principles of Kagan's cooperative learning will be thoroughly examined and will be adjusted accordingly to the actual classroom environment for primary school students. In order to verify the validity of the developed structures, FGIs (Focus Group Interview) with experts in the field of pedagogy and/or primary education will follow. The result of FGIs will be summarized and analyzed to help develop the first draft of the structure into the final version, which will be later adapted to the actual classroom setting.

This study plans to analyze the effects online cooperative learning has on students. More specifically, the validity of the instructional structures will be measured by assessing the improvement rate in students' creative thinking skills and academic performance. In order to prove the importance of collaborative learning in primary education, and verify the substantive results that the structural model of cooperative learning had on children, online classes will be designed and implemented entirely around cooperative learning activities. For the final result of this study, it can be expected that the structure model for cooperative learning will contribute to helping instructors organize classes in online educational settings, which will contribute to the widespread and easy implementation of online cooperative learning. Moreover, students will be provided with a chance to learn collective responsibility of the entire group based on interdependence among group members. By addressing common goals

through group activities, negative emotions that derive from extreme competition in the classroom will be resolved. Instead, it will help improve students' creative thinking skills, leadership, and problems solving skills.

Through the conference, I aim to briefly introduce the main concept behind Kagan's structural model for cooperative learning and the method we used to incorporate Kagan's idea into devising our very own structural model fit for online learning environment. Furthermore, the explanation about the process of deriving structural models for cooperative learning will follow, accompanied by the experiment that will be conducted in an actual class setting where children will be taught by cooperative learning structures in order to test the effectiveness of the structural model we have developed.

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Development of Card Game using Dramatical Methods
-A Study of English Communication-

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ABSTRACT

In this paper, the authors identify the English learners' awareness of English communication through using a card game based on the dramatical method. The new curriculum guidelines include an English education policy focusing on improving student's English communication skills in school (MEXT, 2014). According to the guidelines, students are supposed to learn English through communication with others. The common goals of English education in junior high and high school are to improve English communication skills. When students communicate in English in classroom, they must care about the actual contexts in the conversation (Iwai and Rinnert, 2010). Students need to change the way to communicate depending on the situation and context. In addition, they also should use non-verbal communication such as voice and facial expressions to tell their thoughts and emotions effectively. In communication, non- verbal expressions are essential because non-verbal communication accounts for 65% of interpersonal communication (Birdwhistell, 1970). In English education, teachers sometimes applied a dramatical method to develop student's English communication skills with non-verbal expressions in a real context. The researchers such as Shiozawa (2007) stated that English learners could integrate "emotions," "gestures," and "languages" by using the dramatical method for language learning, and they can practice communicating with others in an authentic context. Although the dramatical method effectively improves English communication skills, it takes time to introduce it into the class. Therefore, the authors developed a card game that teachers can apply the dramatical method easily for the class for

developing English communication skills. The card game that the authors developed is the English version of "Hatteiu Game."

The authors implicated a class with this developed card game at a university in Tokyo on May 12, 2021. The participants were 20 third-year university students. After the implication, the authors employed a questionnaire. As a result of data analysis of free descriptive answers, the authors found the four categories of the awareness: (1) students became aware of the importance of using non-verbal expressions in communications. (2) students noticed the significance to change the way to communicate depending on the context. (3) students realized and learned the vocabulary and grammar which they are not familiar with, and (4) students recognized the effectiveness to enjoy learning English.

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Teacher‘s Image of the Usage of Tablet PCs in one-to-one Setting

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Key words: Image of instruction, GIGA school package, ICT education

INTRRODUCTION

Most students in elementary and junior high schools in Japan were provided with tablet PCs in school year 2020 under GIGA School Package (Global Innovation Gateway for All.) According to The Ministry of Education, the core of GIGA School Package involves one-to-one tablet PCs and communication network with high speed and large capacity. All teachers are supposed to conduct classes using the PCs and the network.

Students are going into highly digitalized society, so called society 5.0, in short future. They have to prepare for the new society and be equipped with qualities and abilities to make full use of ICT, now. It is, then, very important for them to have opportunities to use tablet PCs in various situations.

Teacher plays an essential role in the new types of instruction. It is necessary for them to use the tablet PCs and highspeed network effectively to equip their students with high ICT literacy in their instructions.

According to the Ministry of Education (2020), the package will change the way of instructions. At first, it will be more personalized. Teachers will monitor the situation of students more frequently. Second, it will be more individualized. Students in a class will learn different things based on their own needs. They will be engaged in inquiry learning using various modes of information through the Internet. The way of presentation will be also changed from aural to multi modal one. The third, every student will be able to share their thinking and make claims collaboratively. However, have these changes been realized in classrooms? Does Japanese teachers have the similar image of the instructions as those Ministry of Education described? Based on these research question, the questionnaire survey was conducted in July 2021.

METHODOLOGY

As a pilot study to formulate items of questionnaire, interviews to four expert teachers were conducted. All of the interviewees are leading teachers to establish and made the most of one-to-one setting, The main question for them was about the advanced usages they did and the reasons and policies to do those. 12 kinds of the image of instructions to be asked in the questionnaire were extracted from the analysis of their response. Those are

1. the more stress on expression and presentation of students’ claims,
2. the more frequent recording and documenting of students’ works,

3. the more stress on students' inquiry under give tasks,
4. the more opportunities to share information among students,
5. the more opportunities to create movie producing by students,
6. the movie portfolio taken by students themselves,
7. the more opportunities to share claims among students,
8. the more stress on encouraging meta-cognition of students,
9. the creative activity in a virtual space,
10. the self-regulated learning,
11. the improvement of students' achievement, and
12. the analysis and utilizing of each student's learning.

Two layered questions were prepared for each image: "To what degree of the image are you realizing?" with four points Likert scale and "To what degree of the image do you want to realize from now on?" with five points Likert scale. The invitation-base survey was conducted using Google Forms.

RESRULYS AND DISCUSSION

68 responses were collected from 49 elementary teachers, 13 junior high school teachers, and six compulsory-school teachers. In total, as for the status of implementation, approximately a half of the survey subjects are realizing images of the advanced instruction in their classes with tablet PCs. As for their perspectives, they have more positive images of the instruction. However, there is more room for in-depth analysis such as comparison among the subject they are in charge, location of schools, and so on.

Fig. 1: The Status of Implementation

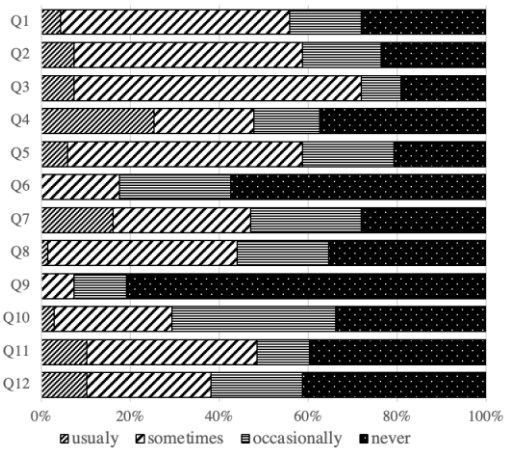
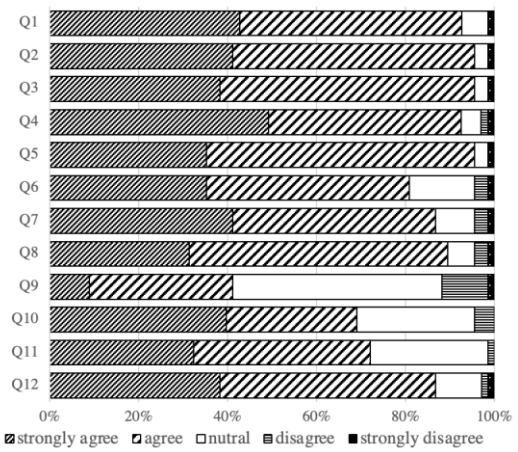


Fig.2: Teachers Perspective



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Development of cognitive load prediction model based on artificial neural network using EEG

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ABSTRACT

The purpose of this is study is to develop cognitive load prediction model based on artificial neural network model using Electroencephalogram(EEG). There are many ways to measure cognitive load, and currently methods through questionnaires are most popular. The questionnaire method can measure cognitive load status after the end of the learning, and it is difficult to identify changes in cognitive load during the learning process(Park, & Mun, 2015). EEG represents the state of human mental activity, which can be analyzed to determine the cognitive load status of learners in real time(Puma, et al., 2018). However, EEG are complex in their interpretations because signals from multiple electrodes need to be considered complexly for analysis. Artificial neural network is an appropriate technique for analyzing complex forms of signals such as EEG(Yoo, & Rho, 2020). Therefore, an artificial neural network model that predicts the cognitive load of learners at two levels will be developed through EEG data when performing different levels of tasks in this study.

The STEW datasets (Lim, Sourina, & Wang, 2018) will be used to train artificial neural network model. The STEW dataset is an open dataset that measures EEG when 48 male participants perform SIMKAP test(Bratfisch, & Hagman, 2008). The task of SIMKAP test consists of high and low difficulty conditions. Low difficulty conditions were performed for 3 minutes and high difficulty conditions for 18 minutes, while only dual task were applied to high difficulty conditions. EEG data for 150 seconds were recorded via Emotiv Epoc+ for each condition. EPOC+ is a non-invasive EEG measurement device that supports 14 channels(AF3, F7, F3, FC5, T7, P7, O1, O2, P8, T8, FC6, F4, F8, AF4). The data was recorded at 128 Hz and would be separated into five channels (Delta, Theta, Alpha, Beta, and Gamma waves) through power spectrum analysis(PSA). The collected data will be preprocessed through

EEGLab(Delorme, & Makeig, 2004) according to Makoto's(Makoto, 2020) guidelines. A 1-50Hz band-pass filter will be applied, and non-brainwave noise will be eliminated by Clean Raw data plug-in. The LSTM(Long short-term memory) algorithm, a kind of RNN(Recurrent neural network) algorithm will be used for the prediction model. RNNs are suitable for analyzing data in time series form by reflecting the results of previous time steps in the next analysis. The accuracy of the model according to the conditions of layer and hyper-parameters will be compared. This study is expected to provide insight into how to analyze learners' cognitive load states in real time.

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Development of VR Simulation to Training Job Competency for student with Mild Intellectual Disability

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Key words: Intellectual Disability, Job Training, VR

ABSTRACT

Virtual reality content for students with intellectual disabilities is used in various areas such as communication training, daily life skills, and job training. However, there is a lack of contents. That is due to the lack of attempts to construct a virtual learning environment that takes their characteristics into account. The purpose of this study is to design and develop job training VR contents about convenience-store staff, suitable for students with intellectual disabilities.

We developed a virtual reality-based training simulation prototype for high-school students with intellectual disabilities (ID). This simulation is to practice a routinized work task for the students with ID in the convenience store context. The significant features of this simulation were observational evaluation and scoring functions for teachers to give the student accurate feedback. It can evaluate the procedures by verifying how students complete each step to build a recursive task required for the job task.

The results of this study will have a positive impact on the integration of students with mild intellectual disabilities into our society. As a follow-up study, we will conduct a usability assessment of students with ID.

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Development of virtual museum simulation with spatial auditory

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Key words: Spatial auditory, Room-scale, Virtual museum, Virtual reality, Simulation

ABSTRACT

To promote learning in a virtual reality environment (VRE), virtual presence is an important factor. A high level of presence can build context and immerse in learning. Room-scaling and spatial auditory were considered as design factors that maximized the users' presence. This study is a purpose to develop virtual museum simulation providing spatial presence, and figure out the effect of auditory effect on virtual presence in VRE.

In this simulation, users wear the head-mounted display (HMD) and physically navigate around the museum by walking a 5×3 meters cubic room. There are five exhibits in the room, users can listen to the auditory sounds as background music. The auditory sounds are matched with descriptions of each exhibit, and users feel that the volume of the background music grows when they get close to each exhibit. Then we conducted a pilot study to find. Participants answered the virtual presence questionnaire after performed the task. The questionnaire contained 15 items with a 7-point Likert scale. The virtual presence questionnaire consists of three subscales — spatial presence, involvement, and realness with five items for each. Two-way multiple analysis of variance (MANOVA) was used to analyze the effect of auditory on subscales of virtual presence ($\alpha < .05$). There were no significant differences in each area of virtual presence.

As the result, as the VRE was visually eye-catching, the effect of spatial and contextual auditory may have been offset. Furthermore, visual explorations are the main focus, and sound does not affect much in museums. One of the participants commented that there is no auditory effect in museums in the real world. Given contextual audios actually could be a factor that reduces the sense of presence. The exhibits were arranged regularly, it was very easy to recognize where the next exhibit is. In another word, the user would not need to try to understand the space. We have confirmed that this research design is

inappropriate to reveal the effects of audio on presence, and we will conduct a follow-up study of an improved design.

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Instructional Design of VR Simulation for students with intellectual disabilities

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Key words: Virtual reality, Vocational learning, Intellectual disability, Immersive learning,

ABSTRACT

It has been challenging to provide vocational training for students with intellectual disabilities because it is hard to build a realistic vocational context in school. However, virtual reality-based simulations can provide various job contexts by creating a virtual learning environment. This study aimed to design and develop a virtual reality-based vocational training simulation for students with intellectual disabilities. Intellectual disability students often have difficulty acquiring knowledge and generalizing it to problem situations. Therefore, we have designed simulations based on design strategies to facilitate learning effectively and to help their generalization strategies. From the design perspective, we applied two instructional strategies: Merrill's first principle to sequence the instructional event and a worked-out example of organizing the instructional sequence. Furthermore, we validated the simulation with teachers' reviews. Five teachers specializing in special education participated in reviewing the simulation. We asked them to evaluate the simulation with SIM-TLX, assessing the task load of the simulation that the student may feel. The instrument consisted of 10 question items with 5-point scales. The result indicated that the simulation was suitable to use for students with intellectual disabilities with sufficient cognitive capacity to follow the application's instructions. Overall, the experts concluded that the simulation was good for students with intellectual disabilities without mental overload.

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Concurrent 1

A Case Study of Accurate Guidance in English Writing Based on Intelligent Assessment Tool

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Abstract: Writing accuracy is an important indicator for evaluating English writing ability. Intelligent Assessment Tool can meet the needs of labor-saving, fast, accurate language assessment and providing personalized feedback， so as to improve writing accuracy. Besides, applying reflective learning to English writing can improve English writing level. Therefore, taking 25 students in the ninth grade in a middle school in Foshan as the experimental object, this study attempts to apply reflective learning strategies to English writing accurate guidance and choose JUKU as Intelligent Assessment Tool to provide personalized feedback, to explore the impact of reflective learning based on personalized feedback on the accuracy of English writing for junior high school students. Thirteen students in experimental group were asked to record and learn personalized feedback, while twelve students in control group were asked to record personalized feedback only. Three writing experiments were conducted to compare the changes in the writing accuracy of the two groups before and after the experiment. The results show that reflective learning based on personalized feedback of Intelligent Assessment Tool can improve students' writing accuracy. We hope this study can provide reference for the reflective learning practice of English writing.

Key words: Reflective Learning, English Writing, Intelligent Assessment Tool, Personalized Feedback, Writing Accuracy, JUKU

INTRODUCTION

English writing, as an important indicator of students' comprehensive English proficiency and application ability, is a major and difficult task in English teaching. Previous studies have shown that the development of English writing ability is embodied in fluency, accuracy and complexity. As an important index to evaluate English writing ability, writing accuracy refers to the degree to which the language produced is consistent with the target language (Yuan f,2003), which shows the ability to express ideas correctly in a second language.

Feedback plays a key role in the acquisition of second language writing ability. Therefore, many researchers use feedback to improve the accuracy of writing. Most of them focus on the effects of the sources of feedback (teacher feedback, peer feedback, computer feedback), the types of feedback (direct written corrective feedback, meta language corrective feedback), the ways of feedback processing (cooperative processing, individual processing), the feedback strategies (direct feedback, indirect feedback) and feedback focus (focused feedback and unfocused feedback) on writing accuracy (Hou Jiandong, 2020). The results show that corrective feedback helps to improve the accuracy of writing language, and meta linguistic corrective feedback is better than written corrective feedback. In addition, meta linguistic explanatory feedback can achieve the feedback effect faster than error code feedback and meta linguistic explanatory feedback, and improve the writing accuracy. Metalinguistic interpretation is that the teacher marks the mistakes and provides the grammatical description of the mistakes, and then the learners correct them (Ellis 2009:98)。

Reflective learning is a kind of learning way to reflect and adjust problems in time to achieve learning goals. Zheng juping (2002) summarized that reflective learning has four characteristics: inquiry, autonomy, development and creativity. Inquiry is its basic feature, and autonomy is the reflective learning process of students' active thinking without the supervision of others; Development is not only the task of reflective learning, but also the development of physiological thinking; Creativity is a kind of comprehensive investigation, analysis and thinking in the process of reflecting and solving problems.

Effective reflective learning can help students correct wrong concepts, consolidate knowledge system, and ensure the accuracy and scientificity of knowledge.Previous studies have shown that reflective learning can improve students' reflective ability, English writing performance (Feng Manzhen et al., 2016, Shi Guoyou, 2019), and reduce the probability of errors in vocabulary, grammar and syntax (Hui Caixia, 2010).

With the development of automatic scoring technology, automatic composition evaluation system is gradually applied to English writing teaching, which can reduce the pressure of teachers to evaluate compositions, automatically provide personalized corrective feedback for students, and improve students' writing ability. As a typical automatic composition evaluation system, JUKU can provide meta language explanatory feedback and give accurate judgment on writing accuracy. Previous studies have shown that JUKU can improve the accuracy of students' writing (Ding Xiaoyan, 2020; Lu Yuanyuan, 2020). Based on this, this study attempts to apply reflective learning to English writing learning by using JUKU as an evaluation tool, and explore the influence of reflective learning based on the feedback of JUKU on the accuracy of junior high school students' English writing.

RESEARCH DESIGN & METHODS

Research participants

In this study, 26 students from two classes of Grade nine in a school in Foshan City were selected as the research participants and divided into experimental group and control group. Both groups were taught by the same English teacher. The experimental group used reflective learning to record and reflect on the feedback of JUKU, while the control group only recorded the feedback of JUKU. Because one student in the control group failed to complete the experiment due to personal reasons, there were 13 students in the experimental group and 12 students in the control group.

Personalized Feedback by JUKU

JUKU is an online service system of English composition automatic correcting based on corpus and cloud computing. It can generate the scores, comments and content analysis results of students' compositions by calculating the distance between students' compositions and standard corpus. After the students submit their compositions, JUKU will make "comment by sentence" on the students' compositions in real time, and score the compositions. In "comment by sentence", it can point out the types of mistakes made in the sentence, such as "spelling errors", " Capitalization and Lowercase Errors ", "collocation errors" etc., and give learning tips, recommended expressions and other learning suggestions.

Figure 2-1

Personalized Feedback by JUKU

As for the classification of writing errors, Carl James (1998) divides writing errors into three types from the perspective of error levels: 1. Substance errors; 2. Text errors; 3.Discourse errors. According to Carl. James' classification, Heniyan (2020) lists the types of errors in each category. In this study, a total of 18 error types were counted from the feedback provided to 25 students. Because JUKU can't judge discourse errors, it only includes two categories: Substance errors and text errors. In order to facilitate the analysis of students' performance in different types of errors, the author refers to the classification method

of Heniyan (2020) and classifies the 18 types of errors provided by JUKU. The results are shown in Table 1.

Table 1

Types of Errors in English writing by JUKU

Substance errors	Spelling Errors		
	Capitalization and Lowercase Errors		
Text errors	Vocabulary Errors		Collocation Errors
			Part of Speech Misuses
	Grammatical Errors	Lexical errors	Preposition Errors
			Noun Errors
			Article Errors
			Conjunction Errors
			Pronoun Errors
			Verb Errors
			Adjective Errors
			Adverb Errors
		Syntactic errors	Subject-predicate agreement
			Sentence elements
			Sentence tense
			Sentence voice
			sentence structure
			sentence order

Teacher intervention

In this study, due to the limitations of school conditions, students can not directly use JUKU to write and view feedback on the platform. Therefore, the researchers input the students' compositions into JUKU to generate the personalized feedback, and then print out the feedback and send it to the students. Through the intervention of teachers, the students in the experimental group were asked to check the personalized feedback of JUKU and carry out reflective learning, while the students in the control group were asked to check the personalized feedback of JUKU and record it. The task requirements of the experimental group and the control group are shown in Table 2.

Table 2

The requirements of the experimental group and the control group

Group	The experimental group	The control group
Task requirements	According to the feedback from JUKU, please answer the following questions: 1.What are the mistakes in your composition? 2.What are the reasons for these errors? 3. How to correct these errors?	According to the feedback from JUKU, please answer the following questions: 1.What are the mistakes in your composition?
Examples of students' answers	(1) My composition appeared 'unforgetable' spelling mistakes, because I wrote a letter 'T' less, the correct way to modify is "unforgettable". (2) There is Preposition error in my composition in "pay attention for". The reason is that I remember the collocation of prepositions wrong, so it should be revised to "pay attention to".	(1) There is an 'unforgetable' spelling error in my composition. (2) There are some mistakes in the preposition "pay attention for" in my composition.

Research procedures

The research process can be divided into three stages: pre test-intervention-post test. In the pre-test stage, students complete and submit their writing in written form according to the teacher's assigned topic within the specified time. In the intervention stage, a total of three times of writing training, the experimental group according to the task requirements to check the personalized feedback of JUKU to carry out reflective learning, the control group only check the personalized feedback of JUKU. In the post-test stage, students complete and submit their writing in written form within the specified time according to the topic assigned by the teacher.

After the end of the post-test, this study conducted a questionnaire survey on the acceptance of learning styles of 25 students, and interviewed teachers and some students who participated in the experiment.

Data Analysis and Discussion

In order to ensure the accuracy of the research, this study checked the number of errors recorded in JUKU to ensure that the number of errors is real and reliable. The number of errors per 100 words reflects the accuracy of writing. At present, many researchers use Chandler's hundred word error calculation method(error number / article length) × 100) to measure writing accuracy. The less the number of 100 word errors, the more accurate the writing.

RESULTS

Analysis of Overall Writing Accuracy

It can be seen from Table 3 that the number of errors per 100 words in the experimental group was significantly different before and after the test ($p = 0.001 < 0.01$) while there was no significant difference in the number of errors per 100 words in the control group before and after the test. And from the change of mean value, the mean value of the two groups both decreased, and the change range of the experimental group was higher than that of the control group. As can be seen from table 2, the error types of the correction network are divided into substance error and text error. Further analysis of the writing accuracy of substance and text shows that there are significant differences in the number of errors per 100 words between the two groups before and after the test; There was no significant difference in the control group. From the change of mean value, the number of errors per 100 words of substance errors and text errors decreased in both groups. Among the 18 error categories, the number of errors per 100 words of 11 categories decreased in the experimental group, while the number of errors per 100 words of 8 categories decreased in the control group.

In addition, from the comparison of the number of errors per 100 words of 25 students before and after the test, the number of errors per 100 words of 11 students in the experimental group decreased, accounting for 84.62%, while the number of errors per 100 words of 7 students in the control group decreased, accounting for 58.33%. Therefore, the feedback based on JUKU can improve the writing accuracy of students, and the use of reflective learning strategy can improve the writing accuracy more significantly.

Table 3

Comparison Results of the Number of Errors per 100 Words in the Two Groups before and after the Test

Category	Group	Stage	Mean	SD	post-test－pre-test	t	p
Total error	Experimental Group	pre-test	12.68	5.63	-5.77	4.475	**0.001**
		post-test	6.91	5.22			
	Control Group	pre-test	11.21	7.19	-3.37	1.697	0.118
		post-test	7.84	4.42			
Substance Errors	Experimental Group	pre-test	3.89	2.94	-2.46	-2.756	**0.006**
		post-test	1.43	1.45			
	Control Group	pre-test	5.87	6.47	-2.95	-1.778	0.075
		post-test	2.95	3.77			
Text Errors	Experimental Class	pre-test	8.79	4.73	-3.32	-2.062	**0.039**
		post-test	5.47	4.72			
	Control Group	pre-test	5.34	3.20	-0.46	0.430	0.675
		post-test	4.88	2.39			

Apart from this, due to the autonomy of reflective learning, although the teachers require the students in the experimental group to complete three reflective learning tasks, according to the reflective learning reports submitted by the students, eight students have carried out three reflective learning, and the remaining five students have only carried out two reflective learning. Further analysis found that: the mean of the number of errors per 100 words of students who have carried out three reflective learning decreased by 5.92 while the mean of the number of errors per 100 words of students who have carried out two reflective learning decreased by 5.56. It shows that the frequency of reflection will affect the improvement of writing accuracy.

Writing Accuracy Analysis of Substance Errors

Substance errors are divided into spelling errors and capitalization and lowercase errors. It can be seen from Table 4 that the number of errors per 100 words of spelling errors in the experimental group

decreased significantly before and after the test ($p = 0.010 < 0.05$), while the number of errors per 100 words of capitalization and lowercase errors did not change significantly. In terms of the mean value, the mean value of spelling errors and capitalization and lowercase errors decreased in both groups. Feedback based on JUKU can improve the substance writing accuracy of students, and the use of reflective learning strategy can improve the writing accuracy of spelling errors more significantly.

Table 4

Comparison of the Number of Errors per 100 Words of Substance Errors in the Two Groups before and after the Test

Category	Group	Stage	Mean	SD	post-test－pre-test	t / z	p
Spelling Errors	Experimental Group	pre-test	3.79	3.01	-2.43	-2.578	**0.010**
		post-test	1.36	1.37			
	Control Group	pre-test	5.04	6.83	-2.93	-1.478	0.139
		post-test	2.11	3.69			
Capitalization and Lowercase Errors	Experimental Group	pre-test	0.10	0.35	-0.03	-0.447	0.655
		post-test	0.07	0.24			
	Control Group	pre-test	0.83	1.01	+0.02	0.000	1.000
		post-test	0.85	1.11			

Writing Accuracy Analysis of Text Errors

Text errors can be divided into vocabulary errors and grammatical errors. It can be seen from Table 5 that there is no significant difference in the number of errors per 100 words between the two groups. In terms of grammatical errors, there was a significant difference in the number of errors per 100 words in the experimental group before and after the test ($p = 0.033 < 0.05$); There was no significant difference in the number of errors per 100 words in the control group before and after the test. On the average, the number of errors per 100 words in vocabulary errors errors and grammatical errors decreased in both groups. It can be seen that the feedback based on JUKU can improve the text writing accuracy of students, and the use of reflective learning strategy can improve the writing accuracy of grammatical errors more significantly. Grammatical errors can be divided into lexical errors and syntactic errors. Further analysis showed that there was no significant difference in the number of errors per 100 words of experimental group students in lexical and syntactic before and after the experiment.

Table 5

Comparison of the Number of Errors per 100 Words of Text Errors in the Two Groups before and after the Test

Category	Group	Stage	Mean	SD	post-test－pre-test	t/z	p
Lexical Errors	Experimental Group	pre-test	0.58	1.39	-0.43	-1.214	0.225
		post-test	0.15	0.37			
	Control Group	pre-test	0.27	0.49	-0.12	-0.736	0.462
		post-test	0.39	0.58			
Grammatical Errors	Experimental Group	pre-test	8.22	3.74	-2.90	-2.132	**0.033**
		post-test	5.32	4.63			
	Control Group	pre-test	5.07	3.20	-0.58	0.589	0.568
		post-test	4.49	2.22			

Research Conclusions

This study applies reflective learning to English writing learning with the help of JUKU. The results show that: personalized feedback based on JUKU can improve students' writing accuracy, reflective learning strategies can make students improve writing accuracy more significantly, and the degree of improvement is related to the number of reflection. The improvement of writing accuracy in spelling and grammar is particularly obvious. Although the accuracy of writing in the control group has been improved before and after the experiment, it is not significant. The possible reason is that the number of experiments is too few, and the students did not go through long-term training. It can be seen that the feedback from JUKU can indeed improve the students' accuracy writing, which is consistent with the research conclusions of Ding Xiaoyan (2020) and LV Yuanyuan (2020). Learners' reflective learning of errors in English writing can help to find and solve the problems in the process of writing, help learners to enter deep thinking, deepen short-term memory in the process of reflection, and avoid repeating the same mistakes, so the effect of improvement is more significant. That’s why the experimental group can significantly improve the accuracy of writing in a short time. Some scholars believe that the automatic

scoring system, like JUKU, pays more attention to the modification of spelling and grammar (Li Xueqing, 2016; Liu Wei, 2017) and give more detailed feedback on spelling and grammar. At the same time, some scholars believe that indirect feedback (such as giving examples) will be more helpful for learners to correct regular knowledge such as grammar and sentence patterns (Liu Wei, 2017). The modification suggestions of JUKU are more in line with the needs of learners to correct grammatical errors. Therefore, with the help of reflective learning strategies, the writing accuracy of spelling and grammatical errors will be more significant.

According to the interviews with students after the experiment, students think that checking the feedback by JUKU is helpful for English writing, which is mainly reflected in accurate word error analysis, better vocabulary expression, improving performance, adjusting learning methods and improving writing confidence. And the students have a good acceptance of this way, and they said they were very adapted to this way of learning. The students who insisted on reflective learning every time according to the feedback from JUKU said that this way of learning was very helpful to their writing. As for the follow-up use intention of the feedback by JUKU, most students said that if conditions permitting, they would like to continue to get detailed personalized feedback and apply it to their daily writing.

Research Suggestions

As for how to better apply JUKU to the teaching practice of primary and secondary schools, this study puts forward the following suggestions: because students have a high acceptance of the process of printing out the feedback by JUKU for recording and reflecting, teachers can use this "grounded" way to let students view their own writing feedback under the limited teaching conditions, This is a more suitable way for most primary and secondary schools to use JUKU to assist teaching. Secondly, students may not know how to make use of the feedback by JUKU. At this time, if teachers can carry out learning intervention, such as asking students to carry out reflective learning or peer evaluation and correction, it will help to improve the accuracy of writing faster. Finally, teachers can make a more scientific diagnosis of learning situation according to the situation of different students in combination with the feedback by JUKU, so as to better help students carry out writing learning.

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Technological Innovations in Counseling and Therapy: A literature review using an adapted framework for identifying emerging themes

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Abstract: Awareness of research on technology's use in counseling and Therapy is vital for counselor educator's currency in the field. Using library databases and Google's N-gram Book Viewer, a collective look at the emerging and extant publications on the intersection of technology and this social science focus was examined. An adaptation of the framework by Muller Bloch and Kranz (2015) was used. A salient understanding movement where technological interventions are helping individuals across a range of impasses across development in the field. In the COVID-19 era, the effects of the Pandemic are unknown; understanding technological approaches to help individuals suffering challenges is vital.

Key words: Technology, Technological Innovations Counseling, Therapy, Research, literature review

HISTORICAL CONTEXT: COUNSELING IN CONTEXT

Counseling is a field that emerged from the grassroots Career Guidance movement. Counseling as a movement looked at the individual's typical problems of living and how to move to wellness. Historically it has and still is focused on approaches in the therapeutic relationship. This approach centers on a therapist/counselor and client moving in individual or group counseling. Primarily the modality is based on individuation and transactions in the counseling relationship. That is, it is people-centric versus technology-centric. However, technology continues to emerge in the field of counseling. Counselor Educators' roles of teaching, service and research embody a great deal of their time. While it is variable, the exposure of these faculty to the intersection of technology and counseling can be highly differentiated. As such, a compilation of literature selected and analyzed can be a useful starting point for their future research interests and development.

LITERATURE SELECTION

The ProQuest database was used utilizing the keyword of technology, counseling, and Therapy. The search was limited to these initial constructs. Articles that focused on topics co-related to counseling such as wellness, interventions, well-being, and mental health and technological advancements emerged

from the initial search constructs and were considered applicable to keep in the literature review. The same Boolean logic was used in the N-Gram Book Reader search.

METHODS

While Muller et al. (2015) focused on finding gaps in the literature, the approach here was to find themes in topics approached at the intersection of counseling, technology, and Therapy. Gaps may be an area of future movement for the authors. For this effort, articles were procured through ProQuest and then analyzed tapped into Bandara et al.'s (2015) approach to a quality literature review. In contrast, the author's note that "In general, it is important to select a reasonable volume of papers on which to base a review (we recommend at least 50 papers)" for this endeavor, thirty-four articles were selected to get a "snapshot" of the extent of research on the mentioned topic areas. One of the initial steps in any literature review is to discern what the initial endgame is for the effort. It was agreed that this truncated literature review is a first step to illuminate individuals in the field of counselor education on the implications of emerging technology influencing and informing counseling. Bandara et al. (2015) affirm that in the early stages, it is vital to discern "What to capture and include in a literature review is something one should start thinking about at the very outset of a study (i.e., at the heart of phase 1 when defining the review's motivation, scope, and goals and deciding which papers to include or exclude), but this can also evolve as the researcher becomes more deeply engaged with the literature(p. 8)." The second database accessed was Google N-Gram Book Viewer to query more extensive writing "architecture" around these topics of counseling, Therapy, and technology.

CODING OF THE ARTICLES

Articles were organized using an adaptation of Muller Block and Kranz's (2015) approach to finding salient topic areas from which more qualitative themes can be found. The Table represents the literature from the article as mentioned above. While the goal of Muller et al. (2015) was to find research gaps in the literature, for this initial inquiry, some of the essential procurement and organizational approaches to analysis were used, transposing aspects of a gap with the topic area. For this research, a topical focal area was looked at to conceptualize initial areas of exploration for a range of individuals in counseling who want to conceptualize the status of technology use. This can range from counselors in training, practitioners in the field, to counselor educators.

Table 1

Analyzed Articles and research topic (s)

Author	Source/Journal		Title	Topic area(s)
Amaya et. al (2020)	Virtual Reality		A virtual reality approach to mindfulness skills training.	Virtual Reality Mindfulness
Balaskas et. al (2021)	*PLoS One*		Ecological momentary interventions for mental health: A scoping review	Interventions Mental Health
Bangkok et. al. (2016)	*Frontiers in Human Neuroscience.*		Virtual embodiment of white people in a black virtual body leads to a sustained reduction in their implicit racial bias.	Virtual Embodiment Implicit racial bias
Broglia et. al. (2019).	*J.M.I.R. mHealth and uHealth*		Counseling with guided use of a mobile well-being app for students experiencing anxiety	Mobile well-being app Student counseling services

			or depression: Clinical outcomes of a feasibility trial embedded in a student counseling service.	
Chan et al. (2021)	*Journal of Social Work Practice*		A narrative review of digital storytelling for social work practice	Digital storytelling Narrative
Chesham et. al (2018).	*Behaviour Change*		Meta-analysis of the efficacy of virtual reality exposure therapy for social anxiety	Virtual reality Exposure therapy
Coffey et. al (2017).	*Educational Technology, Research, and Development,*		The efficacy of an immersive 3D virtual versus 2D web environment in intercultural sensitivity acquisition	Immersive 3D virtual 2D web environment Intercultural
Concannon et. al (2020).	*. J.M.I.R. Serious Games*		Immersive virtual reality for the reduction of state anxiety in clinical interview exams: Prospective cohort study.	Immersive Virtual Reality State anxiety
Falconer et. al (2016).	*BJPsych Open*		Embodying self-compassion within virtual reality and its effects on patients with depression.	Self-Compassion Virtual Reality Depression
Fahiminia et.al (2019).	*International Clinical Neuroscience Journal,*		The effectiveness of mindfulness therapy by V.R. (virtual-reality) with a focus on death anxiety in a patient with cerebellar cancer (case report).	Virtual Reality Mindfulness therapy Death anxiety
Freeman et. al (2017).	*Psychological Medicine,*		Virtual reality in the assessment, understanding, and treatment of mental health disorders.	Virtual Reality Treatment Mental Health Disorder
Garrett et.al (2018)	*J.M.I.R. Serious Games*		Virtual reality clinical research: Promises and challenges.	Virtual Reality Clinical Research
Ghanouni et. al . (2019).	*Journal of Autism and Developmental Disorders*		Social Stories for children with autism spectrum disorder: Validating the content of a virtual	Autism Virtual Reality Program

			reality program.	
Gregg et. al (2007).	*Social Psychiatry and Psychiatric Epidemiology,*		Virtual reality in mental health: A review of the literature.	Virtual Reality Mental Health
Grenier et.al (2015).	*International Psychogeriatrics*		Using virtual reality to improve the efficacy of cognitive-behavioral Therapy (C.B.T.) in the treatment of late-life anxiety: Preliminary recommendations for future research.	Virtual Reality C.B.T. Late Life Anxiety
Gual-Montolio et. al (2020).	. *International Journal of Environmental Research and Public Health,*		How are information and communication technologies supporting routine outcome monitoring and measurement-based care in psychotherapy? A systematic review.	Communication Technologies Outcome monitoring Psychotherapy
Harley et. al (2016	*Educational Technology, Research and Development,*		Comparing virtual and location-based augmented reality mobile learning: Emotions and learning outcomes	Augmented reality Mobile Learning Emotions Learning
Heiden-Roote et.al (2021).	. *Journal of Marital and Family Therapy*		Relational teletherapy experiences of couple and family therapy trainees: "reading the room," exhaustion, and the comforts of home.	Relational Teletherapy Family Therapy
Laura et. al (2020).	. *J.M.I.R. Mental Health,*		Virtual reality meditation among youth experiencing homelessness: A pilot randomized controlled trial of feasibility	Virtual reality Homeless Youth
Johnson et al. (2020)	*Australian & New Zealand Journal of Family Therapy*		Using social media to Change the Narrative Around Chronic Illness.	Social Media Chronic Illness
Kalliopi et. al (2019	*The International Journal of Information and Learning Technology*		Assessing the emotional impact of virtual reality-based teacher training.	Virtual Reality Teach Training Emotions
Kaluzeviciute, (2020)	*British Journal of Psychotherapy*		Social media and its impact on therapeutic	Social Media Therapeutic Relationships

			relationships	
Liddicoat (2019)	. *General Psychiatry*		Mental health facility codesign: A new research method for integrating the service user voice in design processes using virtual reality.	Virtual Reality Mental Health
Luterman (2020)	*American Journal of Speech-Language Pathology (Online),*		On teaching counseling: Getting beyond informational counseling	Teaching Counseling
McDonald et al. (2020)	*BJPsych Bulletin,*		Online psychotherapy: Trailblazing digital healthcare	Online Psychotherapy Digital Healthcare
Myers et. al. (2021)	. *The Journal of Rural Health,*		Flattening the curve by getting ahead of it: How the V.A. healthcare system is leveraging telehealth to provide continued access to care for rural veterans:	Telehealth Rural Veterans VA
Nagarajan et al. (2019).	*Current Psychology,*		Mental health counselors' perceptions on the use of technology in counselling: Research and reviews.	Mental Health Use of Technology in Counselling
Purvis et al. (2015).	. *PLoS One*		Developing a novel measure of body satisfaction using virtual reality	Virtual Reality Body satisfaction
Rizzo et al. (2018)	*European Journal of Psychotraumatology,*		Clinical virtual-reality tools to advance the prevention, assessment, and treatment of P.T.S.D.	Virtual Reality P.T.S.D.
Sampson et al. (2021).	. *Journal of Marital and Family Therapy*		Integration of teaming therapy and mixed-reality simulation as remote learning modality for couple and family therapy graduate training programs	Mixed Reality simulation Remote Learning Couple and family therapy
Schutte et al. (2017).	*Motivation and Emotion,*		Facilitating empathy through virtual reality.	Empathy Virtual Reality

Sharma et. al (2019).	*Journal of Alcohol and Drug Education,*		Potential applications of virtual reality (V.R.) in alcohol and drug education.	Virtual Reality Alcohol and Drug Education
Shepler et. al (2016).	*The Humanistic Psychologist,*		Perceptions of the therapist in a virtual world: An exploratory analog study.	Therapist Virtual World
Stefanopoulou et al. (2019)	*Psychiatric Quarterly*		Digitally delivered psychological interventions for anxiety disorders: A comprehensive review.	Digital Interventions

THE CODING PROCESS

Identification of common topic areas was identified as emerging from the articles. The categories of topics were compiled then looked at my numerical Representation as indicated in Table 2 below. Topics were grouped according to cohesion to other topics. For example, if a theory was mentioned as part of an article, this was umbrellaed under a theoretical approach. If a particular population was a focus of an article, this was considered a diversity factor. This was an iterative process to ensure the accuracy of the topic areas. There was a clear differentiation in the overarching topic interests by authors with subsequent other topics the following suit. These are summarized in the table below.

Table 2

Categories and Representation of topic

Topic areas(s)	Numerical Representation in the literature review
Mindfulness, wellness, empathy	Three Incidents
Online therapy/Technology/social media, Exposure therapy/Digital Interventions	Five incidents
Mental Health focus	Five incidents
Theoretical approaches: C.B.T., psychoanalysis, Existential concerns, psychotherapy, M.F.T., Narrative, Drug, and Alcohol	Six incidents
Diversity factors: gender, homelessness, Chronic illness, rural veterans, racial bias, autism students	Seven incidents
Virtual Reality	Nine-teen incidents

In looking at the literature topic areas, the three top outcomes were 1) Virtual Reality use, 2) A focus on diversity factors in technological use in counseling/Therapy, and 3) Theoretical approaches as a lens towards integrating technology in counseling and Therapy. While less prevalent topics of mental health, the technology itself and wellness also were represented in the writings. This was based on the journal article analyses.

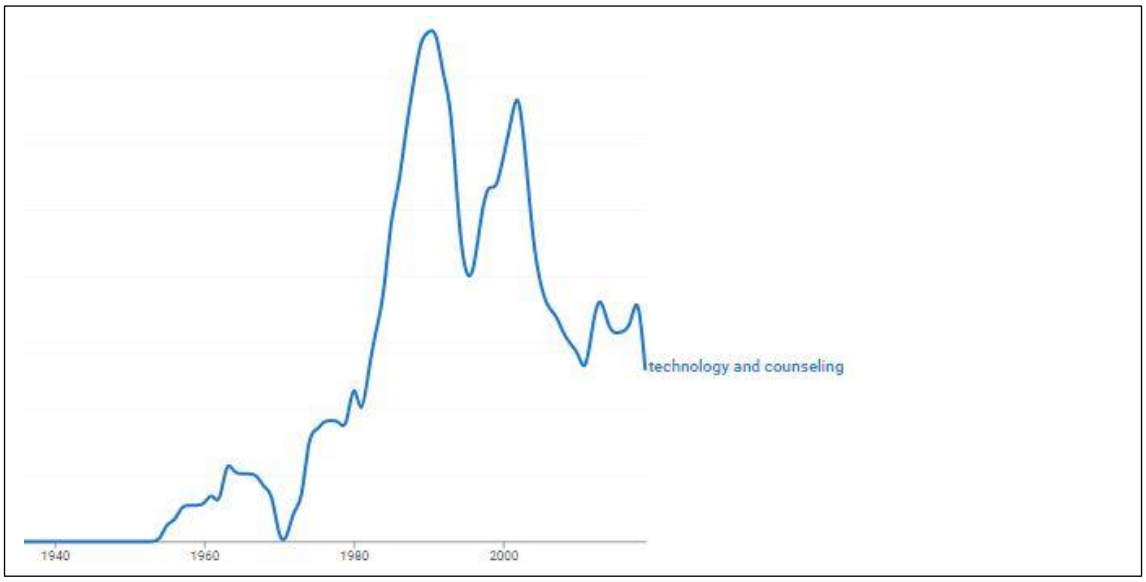
GOOGLE N-GRAM BOOK VIEWER

Google's Ngram Book Viewer was also used to examine the emergence of technology and counseling and technology and Therapy over time. In the initial search, technology and counseling showed an initial height in 1990 with a dramatic dip to 1995. There was a rebound of the topic in 2001, then a steep drop to 2013 and 2018 with trending downwards of present. This is interesting to see this trend downwards to speculate if this literature is housed in other disciplines such as education, psychology, or others? Does the fact that books take longer to emerge relate to this dip? Are there any

other social factors contributing to this decline? Are the rise and falls an artifact of the distance counseling movement? With the emergence of tele-mental health, will further writings and considerations be forthcoming? These are all questions that provoke some thought in examining this data displayed in Figure 1 below.

Figure 1

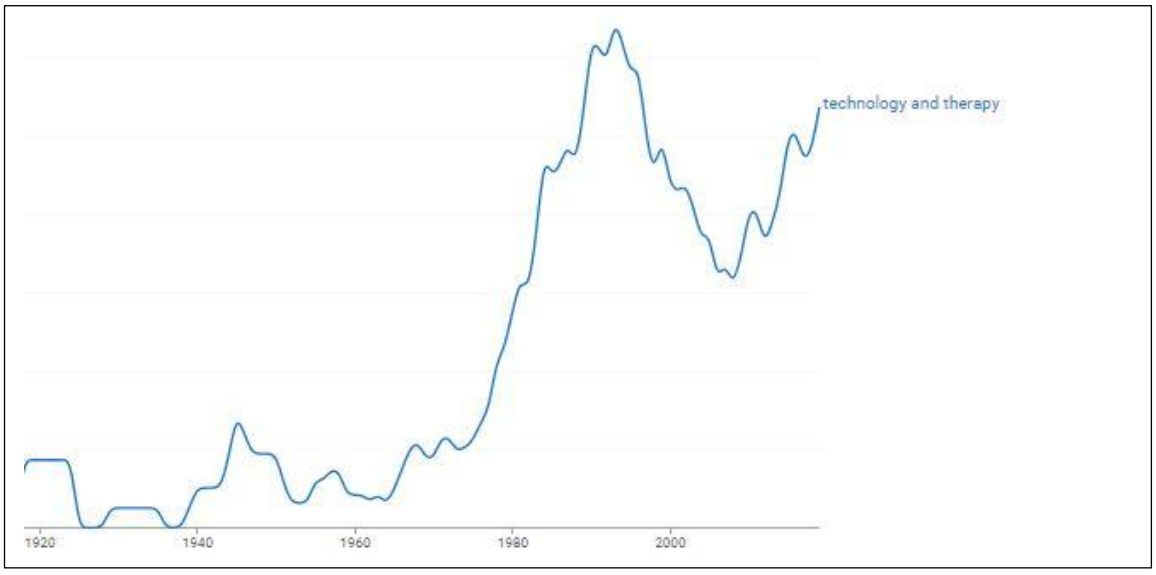
Google N-Gram Book Viewer Construct analysis: Technology and counseling



In the second Google N-Gram Book Viewer, a search of Technology and Therapy had its height of 1993 with a sharp dip to 2006 with rebounding upwards in 2010, 2015. As of 2019, the emerging literature was on an upward trend.

Figure 2

N-Gram Book Viewer: Technology and Therapy



LIMITATIONS AND FUTURE MOVEMENT

This paper is limited in its initial scope of inquiry to be an initial launching point for an expanded discussion on technological use in counseling and Therapy. First, the approach was adaptive and did not fully tap into the Bloch et al. (2015) model for identifying research gaps. Instead it considered the overall organizational philosophy of these strategies for literature reviews. Thus, it is again an adaptive approach, not all its nuances. Secondly, this represents access to one database ProQuest. Other databases might yield additional literature in the disciplines of counseling and Therapy. Third, Google N-Gram Book Viewer merits more aggregate trends and focuses on eras on the timeline of emerging technologies being written in a more expansive approach. Fourth, it should be noted that the full effects of Covid have yet to be seen in terms of influence in the field at the intersection of technology, counseling, and Therapy; thus, it represents a historical time and place that may have had limitations due to the Pandemic.

CONCLUSION

This writing's main focus was to forge a literature review in current evidence-based writings and books on the emergence of technology in counseling and Therapy. Counselor Educators are often challenged by several obligations in writing, teaching, service, along with practice in the field. Keeping up with the salient literature can be challenging. By accessing a couple of review models, this was an initial entry point for furthering discourse on the continued emerging role of technology in the discipline of counseling. It is helpful to contextualize what types of journals these writings are emerging from and narrow to the topics and research being forged. From this analysis, it was noted that Virtual Reality had an overarching influence as a tool in the counseling and therapy space. Finally, books being written on technology and Therapy are advancing, while those within the framing of technology and counseling seem to decline. The authors posed a number of questions above, speculating on some aspects of these trends.

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Influences of Informal Learning on International Students' Curriculum Learning

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Abstract: As of 2020, nearly 300,000 international students study in Japan, and approximately 79% of them study at Japanese higher education institutions such as vocational schools, universities/colleges, and graduate schools. However, many international students in Japan have had some problems: prejudice, loneliness and so on. Although international students have some problems, they would probably be able to change as long as they expose themselves to informal occasions. Therefore, the purpose of this study is to analyze the influences of informal learning on international students' curriculum learning, focusing on the aspect of off-campus learning. This study employs interviews and qualitative analysis as methodologies. The authors conducted the pre-questionnaire to seven international students, and the most of them gave positive answers, which meant informal activities such as a part-time job and off-campus activities could have positive influences on their curriculum learning. In terms of the negative influence on international students' curriculum learning, one of the international students mentioned the difficulty in submitting the assignments within the due date,which meant he would probably lose the credit. Another international student was given an interview and she opened up her negative experience related to her loneliness in school due to a lack of informal activities. Considering the results of the pre-questionnaire and interview, the authors infer that having informal activities such as a part-time job or off-campus activities would bring positive influences on international students' curriculum learning for the most part, which could be different from how it was previously thought. Even though there could be still negative influences on international students' curriculum learning brought by informal learning experience, the existence of some positive influences were substantiated. The authors concluded that it is imperative to establish the informal learning opportunities for international students to optimize so that they will become able to take the first step for learning local languages as international students and to fulfill their learning purpose.

Key words: International students, Informal learning, Curriculum learning

INTRODUCTION

As of 2020, nearly 300,000 international students study in Japan. Approximately 79% of them study at Japanese higher education institutions such as vocational schools, universities/colleges, and graduate schools (MEXT et al., 2020). It is implied that the international students in Japan help improve diverse education at Japanese higher education institutions.

However, Imai and Imai (2019) pointed out that many international students in Japan have had some problems: prejudice, loneliness and so on. It means that Japanese society still struggles to accept international students without any stereotypes. In other words, it can be said that the problems which international students have had perhaps make it more difficult for themselves to study in Japan comfortably.

As mentioned above, the situation of international students in Japan might not be easy; however, the struggles which they have probably would be able to change as long as they expose themselves to informal occasions. It will help Japanese society change its perspectives of international students. Moreover, it is expected to have some impacts on their curriculum learning.

Matsuda (2019) found the key factors to improve international students' language acquisition in the school environment. It is indicated that the importance of setting opportunities for international students to learn a local language with their peers from some practical occasions on campus: presentations, informal gatherings, and interacting with their peers.

Meanwhile, few earlier studies focused on international students' informal learning off-campus even though the number of international students has increased worldwide with the flow of globalization. Therefore, the purpose of this study is to analyze the influences of informal learning on international students' curriculum learning, focusing on the aspect of off-campus learning.

The authors expect this study to clarify both the positive and negative effects brought by informal learning. International students can brush up their language skills through informal learning so that they can study more comfortably at schools; however, it is also estimated that they still have difficulties in studying and having off-campus activities simultaneously.

THE DEFINITION OF INFORMAL LEARNING

Eshach (2007) indicated that formal learning happens in the classroom, while informal learning happens beyond the classroom. In this paper, the authors regard this as the definition of informal learning.

In addition, the authors, for instance, have considered a part-time job, volunteer work, exchange program as the examples of informal learning/activities based on the definition of informal learning behaviors (ILBs) which indicates non-curricular behaviors and activities pursued in service of knowledge and skill acquisition that take place outside formally - designated contexts, suggested by Tannenbaum et al (2010).

RESEARCH DESIGN & METHODS

The authors explore some literature focusing on the extra-curricular programs conducted done by international students. Also, the authors spotlighted the literature focusing on the definition of informal learning behaviors to unblur its ambiguity.

Questionnaire and semi-structured interviews will be employed to clarify the influences of international students' informal learning on their curricula. About 20 international students studying in Japan are expected to be subjected to these methodologies. The authors itemized 13 questions and they are listed in the table1 below. As to the interview, the authors will conduct it if there appears the interesting or focusable answers to the questionnaire.

Table1

lists of questions in the questionnaire

Q1. Do you have a part-time job?	Yes or No
Q2. If yes to Q1, what kind of a part-time job is it?	Free description
Q3. If yes to Q1, how often do you work a week?	Free description(days or hours)
Q4. If yes to Q1, how is your relationship/friendship with your workmates?	Free description
Q5. If no to Q1, please let me know why not.	Free description
Q6. If no to Q1, what do you usually do?	Free description
Q7. Do you have any other activity other than a part-time job?	Yes or No
Q8. If yes to Q7, what kind of activity is it?	Free description
Q9. If no to Q7, what do you usually do?	Free description
Q10. Do a part-time job or activities influence your	Yes or No

curriculum learning in good ways?	
Q11. If yes to Q10, please let me know what it is.	Free description
Q12. Do a part-time job or activities influence your curriculum learning in bad ways?	Yes or No
Q13. If yes to Q12, please let me know what it is.	Free description

Grounded theories will be employed to objectify the results of the questionnaires and interviews. The authors will contemplate the way to make the most use of this theory as one of the methodologies.

RESULTS

The authors conducted the pre-questionnaire to seven international students, and most of them answered that a part-time job or activities they have had have influenced their curriculum learning in positive ways: becoming able to understand Japanese class more effectively, having Japanese friends with whom they can talk, and making it easier to find their job after graduation. Given the results of the pre-questionnaire, the authors infer that the informal learning or activities such as a part-time job or off-campus activities would bring positive influences into international students' curriculum learning.

However, the negative influence was also found out. One of the international students answered that he experienced the negative influence: not being able to submit the assignment within the due date. The authors interviewed him to know more about it, and he mentioned the difficulty studying as an international student and working for a part^time job to earn enough savings simultaneously.

As to the negative influence of not having a part-time job or activities, one student opened up her experience. She described herself as "the lonely international student in a foreign country." She added that she could not have Japanese friends with whom she could mingle with when she wanted to make it happen. The other way around, she could satisfy herself with Japanese friends whom she could meet because of informal activities.

DISCUSSION

The authors found out that having informal activities outside of school could positively influence their curriculum learning in terms of their understanding of Japanese classes and befriending Japanese students or workmates. Judging from the positive results of the pre-questionnaire, it is estimated that it will obviously help international students who have succeeded in optimizing the informal/activities such as a part-time job, volunteer work, exchange program, become better learners in formal learning contexts.

In case of negative influences of informal learning/activities mentioned earlier, the authors conclude that the type of international students' informal learning/activities is certainly related. Those who do not have a part-time job making it difficult for them to communicate with locals or use Japanese frequently are supposed to fail to utilize the opportunities off-campus or to know the worth of them, so that negative influences would be easy to occur.

Considering both positive and negative influences which are likely to occur on international students' curriculum learning, it is suggested that promotion of informal learning/activities for themselves should be emphasized. The authors regard it as a helpful opportunity for international students to look back at what they have done informally or to contemplate what they have done so far, which is expected to lead them to be better language learners.

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An Analysis of Research Trends in Cross-border Higher Education in China using Network Analysis

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Abstract: In recent decades, cross-border higher education has emerged as a distinct field for practice and research in China. However, there are few network analysis of how the research trends and foci of this topic have evolved and shifted over time. This study analyzes Chinese journal articles through both frequency analysis and network analysis in terms of research themes, research purposes, research methods, and research keywords, thus shedding light on overarching developments and trends within the field. In this investigation, the professional visual network analysis tool CiteSpace V is used to generate concept maps based on the keywords of 1,014 articles published in CNKI between 1998 and 2020. Two developmental stages in this research field are revealed: emergence stage (1998-2007) and rapid development stage (2008-2020), the changes in the hotspots of this research field are largely boosted by national policies. It also finds that articles covering overviews and trends constituted the largest proportion of the total literature. However, the microlevel analysis, such as students and teachers as a research focus, is under-researched in the current literature. The methods of document analysis and case study are used widely by the researchers. Finally, future directions for research, including methodological issues and substantive concerns, are addressed.

Key words: Chinese higher education, Cross-border higher education, Research trends, Network analysis

INTRODUCTION

Cross-border tertiary (or higher) education has received growing attention in recent years as more and more students choose to study abroad, enroll in foreign educational programs and institutions in their home country, or simply use the Internet to take courses at colleges or universities in other countries （OECD 2007). It has become a worldwide focus of international concerns, and an important component of tidings of broad internationalization of education. It's also an inevitable result of education reform and development in the context of globalization in that education is one of the sectors impacted by globalization and the growth in cross-border education is seen as one of the direct results of globalization (Knight 2007).

In this circumstance, cross-border higher education has become one of the most important research themes as a body of literature has emerged covering a wide range of themes and addressing various problems both in national and international journals. Accordingly, review studies in the field of education internationalization on a global scale help to discover the hotspots and frontiers of global education internationalization research. Also, understanding the trends of global education can provide reference for domestic scholars to better carry out related research on internationalization of education (Ma & Cai 2016).

The aim of this research was to investigate how the field of "cross-border higher education research" has developed in Chinese academic communities and provide insights and directions on the research trends through analysis of academic journals published in China during the past 23 years, from 1998 to

2020. To achieve this, the study carries out semantic network analysis using research keywords, as well as the frequency analysis with the analysis criteria including publication years, research themes, research purposes and research methods. Through this process, the study tried to systematically and synthetically review the relevant literature and find out major research interests and trace the overall development of the field over a period of 20 years.

THEORETICAL BACKGROUND

Understanding of Cross-border Higher Education (CBHE)

Cross-border higher education is emerging to become a fascinating but very complex phenomenon. The mobility of students, professors, knowledge and even values has been part of higher education for centuries, but it has recently grown at an unprecedented pace. The last two decades have seen a significant growth in the mobility of higher education programs and providers through physical and virtual modes of deliver (OECD 2007).

What is cross-border higher education? Different organizations and scholars have various understandings because of their different focus. Knight (2007) defines that cross-border tertiary education refers to the movement of people, programs, providers, curricula, projects, research and services in tertiary (or higher) education across national jurisdictional borders. As for scholars, Qiang Haiyan (2010) indicates that cross-border higher education refers to the mobility of contents and carriers of any form of higher education people, courses, and education services between countries across national borders, including cooperation between higher education institutions in a country and foreign institutions Opening degree courses, higher education institutions running overseas branches, online distance education, etc. A fuller and more universally recognized description of cross-border education is included in Guidelines for Quality Provision in Cross-border Higher Education jointly developed by UNESCO and the OECD. In that document, cross-border higher education is described as "higher education that takes place in situations where the teacher, student, program, institution/provider or course materials cross national jurisdictional borders. Cross-border education may include higher education by public/private and not-for-profit/ for-profit providers. It encompasses a wide range of modalities in a continuum from face-to-face (taking various forms from students traveling abroad and campuses abroad) to distance learning (using a range of technologies and including e-learning)"（UNESCO/OECD 2005）.

Based on the above understanding and definition, the cross-border higher education discussed in this study refers to any type of movement of people, programs, institutions and etc. in the field of higher education between countries across jurisdictional and geographical boundaries.

RESEARCH DESIGN & METHODS

Data Sources and Selection

This study examines the cross-border research articles published in China from 1998 to 2020. The Chinese literature comes from the China Academic Journals Full-text Database (CJFD) provided by the China National Knowledge Infrastructure (CNKI). In the CJFD, the keywords of kua jing jiao yu (跨境教育; English translation: cross-border education), kua guo jiao yu (跨国教育; English translation: transnational education) as well as gao deng jiao yu guo ji hua (高等教育国际化; English translation: internationalization of higher education) were used for title searching and the results show that around 9,311 journal articles have been published. To guarantee the quality of the journal articles, we limited our analysis to the journal articles from the Chinese Social Sciences Citation Index (CSSCI), during which the first round of searches, a total of 1,715 articles were collected and downloaded by the end of April 2021. The articles were then organized and analyzed with the bibliographic data including research title, author(s), publication year, source, journal name, abstract, key words from CNKI. After all papers were manually screened, non-academic papers such as overlapping or irrelevant documents as well as meeting notices were excluded. Finally, 1,014 Chinese articles were identified.

Analysis Method

This study used two analysis methods of the frequency analysis and network analysis. The frequency analysis is mainly based on the number of papers published in the year, research theme, research purpose and research methods.

This study divides the published articles into a yearly basis, that is, from 1998 to 2020 and then divided into twenty three units; the research methods are divided into documents analysis, trend analysis, case study, comparative study, survey and questionnaires, interview, development research, analytic hierarchy process (AHP) and geographic information system (GIS); the research themes are mainly divided into ten categories: overview and trends, policies, laws, regulations & governance, institutional and management & human resources, quality assurance, student choice, experience, mobility, teaching and learning, joint venture campuses, international branch campuses, cross-cultural issues, educational resources, theories; the research purposes are classified into five categories as historical review, checking the current situation, effectiveness assessment, model development and application research.

Network analysis based on research keywords mainly uses CiteSpace V, the professional analysis software, to analyze high-frequency words and generate visualized knowledge maps. A scientific knowledge map is a series of graphs reflecting the relationship between knowledge development process and structure. Visualization technology is used to present knowledge and their relationship, providing practical and objective reference for discipline research (Hu 2019). In this study, CiteSpace 5.7 R2, a kind of visual network analysis software, was used for data processing and drawing of knowledge map of cross-border higher education research in China from 1998 to 2020.

Firstly, the research determined target articles by investigating the relevance to the research purpose and declassifying unrelated papers. Secondly, research keywords were examined and refined through merging and unifying. 1,014 articles in refworks format were imported into CiteSpace for format conversion. Then, a new analysis project was established: the time interval was set from 1998 to 2020, with 3 years as a time slice; title, abstract, key words were chosen; burst words were selected for the term type; keywords were selected for node type; the contact strength and range were set the default values; and the top 50 high-frequency data of each year were captured. Through this process, this study found the tendency of using research keywords in Chinese study fields regarding cross-border education. Thirdly, a related knowledge map was generated from the semantic network analysis by using CiteSpace.

RESULTS

Through data analysis and software processing, the following results are obtained.

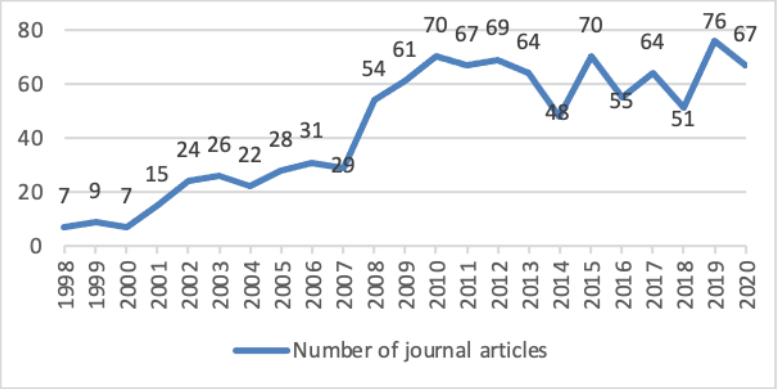
Results of Basic Data Analysis

Publication Year Distribution

Figure 1 shows the number of articles published in Chinese national journals from 1998 to 2020. Chronologically, there has been a steady growth of publications from 2008 onward. 2008 can be seen as a watershed with 54 articles being published, before which the number of publications was relatively small. From 2007 to 2008, various factors contributed to the surge in research such as the Beijing Olympics Games, the severe domestic employment situation in China, the appreciation of the Ren Min Bi (RMB), the increase in the visa rate to the United States (Zhao 2009), and the favorable policies for studying abroad successively introduced by some major studying abroad destination countries, such as Australia's "9.1" policy, the UK "International Graduate Program", Canada's liberalization of restrictions on hiring foreign students, and relaxation of work visa applications. Good policies are a catalyst for the cross-border education market, which greatly stimulates the mobility of cross-border students.

Figure 1

Map of annual publication of CBE research in China from 1998 to 2020



Research Method Distribution

The methods adopted by the researchers are shown in Table 2. The most commonly applied method was document analysis, as 881 articles of 1014 (over 86%) fall into this category. The case study method was also widely adopted by Chinese researchers with 258 articles. Some researchers conducted comparative study (62) while small number of researchers applied the methods of survey (44) and interviews (27) to collect data. In addition, eleven researchers conducted development research (e.g. research on evaluation index system of university's internationalization level or evaluation scale for college students' internationalized competence). Three researchers adopted analytic hierarchy process during their research and only one researcher used geographic information system method to analyze the current spatial distribution of China's cross-border cooperative educational programs.

Table 1

Research Methodologies of Chinese Journal Articles

Method	*Frequency*
Documents analysis	881
Case study	258
Comparative study	62
Survey & questionnaires	44
Interview	27
Development research	11
Analytic hierarchy process (AHP)	3
Geographic information system (GIS)	1

Note. The number is calculated by the frequency of methods that are used. One article may use multiple methods.

Research Theme Distribution

The major themes of Chinese journals articles are categorized and summarized in Table 2. The justification of this categorization of themes is based mainly on previous literatures, particularly from the latest systematic review on transnational, offshore, cross-border, and borderless higher education (Kosmützky & Putty 2016) and a research on cross-border higher education in China (Qin & Alice 2017). Six themes were identified in Kosmützky and Putty's analysis, including: overview and trends; quality assurance and regulation; teaching and learning; institutional and management perspectives; governance and policy, and student choice and student mobility. Thereafter four additional themes were expanded by Qin and Alice's research. In this research, the themes listed previously were adopted as a benchmark for analysis, and new themes were added or adjusted for as driven by the characteristics of the data collected.

Table 2

Research Themes of Chinese Journal Articles

Themes	*Number of articles (%)*
Overview and trends	375 (37.0%)
Policies, laws, regulations & governance	173 (17.1%)

Institutional and management, human resources	240 (23.7%)
Quality assurance	43 (4.2%)
Student choice, experience, mobility, motivations	53 (5.2%)
Teaching and learning	65 (6.4%)
Joint venture campuses, international branch campuses	17 (1.7%)
Cross-cultural issues	16 (1.6%)
Educational resources	9 (0.9%)
Theories	23 (2.3%)
Total	1014 (100%)

Research Purpose Distribution

As shown in Table 3, the research purposes of the journal articles are grouped into five categories. Most studies conducted research for literature review (480) or checking the current situation of cross-border education (480), as 960 articles of 1014 (over 94%) in total fall into the two main categories. Moreover, twenty seven researchers assessed the effectiveness or the quality of cross-border cooperative educational programs while sixteen researchers developed evaluation index systems, and eleven researchers applied related theories and models to cross-border education practice.

Table 3

Research Purposes of Chinese Journal Articles

Purpose	*Frequency*
Literature review	480
Checking the current situation	480
Effectiveness assessment	27
Model development	16
Application research	11

Results of Network Analysis

Keywords can generally summarize the core content of the paper. Therefore, by analyzing the keywords cluster formed by several closely related keywords, we can study the research hotspots in a certain research field. As shown in the figure 2, the cross-border education keywords cluster network graph in CNKI is obtained through the time zone diagram analysis of keywords in the field of cross-border higher education in China. As a result, a total of 5 clusters are formed, of which 4 are obvious clusters. The modularity value of 0.4579 (> 0.3) indicates that the clustering is effective, and the Silhouette value of 0.8136 (> 0.7) indicates that the cluster members have excellent consistency and good gathering ability, which also shows that the research trend in this field is concentrated. The Silhouette value is >0.5, indicating that the clustering result is reasonable and convincing. As can be seen from the figure 3, there are 4 obvious clusters, arranged in descending order of cluster size. The largest cluster is "#0 Internationalization", followed by "#1 International Students", "#2 Internationalization of Education", "#3 Cross-border education", the main keywords in each cluster are shown in the table 4.

Hotspots in CBE Research

Figure 2

CBE keywords cluster network graph

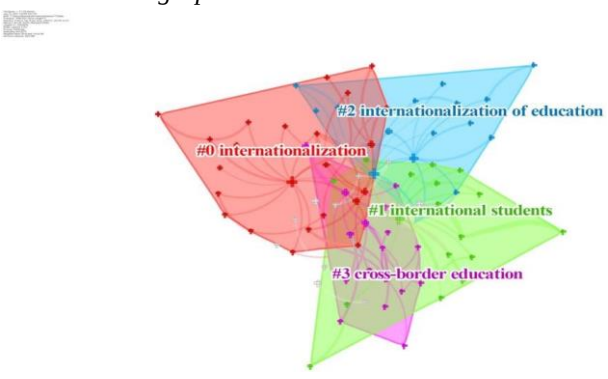


Table 4

Related Keywords of CBE Cluster Network Graph

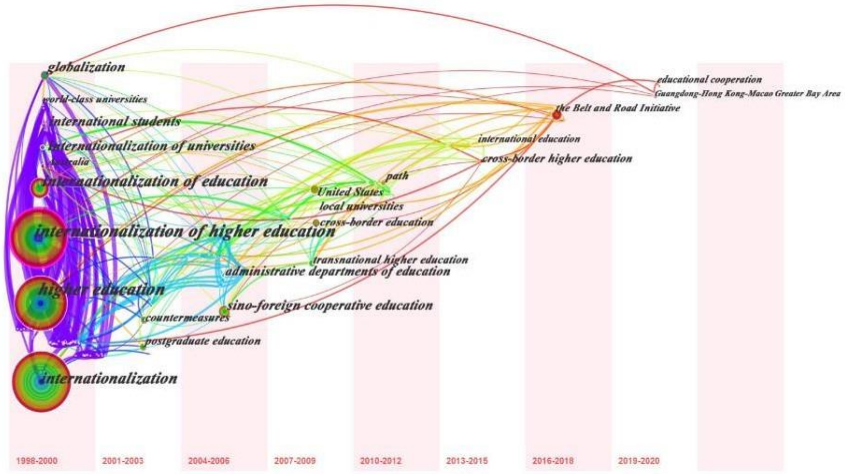
No.	Size	Silhouette Coefficient	Year	Related Keywords
0	24	0.818	2010	internationalization; postgraduate education; factor; index system; internationalization of higher education; path; education, higher vocational education; educational reform
1	20	0.785	2010	international students; internationalized process; facing the Southeast Asia; internationalization of higher education; training mode; influence factor; scale of higher education
2	18	0.915	2012	internationalization of education; United States; student mobility; higher education; teacher training; educational service trade； internationalization level; the Erasmus Programme
3	18	0.696	2008	cross-border education; internationalization; internationalization of postgraduate education; transnational higher education; cooperative education; globalization; Central Asia; sense of community with a shared future for mankind
4	9	0.809	2016	cross-border mobility of students; cross-border higher education; international students in China; the Belt and Road Initiative; countries along the Belt and Road; enrollment scale

General Trend of CBE Research

The timezone view and can comprehensively present the historical development process as well as the evolutionary path of relevant research topics. From 1998 to 2020, the co-occurrence graph of keywords in CBE studies was drawn by CiteSpace, as shown in Fig. 3.

Figure 3

Timezone View of Keywords co-occurrence in CBE research



CONCLISION

Conclusion and Suggestions

Based on analysis of the findings on cross-border higher education in China, the implications are as follows.

First, in terms of the specific themes, general analysis or discussion on overviews, trends and policy issues has dominated the current literature in Chinese journals. For instance, the numbers of overview analysis account for more than 37.0% with 375 articles of the overall articles. In terms of methodologies, the method of document analysis is largely used, a large proportion of Chinese research is literature reviews or checking the current situation from personal perspective, lacking qualified firsthand data and convincing proof.

Second, this study finds that most of China's cross-border education research focuses largely on the national or regional, institutional or project levels, analyzing the macro-level national policy or middle-level institutional management, however the microlevel analysis, such as the students and teachers as a research focus, is seriously under-researched in research articles. Despite the large number of students participate in cross-border joint programs or institutions, little attention is paid to their lives and actual experiences. Among the 1,014 articles, only 53 discussed student choices or motivations of their cross-border mobility. Among them, there are very few empirical studies on student experience. In addition, the international level of teachers is one of the key elements to ensure the quality of cross-border education. Therefore, to understand the problems and needs of teachers involved in cross-border education activities is highly needed.

Finally, it can be concluded through network analysis that the development of cross-border education research in China has gone through two stages from 1998-2020. The changes in the hotspots of this research field are largely boosted by national policies, such as the policy of "the Belt and Road Initiative", "Guangdong-Hong Kong-Macao Greater Bay Area", and etc. Such important opening-up policies of China brought about changes in the requirements of higher education in the new era. Moreover, besides the national policies, it will also be affected by international environment and policies, such as favorable measures for studying abroad and visas issued by various countries. An open attitude will promote the rapid development of cross-border education. Especially since the burst of COVID-19 in 2019, cross-border distance education and online courses have been applied widely and gradually, making it the quality assurance issue of cross-border distance education a promising core research hotspot in both national and international research communities in the future.

Suggestions

To conclude, the existing literature on cross-border Chinese higher education could be viewed as an emerging field in its infancy, particularly in terms of theoretical maturity and methodological sophistication. Much academic effort is required for the growth of the field, particularly in the following aspects.

First, despite the long history of cross-border education activities, there is a lack of theoretical research. Among the 1,014 journal articles analyzed in this study, only 23 concerned the discussion of theories or concept distinction. Relevant theories as well as a scientific theoretical system needs to be explored in future studies in that it can better guide or regulate cross-border educational activities.

Second, more studies at the microlevel, in particular the life experiences and career paths of students who are enrolled in cross-border joint programs and institutions deserve further investigation. For instance, what are the benefits of students participating in cross-border education? Does it simply lie in the language and cultural advantage? Compared with students in other majors, do they have other advantages in future employment? If so, is this impact long-term mentally or physically? Future researches can trace the follow-up or long-term impact of cross-border education activities on student participants, such as the impact on their academic development, career identity and even life planning.

Third, more diversified research methods are suggested so as to collect and analyze qualified first-hand data.Research articles which solely rely on second-hand data are not adequate or convincing enough to address and explain the complexities of topics within cross-border higher education. Quantitative and qualitative research methods based on data collection and analysis are rare. Few researches studied the impact or effect of cross-border education on participating students, and there is a lack of qualitative research that can track the follow-up effects of participants. Future researchers can focus more on the actual experience of cross-border education participants.

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Reflection System based on Teacher's Behavior and Speech for Improving Class of Beginner Teacher

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Abstract: Educational institutions in elementary, junior high and high schools hire new teachers every year. Many new faculty members are hired after graduating from a university or graduate school with no social experience. Focusing on the hired students, it is the period of practical training in the teaching profession that allows them to take practical lessons, and it takes about two weeks to one month depending on their license. During this time, the newly appointed teacher can learn points to be improved and points to be noted in the lesson from the instructor, but the instructor is also in the same space, which is different from the actual on-site space. In addition, it is possible to learn the flow of the lesson through mock lessons, but there is no reaction from the children and students, and it is very different from the actual site. Therefore, it is unknown whether a new teacher can control the lesson well by himself in the practical field.

Key words: Reflection System,Teacher's Behavior Analysis, Teacher's Speech Analysis, Quantitative of Beginner Teacher

INTRODUCTION

Students take a teaching course at a university, and after graduating from a university, they are hired in a elementary, junior high, and high school educational institutions.

New teachers include newly appointed teachers with social experience, new faculty members with practical experience such as part-time lecturers and full-time lecturers, and newly appointed faculty members who are hired after graduating from university or graduate school.

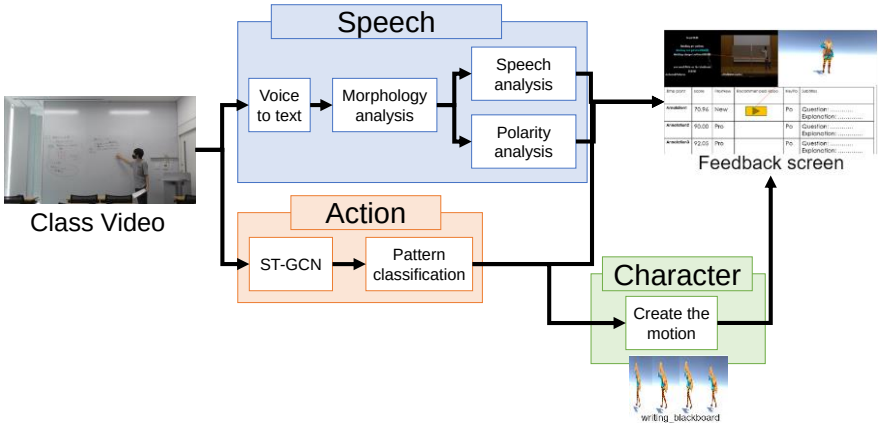
In particular, new teachers after graduating from the university have little teaching experience. Since the period of teaching training is only about 2 weeks to 1 month, their teaching abilities is inadequate resulting in low quality of classes. In order to improve the quality of classes given by newly appointed teachers, it is important to (1) conduct training in an environment close to a classroom, (2)

quantitatively grasp the behavior of teachers （learn newly appointed teachers classroom behavior）, and (3) Show example of teachers with good experience so that new teachers can understand the difference. The purpose of this study is to develop a system to give awareness to beginner teachers by achieving the above goals (2) and (3). To realize these goals we proposed a reflection system for improving beginner teachers' classes based on teacher's behavior and speech, as shown in Figure 1.

Figure 1
Reflection system

In previous research, we focus only on teacher's behaviors, analyze patterns between beginner teachers and expert teachers during trial class using spatial-temporal graph convolutional network (ST-GCN) (Sijie Yan, Yuanjun Xiong, Jingbo Wang, Dahua Lin 2019), (Shunyu Yao, Sho Ooi, Haruo Noma, 2018). We made a reflection system and conducted experiments on college students who want to become teachers (Wang Yuchen, Sho Ooi, Matsumura Kouhei and Haruo Noma (IPSJ Interaction 2020)). The results from the previous research are feedbacks collected from a survey. people asked to add two function add teachers speech Utterance expression and also improve the UI of the reflective system. This research is aimed to improve on the system based on the above feedback. New system design is shown by figure 2. Specifically, firstly, we focus on the fact that the teacher's words affect the student's desire to learn, analyze the teacher's wording and the polarity of the words by morphological analysis. Then, as an improving the UI, this study has improved it so that we can look back on the WEB page and created a feedback video of improvement actions using virtual characters.

Figure 2
System flow



As experiments, firstly, we analyze speech for two students during a trial lecture, verify the accuracy of speech classification, calculate polarity points using "Oseti (Masahiko Higashiyama, Kentaro Inui, Yuji Matsumoto 2008)." Then, we develop a feedback system that included actions and remarks, evaluate this system by students who actually gave the trial lessons.

As a result, in the speech analysis, teachers can extract "questions" and "explanations" to students to 80%, and the analysis engine "Oseti" used for word polarity analysis integrates the polarity points for each word. Because it is a thing, more than half of them got "Positive". On the other hand, based on the evaluation of the feedback system, "It is easy to understand because of the points to be improved are concretely presented. There are positive opinions such as "I can know patterns that I usually do not notice" and "I can understand behaviors that I am not aware of." and by presenting objectively analyzed behaviors and remarks, I can do my own I was able to give awareness about the class.

RESEARCH DESIGN & METHODS

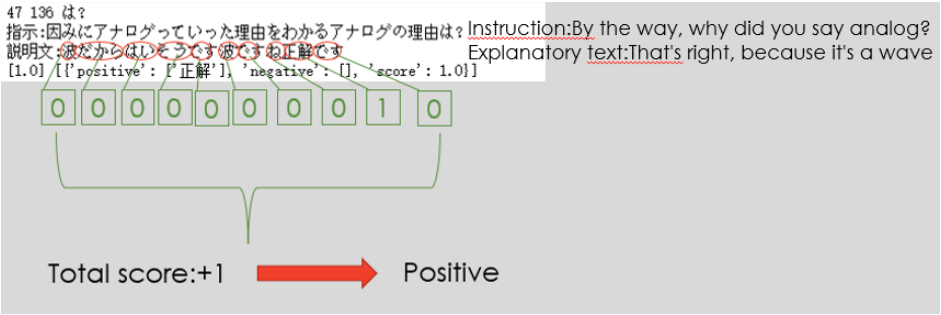
In this research, input data is a video of a trial lecture, there are three processes as shown in Fig.1.

Firstly, this study used Vrew software as the speech recognition for linguistic analysis, which is not very accurate, so it is necessary to manually correct these sentences. After a translation of speech of text, we conduct morphological analysis using MeCab (Taku Kudo, Kaoru Yamamoto, Yuji Matsumoto 2004) and calculate polarity analysis using Oseti. As a classification of speech, this paper defines two types of remarks made by teacher during class, "question" and "explanation." Here, we explain MeCab. MeCab is a high analytical accuracy based on the Conditional Random Field (CRF). Although it has a fast TRIE structure, it's faster than ChaSen or KAKASI Double-Array and uses a dictionary search algorithm / data structure. It is an open source analysis engine including a reentrant library. MeCab is used as a self-made dictionary, and frequently used keywords are added to the dictionary in the teacher's "question" and "explanation" sentences.

According to the dictionary, the audio texts in class are classified into "question", "explanation", and "other" by the teacher, focusing on the question and explanation, and further analyzing the polarity of the words. Oseti is a Japanese evaluation polarity dictionary using a sentiment analysis library for Python. As shown in figure 3, "+1" and "-1" are added to each word, and the total score of this sentence can be calculated by adding all the scores in one sentence. The polarity of one sentence was evaluated using the score.

Figure 3

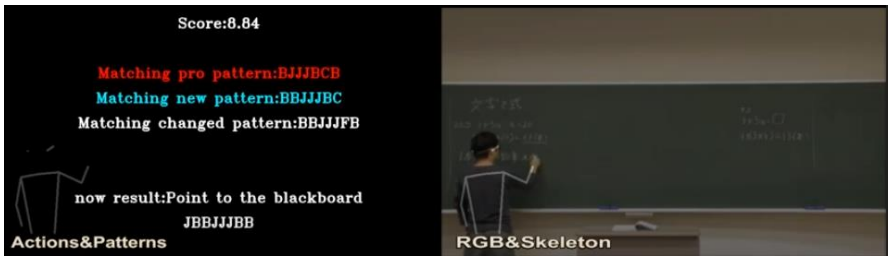
Polarity analysis discrimination



Secondly, in the action recognition, we have studied that by classifying teachers' behaviors into 10 types using ST-GCN and dividing the video by a predetermined number of seconds, one video is divided to several parts, and individual movements are combined into a series of behavior patterns (Sho Ooi, Shunyu Yao, Haruo Noma). And in order to obtain objective feedback from new teachers, we created a behavioral feedback system as shown in figure 4 by comparing the behavioral patterns of new teachers with the behavioral patterns of expert teachers. In this system, as a method of visualization, the behavior of the teacher who gave the lesson was learned in advance using a pattern. Recognize whether the behavior is similar to the skill pattern (pro pattern) or the new pattern. "Matching pro pattern" extracts the behavior of the new teacher similar to that of the expert teacher. The "Matching changed pattern" indicates the movement that the system should change to a new faculty member. To be specific, if it is

classified into a new appointment pattern, give feedback on what kind of behavior should be changed to become a skilled behavior. This system allows teacher to look back objectively, but it presents only behavioral labels as shown in figure 4; therefore, it teachers is difficult to look back at their own trial lecture.

Figure 4
Visualization of trail



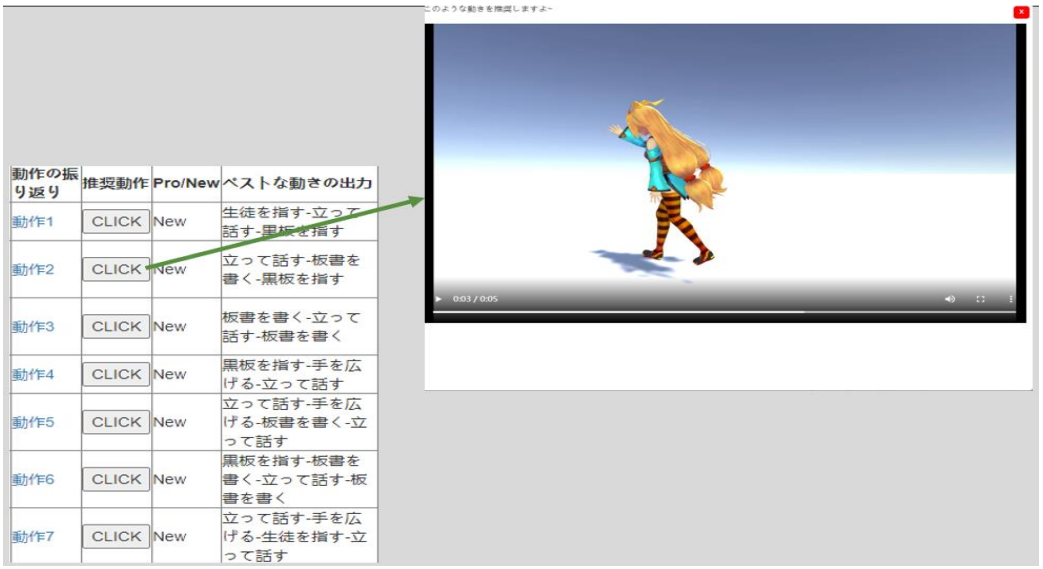
To solving this problem, as thirdly steps, we visual a correct teacher behavior. By trace using Openpose and adding bone information to the character in 3D space again as shown in figure 5. Added movements to the system that are consistent with the faculty. By reproducing the teacher's behavior in such a virtual space, it is possible to look back on the teachers' behavior pattern by the actual movement instead of the label display, so it becomes easier to understand how to improve.

Figure 5
Behavior reproduction in virtual space(Action label:"J"and"B")

The overall view of the system is shown in figure 6. The video at the top is the result of the video analyzed using the conventional system. The frame surrounded by the red line analyzed the teacher's remarks. The frame surrounded by a green line displays each reflection point, and you can watch the video as shown in figure 7 by clicking the button. Also, the right side is "Matching" of the behavior analysis system above. "changed pattern" By the way, the meaning of the output label is explained.

Figure 6
Proposed system

Figure 7
Recommended system features



EXPERIMENTS

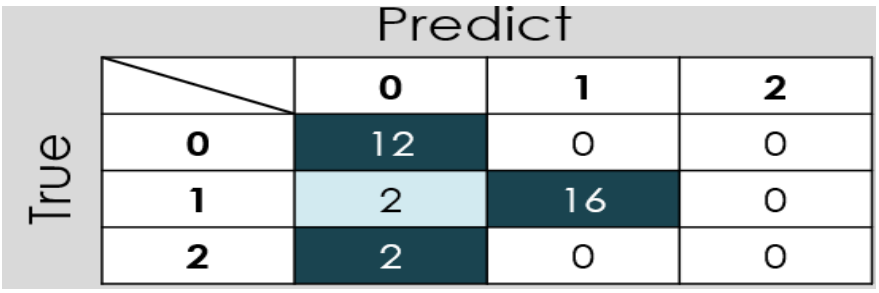
This study conducted two experiments. The first is to verify the accuracy of speech classification. As a method, we extracted voice data from two mock lessons, decomposed it into morphemes using MeCab, and classified the words. At this time, the correction label of the word was labeled in advance by three people including authors. The number of sentences targeted in this experiment is 32 sentences.

The second is to verify the effectiveness of the feedback system. In this study, two students aiming to become teachers cooperated in the experiment. Each student conducted a 15-minute trial class, and then looked back on their trial class using the feedback system proposed by this study. After that, we evaluated the system by conducting interviews and analyzing it.

RESULTS

First, there are results and considerations regarding speech. In this research, the recorded voice of the teacher is recognized and output as a text. Using Mecab, teachers classify speeches into two types of words, "question" and "explanation." As a result, 32 sentences can be detected from spoken text, and moreover, As shown in figure 8, the accuracy of the system measured using the Confusion matrix reached 87.5%. Furthermore, the polarity analysis of "Explanation" was performed with Oseti, and the output result and the output time zone in the video were adjusted. When you click it, the system will take the action you want to recommend.

Figure 8
Confusion matrix of speech classification



In order to examine the usefulness of speech analysis, we asked elementary school teachers to look at it and conducted an oral survey. As a result, we receive 5 pieces of advice including the improvement points as follows:

(1) It is good for the principal to be able to look back quantitatively

(2) It is easy to understand that you can actually see the correction behavior with a 3D model.

(3) I hope the system is easy to use

(4) In addition to words and actions, it is better to look back on the lessons of the principal if you can see the learning guidance plan.

(5) There is a part where the language is a little strange

With these advices, we would like to mention some points that the system can be improved based on the advice of elementary school teachers. We adopted the language analysis of the teacher as an analysis element, but due to teachers are wearing a mask, there are places where it cannot be heard clearly. Misrecognition of speech recognition occurs, and for morphological analysis and word polarity analysis Then, in the previous research on visualization of teacher behavior, we classified the movements of teachers into 10 types and created a visualization system of teacher behavior based on them. From now on, by increasing the types of movements of teachers, the movement patterns between frames can be output without omission. We believed that we can aim for a more accurate system. Also, let us show details such as where the new teacher should stand and the number of times to look back on the blackboard. we would like to be able to add other functions.

Next the results and considerations regarding the feedback system. We are able to classify the responses obtained from the questionnaire into four categories by subject analysis.

a) Comparison with others:" About teacher behavior I thought it would be useful because it would be an opportunity to improve behavior patterns that teachers do not notice by themselves."

b) Improvement points:" Display teacher behavior patterns according to the lesson style (regular lessons, experiments, etc.)"

c) Awareness:" It was good that the machine picked up points that I and others didn't notice."

d) Expectations:" It would be nice to know the pattern of the position where the teacher is standing"

In this research, we gave feedback on the mock lesson training system by focusing on the teacher's remarks and nonverbal behavior. However, this time we focused only on the teacher and did not incorporate elements such as students, so the general support system I couldn't do it. Therefore, it can be expected that the practicality will be further improved by analyzing the movements and remarks of students and incorporating them into this system. In addition, the time of each process is shortened as much as possible. In other words, we aim to create a system which anyone can immediately produce results by automating the entire processing process.

Acknowledgments

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Teachers' Awareness of Issues and Their Transformation regarding to Classroom Management Using One-to-One Computers

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Abstract: The purpose of this study is to investigate 1) what kind of awareness of issues teachers have when they participate in the professional development training, and 2) how teachers' awareness of issues is changed by the professional development in one to one computer environment. The method of the study was to train 26 general elementary school teachers and to conduct a questionnaire survey before and after the training. As a result, many teachers felt a lack of knowledge and skills related to ICT equipment, and teachers who were not good at it felt that they lacked the ability to respond to students' stumbles and prevent students from stumbling. These were expected to be solved by promoting more practical training that assumed actual classes. On the other hand, teachers who are not good at utilizing ICT are faced with a new problem of "can I proceed with classes by myself?", and it was found that they felt uneasy about their lack of ability.

Key words: One-to-One Computers, Teaching Abilities, Teacher Professional Development

INTRODUCTION

With the advent of technology that enables new education, there is a need for change in the education field. In recent education and research, many of them have been presented that question the possibility of utilizing one-to-one computers in a well-developed Internet environment. For example, the usefulness of one-to-one computers, such as the consciousness and learning effect of students in the one-to-one computers environment, the transformation of skills, or the characteristics of learning activities, has been verified in many fields (Hayashi, Umeda 2021, Horiuchi et al. 2021, Hisakawa et al. 2021, Murakami et al. 2021).

On the other hand, research focusing on the ability formation and training methods on the part of teachers who need to construct these new educational environments is extremely rare. It can be said that the series of researches by Yagisawa and Horita is a valuable research that asks the characteristics of teaching behavior, expertise of teachers used there, and teacher decision-making in class scenes in the one-to-one computers environment (Yagisawa, Sato, Horita 2019, Yagisawa, Horita 2021a, Yagisawa, Horita 2021b). However, since it is not pursued how these skills can be obtained, the formation process and training method, it can be said that clarifiing these knowledge will lead to better ability formation of teachers in education.

In this study, one-to-one computers begin to be introduced to schools, and its utilization was required, "What kind of problem consciousness does the teacher work on the training?" and "How to solve the problem by working on the training?", and the features were clarified based on the questionnaire survey.

RESEARCH DESIGN & METHODS

In this study, we proceeded to public A Elementary School. Since June 2021, A Elementary School has been distributing one-to-one computers (Chromebook) to students, and has been using them for about a month. In addition, the school will provide teacher training "Let's make use of Chromebook in class!" (90 minutes) was held on July 21, 2021. A Elementary School has been conducting class research using one-to-one computers since this fiscal year, and teachers are composed of various ages from 20s to 60s, and there are a certain number of teachers who are not good at utilizing ICT equipment. Based on these conditions, we judged that A Elementary School was a general elementary school composed of teachers with various consciousnesses, and selected it as an object.

We extracted items related to teachers' weak consciousness and sense of trouble from previous research on the utilization of information terminals (Yamamoto, Horita 2020, Goto, Oyanagi 2021), examined the overlap and clarity of the contents of each item, and improved the sentences as necessary. As a result, 25 items on the problem of the teacher in the utilization of the one-to-one computers, and the questionnaire item was made (**Table 1**).

We conducted a questionnaire survey of 26 teachers at A Elementary School from July 19 to 21, 2021 using the survey items created by the above procedure.We showed the 25 items we created, asked questions using the six-step Rickert scale of "How well do these apply?" and asked for answers. Furthermore, in order to extract elements that are not included in the 25 items, we set up a free-form question such as "Please tell me if there are any other concerns, problems, requests that do not apply to the above", and asked for an answer. After the teacher training, we conducted a questionnaire survey of 26 faculty members who participated in it.

Teacher training "Use Chromebook in class!" (90 minutes) was aimed at exchange of class practices utilizing Chromebook, which have been carried out so far in each grade group, and to exchange opinions on more effective ways to utilize them and how teachers should be empowered in the future. **Table 2** shows the detailed process of teacher training.

In the questionnaire after the teacher training,"(1) Please answer the satisfaction of this training. (Hereafter, "Satisfaction")," "(2) Did this training eliminate any anxiety or concern about using Chromebook? (Hereafter, “Anxiety relief")," and answers were requested using a six-step Rickert scale. In addition, for those two items, we set a free-form question with the content "Please let us know why you answered it that way", and asked for an answer.

Table 1

Results of questionnaires on teacher assignments

Question items	All (n=26)		Good group (n=8)		Weak group (n=18)		Effect
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
(1) Trouble because the child forgets the terminal	3.9	1.6	3.9	1.5	3.9	1.7	*n.s*
(2) Not connected to Wi-Fi	4.7	1.4	5.0	1.0	4.6	1.5	*n.s*
(3) I can't cope with the trouble of the terminal	4.9	1.3	4.4	1.3	5.1	1.1	*n.s*
(4) The difference in the frequency of ICT utilization for each class is large	3.4	1.5	2.6	1.0	3.7	1.6	*n.s*
(5) I can't operate ICT well	4.3	1.1	3.4	1.1	4.7	0.8	＊＊
(6) I don't know much about the software's features	4.8	1.2	3.9	1.4	5.3	0.7	＊＊
(7) I don't know many practical examples of how students use ICT	4.8	0.9	4.4	1.2	5.0	0.6	*n.s*
(8) I can't teach students well when they use ICT.	4.5	1.1	4.0	1.4	4.8	0.8	*n.s*
(9) I don't know how to improve students’ ability to utilize ICT	4.8	0.9	4.4	1.1	4.9	0.8	*n.s*
(10) I can't deal with students’ failures in ICT utilization	4.7	1.0	4.0	1.0	4.9	0.8	＊
(11) I don't know how to prevent students from failing in the use of ICT	4.8	0.9	4.1	1.2	5.1	0.6	＊
(12) I don't know why students fail in the use of ICT	4.1	1.3	3.5	1.2	4.4	1.2	*n.s*

(13) I can't deal with students' selfish use of ICT	3.9	1.5	3.3	1.7	4.2	1.2	*n.s*
(14) An expected trouble occurs	4.8	1.0	4.5	1.2	4.9	0.8	*n.s*
(15) I don't understand the situation where students use ICT	4.3	1.1	4.0	1.4	4.4	0.8	*n.s*
(16) I can't assemble classes where students use ICT	4.6	1.1	4.3	1.4	4.8	0.9	*n.s*
(17) The difference in ICT utilization ability among students is large	4.5	1.0	4.3	0.7	4.6	1.1	*n.s*
(18) The difference in ICT utilization ability among teachers is large	4.5	1.3	3.9	1.3	4.8	1.2	*n.s*
(19) Strong awareness of ICT	4.2	1.4	2.5	0.7	4.9	0.8	—
(20) Few opportunities for ICT training	3.7	0.9	3.4	0.9	3.9	0.9	*n.s*
(21) The training system in the school is weak	3.2	0.9	2.9	0.8	3.3	0.9	*n.s*
(22) There are few materials for teachers on ICT utilization	3.8	1.2	3.8	1.2	3.8	1.2	*n.s*
(23) I need a better application	3.8	1.3	4.3	1.6	3.7	1.1	*n.s*
(24) I need an ICT technical support staff in the class	4.8	1.4	4.6	1.9	4.9	1.1	*n.s*
(25) I don't know what to learn about the use of ICT	4.5	1.2	4.3	1.5	4.6	1.0	*n.s*

** : $p < .01$, * : $p < .05$

Table 2

The detailed process of teacher training

1. Introduction of recent one-to-one computers
2. Introduction and operation experience of class practice examples by each school group
3. Method of class design using one-to-one computers
4. Reflection & Discussion

RESULTS

First, the average point and standard deviation were determined for 25 items related to the problem point in the utilization of the one-to-one computers(**Table 1**). In order of high scores, items such as "(3) I can't cope with the trouble of the terminal ", "(6) I don't know much about the software's features ", and " (24) I need an ICT technical support staff in the class ". In addition, in order of low scores, items such as "(21) The training system in the school is weak ", "(4) The difference in the frequency of ICT utilization for each class is large ", and "(20) Few opportunities for ICT training ". From these results, it can be seen that many teachers have concerns that they can't deal with problems with terminals because they lack the knowledge and skills to operate information terminals, and that they want to have support staff in the class to solve them. On the other hand, it can be seen that the teacher training system of A Elementary School is in place, and that it can be seen that each class can use one-to-one computers to the same extent. In general, the consciousness of many teachers at A Elementary School is "Let's practice it in class!" It is a state. Since teachers are looking for support to use in class, it can be said that more practical training is required, such as learning how to use and deal with classes, and learning how to design classes using one-to-one computers, rather than simply learning how to operate it.

Next, we tried one-way ANOVA using two groups of "(19) strong awareness of ICT" as variables: the group that answered positively as " Weak (n=18) " and the group that answered negatively as "Good (n=8)" (**Table 1**). As a result, there was a significant difference at the 1% level for the two items of "(5) I can't operate ICT well " and "(6) I don't know much about the software's features " ($F(1,24)=11.23, p=0.003$), ($F(1,24)=10.68, p=0.003$). In addition, there was a significant difference at the 5% level for the two items of "(10) I can't deal with students' failures in ICT utilization " and "(11) I don't know how to prevent students from failing in the use of ICT " ($F(1,24)=6.26, p=0.02$), ($F(1,24)=6.46, p=0.02$). In other words, it can be seen that the group " weak " it is aware of the lack of "knowledge and skills related to information equipment", "the ability to respond to students' stumbles and the ability to prevent students from stumbling" compared to the group "good ". From these results, it is

thought that it is possible to eliminate the teacher's weak consciousness by raising these two skills by teacher training and class practice in the future.

In addition, the average point and standard deviation were determined for two items of " Satisfaction " and " Anxiety relief "(**Table 3**). As a result, both of them scored highly, so we believe that this training has had certain results for teachers.

Also, we tried one-way ANOVA using two groups of "good and weak" as the same method as described earlier as the variable(**Table 3**). As a result, only the item of " Anxiety relief " showed a significant difference at the 5% level ($F(1,24)=4.56, p=0.044$). In other words, it can be seen that the level of anxiety relief is lower in the group " weak " than the group "good ". In order to find out the reason for this, when two free description-style questions in the questionnaire were analyzed, the features shown in **Table 4** and **Table 5** were seen.

From **Table 4**, it is thought that "I was able to know how to use it specifically in class and how to design a class", and "I was able to have a future outlook" lead to satisfaction. This reliably meets the needs of teachers that "more practical training is required" as indicated in 3.1, and in that respect, it can be seen that this training was a good content with a fixed goal. On the other hand, as can be seen from **Table 5**, it can be seen that new anxiety has occurred in the training due to "reconfirming the lack of one's own utilization ability, teaching ability, response ability, etc.". In other words, by going through practical teacher training, teachers who are weak are faced with the new problem of "can I proceed with classes by my own?", and it is thought that they are worried about the lack of ability at that time.

Table 3

Results of questionnaire after the teacher training

Question items	All (n=26)		Good group (n=8)		Weak group (n=18)		Effect
	Mean	S.D.	Mean	S.D.	Mean	S.D.	
Satisfaction	5.28	0.72	5.50	0.76	5.18	0.73	*n.s*
Anxiety relief	4.00	0.63	4.38	0.52	3.82	0.64	*

* : $p < .05$

Table 4

Reasons for satisfaction

"I got some tips on how to use it in my subjects."
"Because I actually touched it and learned how to use it in various ways."
"Because I learned about practical examples of each school year"
"It was nice to be able to consult with the school group to assemble classes concretely."
"I was able to have a prospect of utilizing ICT for next semester."

Table 5

Reasons for anxiety relief

"I realized that I don't have the ability to operate myself."
"I'm worried because there are still a lot of things I don't know."
"I know what I can do with ICT, but I still have concerns about ingang my own instructions and using it for my students."
"I don't really have my own way of dealing with trouble."
"I still can't do enough alone."
"I wish I had a good image of the teaching."

FUTURE WORKS

Based on the above results, we should clarify the support methods necessary for teachers who are not good at utilizing one-to-one computers to operate classes independently. In this study, we were able to get a glimpse of the process of teachers' ability formation in class management using one-to-one computers. In the future, I would like to systematically summarize what challenges we will face at each stage and what kind of training is necessary.

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Covid-19 Pandemic: Emotional Attitudes and Opinions of Digitally Disadvantaged Students towards Emergency Online Learning

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Abstract: This study examines the emotional attitude and opinions of digitally disadvantaged students undergoing emergency online learning in Malaysia. The aim was to identify the positive and negative experiences of the students regarding online learning with unstable internet connection. The data was collected through one-on-one interview with nine digitally disadvantaged students undertaking engineering undergraduate program at a university in Peninsular Malaysia. Scopes of the interview encompassed the situation faced by the students, emotional responses towards the situation faced and their opinions towards online learning. The results from this study can be used for the pedagogical considerations for online learning so that the learning experience of digitally disadvantaged students undertaking the emergency online learning can be improved.

Key words: Digital divide, Emergency online learning, Engineering education

INTRODUCTION

The lockdown situation in many countries to control the spread of Covid-19 pandemic has forced emergency switch of learning mode from face-to-face to online learning for the continuity of education activities. This situation exposed some inequalities and challenges for equal education access, especially in developing countries (Lembani, Gunter, Breines, & Dalu, 2020; Mukherjee, 2021). Students with poor internet access was found to have lower satisfaction towards their learning experience due to the difficulty accessing to online learning (Unger & Meiran, 2020). In Malaysia, students undertaking undergraduate degree program have been on emergency online learning mode since the first lockdown in mid of March 2020. To date, the transition back to full face-to-face (physical) learning method remains uncertain.

A study by Bawa (2020) revealed that learners can be academically successful even under emergency online learning, provided that effective ways are strategized by the educators. The pedagogical approach needs to be complemented with the attitude, motivation, self-efficacy, and use of technology at the student's side (Patricia Aguilera-Hermida, 2020). As such, the purpose of this research is to unveil the emotional attitudes and opinions of digitally disadvantaged students so that educators are able to adopt or design the appropriate pedagogies to improve students' online learning experiences.

RESEARCH DESIGN & METHODS

A qualitative research method was used in this study using one-on-one interview approach. The data collection involved a semi-structured interview with nine second-year students who expressed that they had unstable internet connection in a survey form. The interview was conducted through Cisco WebEx Meetings platform for eight participants and WhatsApp voice message for one participant.

Thematic content analysis was conducted for analysis of the interview transcript to identify patterns or themes within the qualitative data (Maguire & Delahunt, 2017). The themes were searched, reviewed, and defined (Maguire & Delahunt, 2017). Finally, a thematic map was created to illustrate the connections between all the themes. Quantitative descriptive analysis (QDA) was also applied on the conditions faced by the students and their emotional responses to the digital disadvantaged situation (Libarkin & Kurdziel, 2002) for better understanding on the themes.

RESULTS

Figure 1 shows the thematic map for this study. The 'digitally disadvantaged students in emergency online learning' shown in the oval box is the focus of this work. Two major themes, as shown in white square box, were identified from the data collected in this study, i.e. learning barriers faced by the digitally disadvantaged students and their perception towards emergency online learning. Two sub-themes were identified under the learning barriers theme, i.e. the emotional attitudes of the students towards disadvantaged online learning environment and the consequence(s) of being digitally disadvantaged towards the learning process. We are in opinion that the emotional attitudes of the students could indirectly compound the impact towards consequence(s), hence, the sub-theme box for 'emotional attitudes' is also connected towards the sub-theme box for 'consequences'. Meanwhile, a sub-theme of 'students' needs' was identified under their 'perception towards emergency online learning.' This would allow for better understanding of their needs through their direct expression and opinions.

Theme #1: Learning barriers faced by digitally disadvantaged students

Figure 2 shows the distribution of situations faced by the digitally disadvantaged students. Note that there could be multiple situations faced by each participant. Based on data collected from the interview, slow internet was the dominant issue faced by the students under emergency online learning. Some students experienced slow internet during bad weather such as raining or windy condition. The next major issues reported was technical problem such as computer software, hardware, or network issues during online class (Muilenburg & Berge, 2005). Students experienced live class glitches and problem with video or audio.

Figure 1

Thematic map for this study

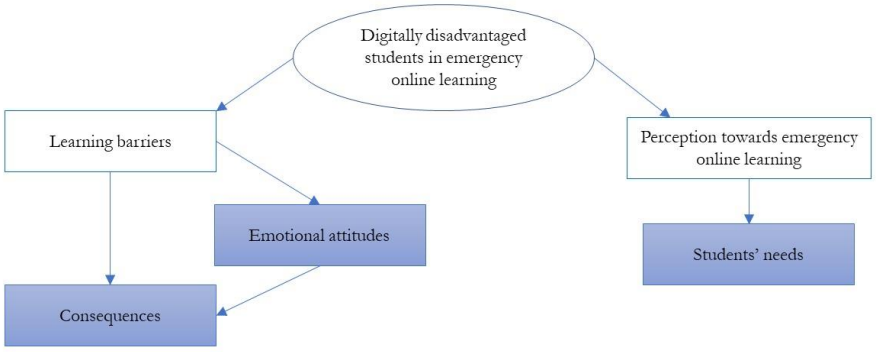
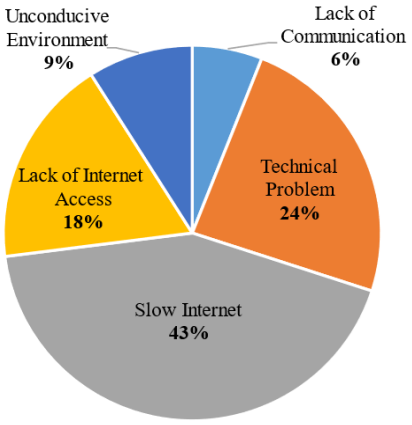


Figure 2
Situations faced by students under emergency online learning



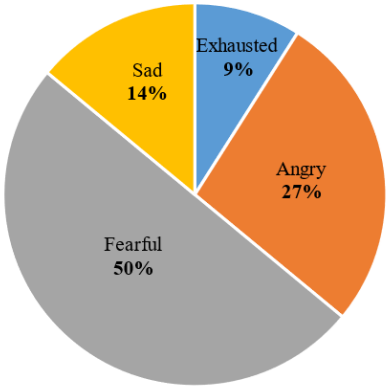
Other learning barrier faced by the students was lack of internet access (Gan & Sun, 2021). They could only rely on mobile hotspot to proceed with online learning. The mobile data allocation was limited and often not sufficient to completely support the monthly data usage required for online learning activities. Worse still, some did not have internet coverage in their respective residence, and they had to go elsewhere to proceed with online learning.

Not having conducive environment for learning (Gan & Sun, 2021) due to noisy environment, family commitment and sharing of same space with siblings and parents while undergoing online learning was also deemed by some of the students as a barrier towards online learning. The same goes for lack of communication (Nogales-Delgado et al., 2020) with peers due to remote location from each other.

Emotional attitudes of students towards disadvantaged online learning environment

Figure 3 shows the emotional responses of the students towards their disadvantaged learning environment. Again, note that there could be multiple emotional attitudes experienced by each respondent. Based on the data collected, the most dominant emotional attitude experienced by the students was fearful. They expressed emotional attitude of worried, anxious, panicked and stressed which were in line with the findings by Raypole (2019). They were afraid of missing out on lecturer's explanation halfway through the lesson, being called by lecturer during disconnection time or not being able to submit their answer script during assessment.

Figure 3
Emotional attitudes when experiencing disadvantaged online learning environment



The next dominant emotional attitude expressed by the students was angry. They felt distressed and frustrated (Raypole, 2019) because they had no control over the situation that they were facing. Sadness was expressed by some students as some of them felt lost (Raypole, 2019) when having to bear through such disadvantaged online learning environment. Emotionally exhausted was also expressed by some of the students. It could be due to the overwhelming feeling of having to manage online learning under disadvantaged learning environment.

Consequence of being digitally disadvantaged towards the learning process

Being digitally disadvantaged, all of the interviewed students unanimously expressed a similar consequence to the learning process, i.e. access-to-knowledge difficulties. They indicated that it was difficult to follow online lessons due to the situations faced. It could also be compounded by the emotional responses experienced by them. This shows the criticality of intervention required to bridge the gap of knowledge faced by the students due to their digitally disadvantaged condition.

Theme #2: Perception towards emergency online learning

The perception of the digitally disadvantaged students towards emergency online learning was more inclined towards the negative side. The students deemed online learning as having more workload. According to some of them, there were more assignments compared to face-to-face learning. Online learning was also perceived as posing communication barrier. This could be due to difficulty to reach out to others due to being physically remote from each other.

Knowledge barrier was also among the perceptions given by the students. Some of them expressed that they found it more difficult to understand the subject content when instructor explained in online environment. This could also be compounded by the communication barrier which they faced while undergoing online learning. One of the respondents expressed the thought of online learning as intimidating.

They acknowledged that in general, students required strong self-discipline to go through online learning. The physical presence of instructor was deemed to make a difference to them. Nevertheless, some students commended the positive side of online learning where they could re-watch recorded lecture for revision. Recorded lecture was rarely provided by their instructors during the previous face-to-face learning method.

Digitally disadvantaged students' needs

Most of the students expressed that they needed flexible learning time, especially to attend online lessons. The need for recorded lecture was evident from the responses provided by majority of the students. This was because students could choose to undergo the learning activities during off-peak internet usage time when their internet connection was at a more stable condition.

On top of that, some expressed their hope for empathy from instructors. Structured learning activities such as assigning homework related to the class content would be helpful for them to persevere through emergency online learning. Assigning homework related to class content could indirectly compel the students to be more focused towards the subject content. However, it should be done cautiously so as to not overburden the students.

DISCUSSION

In the Results section, the digitally disadvantaged students expressed their need for recorded lecture. Recorded lecture could provide the flexibility of time for them to watch at their own pace when the situation permitted. However, merely providing online lecture or recorded lecture for online learning is insufficient. This is because online participation from the leaner is the driving factor towards online learning. Online lecture or recorded lecture lacks a key characteristic of online learner participation, i.e. a complex process of taking part and maintaining relations with others (Hrastinski, 2009).

Hrastinski (2009) advocated that to enhance online learning, we need to enhance online learner participation. Hence, in order to encourage participations from all students, designing an online classroom

where the students could have peers to fall back on and providing support to each other as a community is crucial, although it is easier said than done.

The details of planned learning activities should also be provided and explained to student at the beginning of the semester. This would enable the students to have a better clarity on the structure and flow of the teaching and learning activities. The necessary mental and digital preparation for the activities could be made upfront and the students would not be caught off-guard by sudden instruction of activity which they need to complete.

Last but not the least, instructors are recommended to maintain two-way communications with the students. Providing online avenue for the students to give feedback from time to time would enable better understanding on their situation. If necessary, adjustment can be done to the online instruction for a more inclusive online learning environment towards the disadvantaged students.

CONCLUSION

This study found digitally disadvantaged students faced not only digital access hurdles while undergoing emergency online learning, but also non-digital access related challenges. The disadvantaged situation affected them negatively, in terms of emotions and access-to-knowledge. The digitally disadvantaged students generally had negative perception towards emergency online learning, although some could see the silver lining in it. With the uncertain timeline for transition back to face-to-face learning method, they hoped for flexibility of lesson time through recorded lecture, empathy from instructors and structured learning activities. We hope that the findings from this study could compel instructors or education practitioners to rethink and redesign the online teaching and learning activities to enable a more inclusive emergency online learning environment for digitally disadvantaged students.

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Analysis of Participants' Learning Outcomes Focusing on 21st Century Skills in Online International Projects

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Abstract: This study analyzed participants' learning outcomes focusing on 21st century skills such as collaboration skill, problem-solving skill, and ICT literacy skill through taking part in online international projects- Asian Students Exchange Program (ASEP) and World Youth Meeting (WYM). ASEP and WYM, which have 20 years of history, aim to enhance ICT utilization and English education in the Asian region. In 2020, ASEP and WYM were unavoidable to be changed to take place online due to Covid-19. Therefore, online applications such as Microsoft Teams, Slido were used to adjust to this situation. In this research, the author interviewed participants and conducted questionnaire survey to reveal in what situations and how participants had the chances to take advantage of 21st Century Skills as the proof of learning outcomes. By conducting those researches, several learning outcomes, which nurtured their overall 21st century skills, were demonstrated through the process of preparing the presentation. The research showed that they also used those skills to do research in the regular class after joining ASEP and WYM. That shows that the ICT literacy skills which the participants learned have been applied to their real-life situations as well.

Key words: *:*21st Century Skills, English Presentation, Collaboration, Problem-solving skill, ICT literacy skill

INTRODUCTION

International projects – ASEP and WYM

International projects- Asian Students Exchange Program (ASEP) and World Youth Meeting (WYM) have been hosted for 20 years, aimed to enhance ICT utilization and English education in the Asian region. Kageto, Sato and Kirkpatrick (2012) stated "We (Nihon Fukushi University) have been hosting the International Collaborative Project (ICP) named the World Youth Meeting (WYM) since 1999" (pp. 76) and Hsieh, Kageto and Sato (2020) said that "Asian Student Exchange project (was) with the warm-hearted support of the Board Chair of Kaohsiung Bureau of Education" (pp.214). Both two projects are designed for students from Asian countries by taking "Task-Centered Instruction" (Reigeluth, 2016) and "Experiential Learning" (Kolb, 1984) as the theoretical backgrounds. Kageto (2016) noted that "it is easier for young Asians to communicate in English, rather than learning the languages of multiple other countries". Kageto (2016) also says that "the English used by the Asian younger generations is what we

call 'Asian English'" (pp.3). The participants of ASEP and WYM are mainly from Asian countries such as Japan, Taiwan, Indonesia, Vietnam, Cambodia and so on, so in these international collaborative projects, they utilize Asian English as a lingua franca to communicate.

The Implementation of ASEP and WYM

Hsieh et al. (2020) showed that "In the case of Japan and Taiwan, 97% of people speak mother languages in their daily lives so that they have to find out something sufficient occasion as a new learning environment" (pp. 214). In Asian countries, learners have less opportunities to learn authentic content which relates to the real world. And those contents highly focus on reading and understanding only. Also, the content is usually preparing for the entrance exam for school. In addition to that, an educational method used in Japan and Taiwan is so called "banking style" (Freire, 1968). That is students merely absorb information by depending on their teachers in the classroom and this might reduce student engagements in learning and developing critical thinking skills. Therefore, ASEP and WYM applied "Task-Centered Instruction" (Reigeluth, 2016) theory which is referred to foster intrinsic motivation by centered on authentic and collaborative tasks.

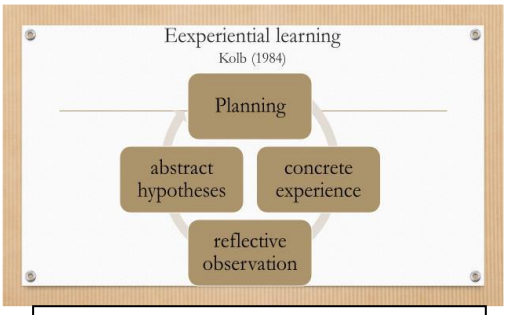


Figure1. Kolb Experiential Learning

In addition, according to Kageto (2016), "The WYM and the ASEP are built on a foundation of experiential learning as advocated by Kolb, which follows the learning cycle of planning, concrete example, reflective observation, and abstract hypothesis. Not only students, but teachers as well, have learned how to enhance the project, reflecting this model. Recent hypotheses (new solutions) involve how to get students to best interact and engage with the audience" (pp.7) (Figure 1). Learners experienced this learning cycle by participating in both projects. In conclusion, the methodology of ASEP and WYM are based on the theory of "Task-Centered Instruction" (Reigeluth, 2016) and "Experiential Learning" (Kolb,1984) and the specific procedures are as follows.

The flow of ASEP and WYM consists of three stages: 1) online preparatory stage, 2) face to face stage, 3) online reflection stage, which are based on Kolb's learning cycle. In the first "preparatory online stage", participants are in different countries, so they use ICT tools such as Zoom to discuss the topic of the presentation and prepare the presentation together. In the second "face to face stage", all participants physically gather in Japan or Taiwan to give an English presentation in front of other participants. After completing their presentation, presenters must answer the questions from their audience, including other participants. In the third "online refection stage", participants share their feedbacks and assessments by using Google Form after going back to their countries.

Moreover, the ICT utilization is applied into each stage such as using Google Document, LINE and so on as assistance tools (Figure 2). Hsieh et al. (2020) indicated that "Experiential learning explicitly differs from learning in school, learners in experiential learning such as authentic setting learning have to respond quickly in the process of collaborative work. They have to decide what they stand for, what they think, what they face next issue" (pp.215).

Country/ Place	Stage	The use of ICT	
Japan Taiwan	Preparatory (Online stage)	**Google, LINE, Zoom, Google Meets, etc. PowerPoint, Video**	abstract hypotheses
			Planning
Taiwan	Collaboration Conflict resolution (Face to Face)	**Google Document, PowerPoint**	concrete experience
Japan Taiwan	Share the feedback Questionnaire form	**Google Form**	reflective observation

Figure 2. The flow of ASEP and WYM

The Impact of Pandemic in 2020

However, in 2020, ASEP and WYM were unavoidable to be changed to take place online due to the surge of pandemic cases. To adjust this situation, the "face to face stage" (the stage 2 mentioned above) of ASEP and WYM was also performed through online applications such as Zoom and Microsoft teams for WYM, Google Meets and Slido for ASEP. Depending on the epidemic prevention policy of each country,

Figure 3. online WYM(left) and online ASEP(right)

participants accessed the online applications from their home or their school. In addition, participants can choose how they give the presentation by giving 1) live presentation + live Q&A, 2) only giving video recorded presentation, or 3) giving video recorded presentation + live Q&A for WYM and giving video recorded presentation + live Q&A for ASEP (Figure 3). Unlike normal ASEP and WYM, the "face to face stage" transformed into online stage so it needs strong internet connections. Participants faced to difficulties such as poor internet conditions, hard to recognize the reaction from audiences through online meeting tools and so on. However, participants also stated that they were satisfied with participating in online projects from home during the lockdown period and so on. Therefore, the analysis targets of this study are especially focusing on the participants who attended online ASEP and WYM.

Participants Learning Outcomes

Kageto (2016) pointed out participants "strived to complete their tasks, while gaining experience through making a joint presentation. As for Asian students, it was difficult to get the opportunity to work with students who had different cultures, this experience in a heterogeneous environment surely helped them develop their collaborative skills" (pp.9). Participants who have different cultural background might easily encounter conflicts with other participants because of having different opinions and perspectives toward the contents of the presentation. However, to complete their presentation, participants have to overcome the difficulties such as disagreement of opinion, language barriers, no sufficient time for the preparation, and lack of ideas. By finding the ways to solve those problems, participants develop their abilities to collaborate with other participants to solve the problem by themselves, and to enhance their ICT literacy skills.

Moreover, Kageto et al. (2012) stated "In the process of completing the presentation, overcoming the conflicts is needed. In this way they come to understand what are 21st century skills that enable them to acquire the mastery to break through the wall of strained circumstances" (pp.78). That is, participants nurture their overall 21st century skills regarding to collaboration skill, problem-solving skill, and ICT literacy skill while engaging the process of ASEP and WYM.

RESEARCH DESIGN & METHODS

To examine learners' learning outcomes related to nurturing 21st century skills (collaboration skill, problem-solving skill, and ICT literacy skill), both quantitative and qualitative research methods were conducted through questionnaire survey and interview to participants after them taking part in online projects.

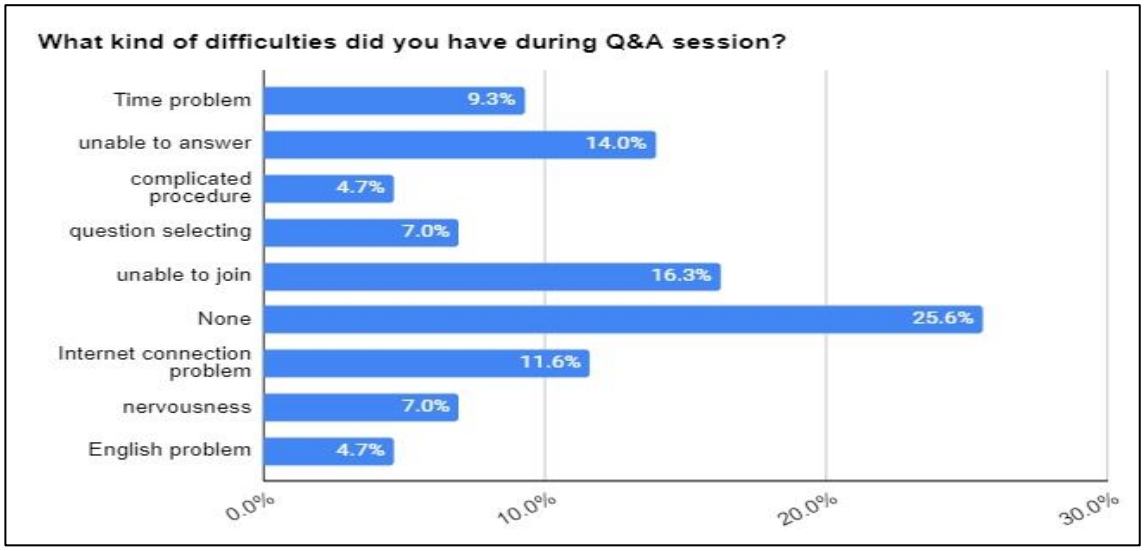
Questionnaire

The questionnaire surveys were given to solicit learners' feedback on the post event through Google Form. The target participants for this questionnaire consisted of 43 learners who joined the online ASEP. The online evaluation questionnaire consisted of 9 fixed-response items including 1-point rating questions (1 Poor – 2 Fair – 3 Good – 4 Excellent), and multiple-response (check all that apply) items. In addition, there were also six open-ended questions to gather qualitative, longer, and more detailed responses. This questionnaire was composed of three sections. The first one focuses on the learners' difficulties during the preparatory stage (Stage 1) and how they solved those difficulties. The second one refers to the difficulties during the presentation stage (Stage 2) and how they fixed up the problems. The

third one focuses on their learning outcomes in the entire WYM and ASEP projects (Stage 3).

Interview

Five participants were the targets in this one-on-one oral interview. This interview was conducted after they participated in the online ASEP. The interview questions were composed of three sections which are the same sections composed for the questionnaire to collect learners' more detailed feedback.



METHODOLOGY& RESULTS

KJ Methods

Kawakita (2017) noted that the effective way to summarize the heterogeneous data in the field science is to use the data integration that leads to the way of thinking (pp.57). The KJ Methods were conducted to conceptualize the interview contents with target participants.

Due to the limitation of paper length, the questionnaire results (Figure 4,5,6) and interview results (Table 1,2,3) will be shown together and the analysis results are centered on "difficulties during the presentation stage" (stage2) (Figure 4 and Table 1) and "how they fixed up the problems" (Figure 5 and Table 2) and "their learning outcomes in the entire online projects" (stage 3) (Figure 6 and Table 3).

The first question asks about what kinds of difficulties participants had during the Q&A session to specifically clarify participants' problem-solving skills regarding 21st century skills. Specifically, during the presentation stage (Stage 2), the process of participants utilizing and learning problem solving skills in the difficulties in Q&A session was analyzed. Questionnaire result (Figure 4) shows particpants mainly encounterd 8 difficulties which are "time problem" (9.3%), "unable to answer" the questions (14%), "complicated procedure" of Q&A session (4.7%), "question selecting" was hard (7%), "unable to join" Q&A session (16.3%), "internet connection problem" (11.6%), "nervousness" (7%), and "English problem" (4.7%). However, some participants did not face any difficulties in this session (as "None", 25.6%).

Figure 4 Questionnaire result of the difficulties from participants during Q&A session (stage 2)

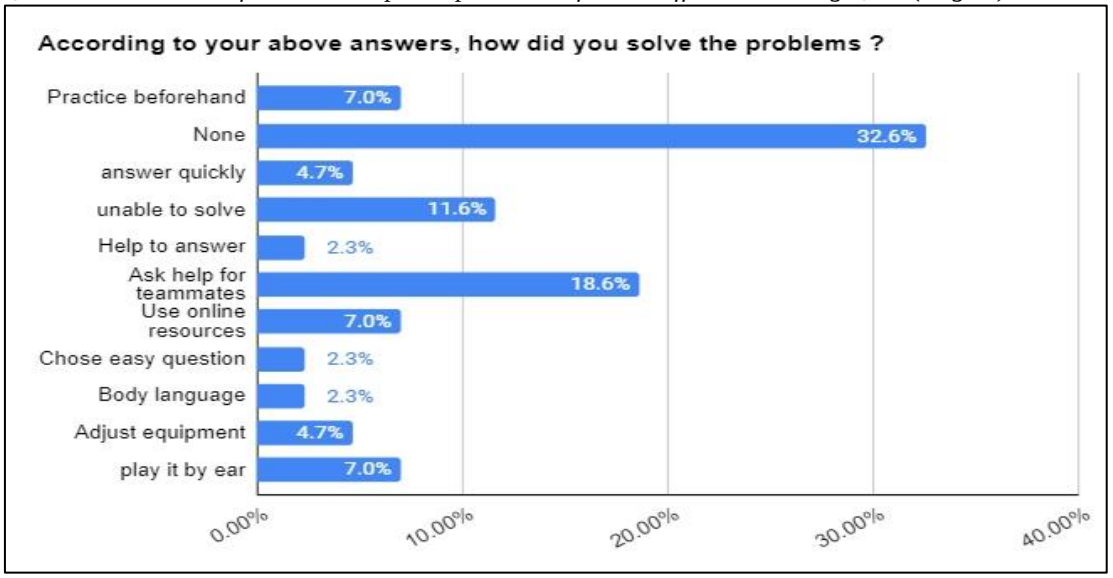
Interview result (Table 1) shows that "1.1 nervousness" and "1.2 lack of Q&A practice" are the factors resulting in "1. participants' anxiety" such as "1.1.1 Time limitation for discussion with teammates", "1.1.2 Unable to answer the questions smoothly", "1.1.3 Poor internet connection", "1.2.1 Questions from the audience were too many to choose" from the list, "1.2.2 Unable to answer the questions immediately", "1.2.3 Lack of preparation for Q&A beforehand" and "1.2.4 Forgot the prepared questions and answers". In addition, "2.1 Poor response from the audience" and "2.2 Unfamiliar with using online applications" are the "2. Difficulties with external factors" including 2.1.1 "Unable to see the face of audiences", "2.1.2 Unable to recognize the response from audiences" and "2.2.1 The steps for proceeding Q&A session were complicated".

Table 1
Interview result of the difficulties from participants during Q&A session through KJ method (stage 2)

Q: What kinds of difficulties did you have during the Q&A session?		
1. Participants' anxiety	1.1 Nervousness	1.1.1 Time limitation for discussion with teammates
		1.1.2 Unable to answer the questions smoothly
		1.1.3 Poor internet connection
	1.2 Lack of practice for Q&A	1.2.1 Questions from the audience were too many to choose
		1.2.2 Unable to answer the questions immediately
		1.2.3Lack of preparation for Q&A beforehand
		1.2.4 Forgot the prepared questions and answers
2. Difficulties with external factors	2.1 Poor response from the audience	2.1.1 Unable to see the face of audiences
		2.1.2 Unable to recognize the response from audiences
	2.2 Unfamiliar with using online applications	2.2.1 The steps for proceeding Q&A session were complicated

The second question asks about the solutions which the participants used for the difficulties they had during the Q&A session. The questionnaire (Figure 5) shows 8 kinds of solutions that participants used were found. Those were "practice beforehand" (7%), "answer (the questions) quickly" (4.7%), "unable to solve (the problems)" (11.6%), "help (teammates) to answer (the questions)" (2.3.%), "ask help for teammates" (18.6%), "use online resources" (7%), "choose easy questions" (2.3%), "body language" (2.3%), "adjust equipment" (4.7%), "play it by ear" (7%). There was also an answer which was participants were not able to join the Q&A session for their personal reason (32.6% as "none").

Figure 5
Questionnaire result of the solution participants used for the difficulties during Q&A (stage 2)



Then, the interview (Table 2) shows that there were 2 main solutions were used. They were "1. Ask

for helps to teammates" and "2. Preparation for the answers beforehand". For "1. Ask for helps to teammates", there were 4 ways, those were "1.1 To call on the phone to teammates to know the guidance of Q&A session", "1.2 To give more opinions when teammates were not able to answer the questions smoothly", "1.3 To ask for helps to teammates who are good at ICT skills due to the disconnection of webpage" and "1.4 To choose the teammate who had experienced ASEP to answer the questions quickly". Then, for "2. Preparation for the answers beforehand", 2 ways were found. Those were "2.1 To predict the questions before the Q&A session", "2.2 To prepare notes with prepared answers to each predictable question".

Table 2

Interview result of the solution participants used for the difficulties during Q&A through KJ method (stage 2)

Q: According to your answers above, how did you solve the problems?	
1. Ask for helps to teammates	1.1 To call on the phone to teammates to know the guidance of Q&A session
	1.2 To give more opinions when teammates were not able to answer the questions smoothly
	1.3 To ask for helps to teammates who are good at ICT skills due to the disconnection of webpage
	1.4 To choose the teammate who had experienced ASEP to answer the questions quickly
2. Preparation for the answers beforehand	2.1 To predict the questions before the Q&A session
	2.2 To prepare notes with prepared answers to each predictable question

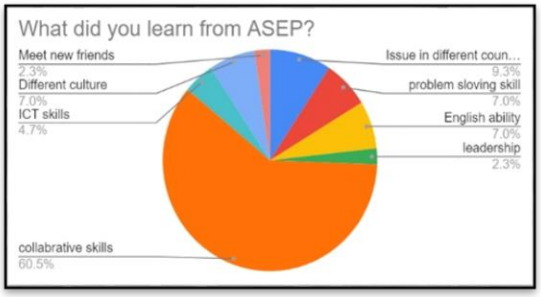
The third question asks about what participant learned from ASEP (stage 3) specifically clarify participants' problem-solving skills, collaborative skills and ICT skills regarding 21st century skills. The questionnaire result (Figure 6) and the interview result (Table 3) show that "ICT utilization" (4.7%) such as using Google Form, Zoom, LINE, Google Document and Power Director was increased. A participant stated that she applied this skill into her regular class to conduct research. Moreover, "English abilities" (7%) that are pronunciation and speaking skills are enhanced during the preparation stage (stage 1). Some participants also said they learned English expression in order to make teammates understand clearly. In addition, their "collaborative skills" (60.5%) were nurtured by communicating with teammates, for instance, participants learned to integrate with different opinions and to do the time management in order to collaborate with teammates effectively and smoothly. Besides, "problem-solving skills" (7%) and "leadership skills" (2.3%) were nourished in the entire project. Also, participants learned "different cultures" (7%), different perspectives toward "issues in different countries" (9.3%) and had the chances to "meet new friends" (2.3%) in ASEP. Figure 6 Questionnaire result of the participants' learning outcomes

Table 3

Interview result of the participants' learning outcomes after joining ASEP (stage 3)

Q: What did you learn from ASEP?	
ICT utilization	1.To get accustomed to use Google Document
	2.To get accustomed to use Google Form
	3. To get accustomed to use Zoom
	4.To improve the skill of editing film by using Power Director
Improvement of English abilities	1.English pronunciation
	2.English oral skill
Collaborative skills	1.To integrate with different ideas in order to collaborate smoothly
	2.To do the time management in order to collaborate effectively

CONCLUSION



In conclusion, through this research, it was revealed that the participants of online WYM and ASEP surely developed 21st century skills including ICT literacy skills, collaborative skills and problem-solving skills. The questionnaire and interview results showed that participants applied ICT skills into their regular class and real-life situations. In addition, participants tried to help their teammates when teammates had problems during the Q&A session referring to problem-solving skills and collaborative skills. However, the results also showed that there were some difficulties that participants were unable to solve. Therefore, in the next research, the possible solutions for those unsolved difficulties also will be the target of analysis.

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Transformative Digital Communities through Participatory Pedagogy

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Abstract: Due to the COVID-19 pandemic an international school in Brazil has been operating a hybrid timetable online since March 2020. To better suit online learning, the school changed from a 5 to a 6-day rotation in January 2021. This, combined with the cancellation of IGCSE exams in Brazil due to COVID-19, created significant independent time for Years 9 and 10 (ages 14-16).
Tasked by the School Principal to transform this challenge into an opportunity, the authors drew on the architecture of Salmon's 5-Stage Model to change a key event in the school's calendar from a face-to-face to an online event. Coaching a cohort of six learners, the authors facilitated a structural change in the event, from one designed on behalf of the students to one designed by them.
The authors sought to determine how far theories of Digital Critical Pedagogy, Pedagogy of Freedom and Social Capital Theory could act as praxis for these six learners, affording them opportunities to learn in ways transcending disciplines, generating interpersonal and community trust and capitals as a transformative digital community over a six-week project cycle.

Key words: Social-Emotional Learning, Online, Hybrid, Participatory Pedagogy, Social Capital, 5-Stage Model, Digital Transformation.

INTRODUCTION

Using a narrative approach, this paper describes how Year 9 and Year 10 learners in an international school designed, organised and implemented an online version of the school's traditional end-of-year Inter-House Festival. The narrative aims to show holistic experience and to mirror the receptive and relational nature of relationships between participants and facilitators (Noddings, 1984). By being active decision and meaning-makers each of the 5-Stages and responding to challenges as a self-determined network, students were able learn in such a way as to reorganise their understanding of themselves(Illeris, 2009 in Illeris et.al, 2009) generating knowledge between them not often seen as part of the curriculum (Noddings, 1984, Freire, 2000).

1.1 Discontinuity as catalyst for Transformation

Due to the COVID-19 pandemic, heightened focus has fallen upon the importance of Social Emotional Learning (SEL) as a key part of education. It has taken a pandemic to "make the value of SEL evident to all." (Garcia & Weiss, 2021.)

As physical isolation has become a norm so has the way in which socialisation has been defined (Srivastava, 2020). Teachers previously familiar with in-school learning have been asked to turn to online instruction to educate the approximate 1.4 billion learners affected by the pandemic at its peak (UNESCO, 2021) calling forth the existential question: what does it mean to be a teacher? If the pandemic is viewed as catalyst for the rupture of how teaching is conceptualised (Foucault, 1972; Lee, 2020) it could be argued that this transformation represents one of the 'most radical' ruptures to the discourse of what teaching is (Foucault, 1972; Lee, 2020).

Educators worldwide have broached the dichotomy of their own isolation and needs alongside rapidly digitising their practices. Pettersson's (2020) adaptation of Engeström's Cultural, Historical Activity Theory (CHAT) (Engestrom,1987 in Illeris et.al 2009) alludes to how recognition of rupture can lead to new architectures of practice:

Figure 1

Pettersson's Learning Levels in a Digitalized School Context (Inspired by Engeström 1987)

Learning Levels	Examples of Change
Learning I	*Digitalization as very small-scale implementations of new digital tools supporting previous practices*
Learning IIa	*Digitalization as implementation of new digital tools supporting previous learning practices without changes in learning practices*
Learning IIb	*Digitalization as implementation of new digital tools with development of new teaching and learning practices*
Learning III	*Digitalization that includes new ways of teaching, working, and organizing the school organization, including its form and structures*

Paraphrasing Foucault, we define Digital Transformation as a means to construct new meaning using digital tools in the "unfinished totality of the present" (Foucault, 1972). Since present and future are unfinishable, digital transformation initiatives become wasteful (Tabrizi et. al, 2019). If digital transformation requires new discursive practice (Foucault, 1972), new forms and structures (Engeström, 1987; Pettersson, 2020), what should those new forms and discourses be?

1.2 Human Discourses of Digital Participatory Pedagogy

Digital transformation refers to change in people, not technology (Frenziewicz & Chamorro-Premuzic, 2020), thus Mezirow's definition of Transformative Learning as "the process by which we transform problematic frames of reference [...] to make them more inclusive, discriminating, open, reflective and emotionally able to change." (Mezirow, 2006 in Illeris et. al, 2009) offers a useful staging post here, given its hermeneutic nature. As such, digital transformation can be understood as the ways in which people go about making new knowledge and uses of technology as a result of critical reflection about the assumptions that drive its use.

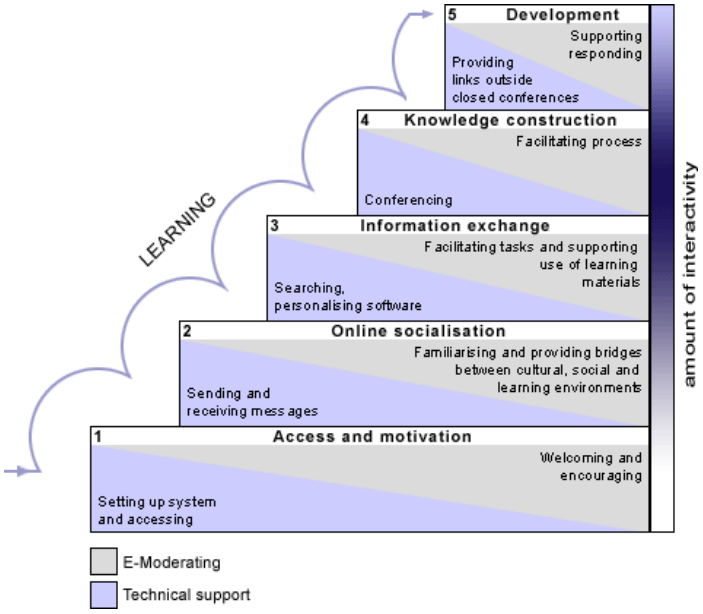
If digital transformation calls teachers to question how they exist as teachers (Biesta, 2020), then to be successful in a new, online environment, teachers must go through the process of reinvention themselves with a genuine focus on care for the people teachers work with (Hooks, 1994). Transformative digital learning emerges as a consequence of the community working ecologically to build one another (Hooks, 1994), with the teacher critically conscious of the 'I'-ness of each student and helping the student transform themselves (Biesta, 2020).

Salmon's 5-Stage Model was chosen as a framing architecture for its transformative, humanistic potential. Its dual physical and psychological dimensions (Salmon, 2013) helped reduce interpersonal isolation among participants, as the authors had experienced as University students in online, distance learning programmes, where students make meaning collaboratively in a framework of 'networked heutagogy' (Hase & Kenyon, 2000, 2016; Curcher, 2019). The products of such networks could be seen as cultural and social capital (Bourdieu, 1986). The inter-house project aimed to generate increased social capital between participants, in particular those of trust and communal vitality (Bourdieu, 1986; Siisiäinen, 2000).

The 5-Stage Model's absence of predetermined outcomes made it a suitable means to funnel Freirian praxis (1970), Noddings' (1984) and Hooks' (1994) notions of joy and as a mechanism for students to change themselves and their constructions of meaning (Biesta, 2020), (Foucault, 1972),

(Mezirow, 2006; in Illeris et. al 2009). Since the students are more important than the content (Noddings, 1984), the role of the teacher is one of facilitator, coach, mediator, (Hase & Kenyon, 2000, 2016; Curcher, 2019,) **Figure 2**

Salmon's 5-Stage Model (2013).



RESEARCH DESIGN & METHODS

2 Access and Motivation

The authors had until Monday April 26th to prepare materials to introduce the proposal to the Year 9 and 10 students, as well as to lay foundations of a safe space for minors to practice networked heutagogy. (Hase & Kenyon, 2000, 2016; Curcher, 2019) Given that all students in the school already used Google Suite Learning Management System (LMS) this accelerated Salmon's (2013) question of access. Additionally, Miro and Menti, platforms that many learners had used previously in academic classroom contexts and that connect via their school Google accounts were used to promote "a sense of belonging inonline learning" (Thomas, Herbert & Teras, 2014).

The authors introduced the proposed project to the Year 9 and Year 10 learners on 26th April 2021, via a set of Google Slides shared in newly created Google Classroom, alongside a synchronous Google Meet video call for all Year 9 & 10 students. The authors marketed this event to Year 9 and 10 learners and their parents in advance via letter, welcoming all students to take part should they wish, whilst signposting the ways in which the school was seizing opportunities with time to parents.

During this first session, the authors clearly signposted language reflecting the tenets outlined by Morris & Stommel (2014), to show students that they were trusted by the supporting adults (Hooks, 1994; Hasinoff, 2018) and that the adults were not experts, instead learning themselves as subjects by working with the students (Hooks, 1994; Freire, 2000, p.38) so that students involved could reach their own "*epiphanies*" (Morris & Stommel, 2014) with "*forms of knowledge that are seldom part of the curriculum"* (Freire, 2000, p.38)

3 Socialisation

The second synchronous session (May 4th) focused on Stage 2: Online Socialisation (Salmon, 2013). In using the Miro, learners were able to interact with each other collaboratively on a massive scale, building meaning and ideating with one another. Adults involved coached, using the 'sticky-note' function in Miro to ask follow-on and subsidiary questions in order to encourage deeper thinking from the learners, leadingstudents to their own reflection-action praxis (Freire, 1970).

4 Information Exchange

As a result of the two sessions spent in Stage 3: Information Exchange (Salmon, 2013) a group of six learners shared a desire to take on a clearer leadership role with facilitators and to turn the ideas shared in the Miro into a tangible end product, indicating that the model was helping to call forth the 'I'-ness in some students (Biesta, 2020). This group also asked for a Google Hangout to be set up for asynchronous messaging between students and facilitators to more easily share ideas and to reach out to staff when video conversations were needed, indicating that these six people were furthering their praxis (Freire, 1970).

As Salmon's Information Exchange Stage culminated the learners began to transform their conceptualisation of the project. As the final inter-house product became more feasible and real, so too did the realisation that the focus of the work was shifting from asking questions of 'why' or 'what', but instead, 'how' to bring the information together. This existential shift, from 'what do I want to do?' and 'why do I want to do it?' to 'how might I do what I want to?' shows that calling the 'I'-ness of oneself into the world is interruptive (Biesta, 2020).

5 Knowledge Construction

As learners realised their work had a greater focus on 'how', they sought to organise the different aspects of their learning into a Shared Google Drive, so that they could interact with one another collaboratively. This can be seen as reproduction of capitals within the group, since all the group members felt that their work was contributing to benefit the group itself (Bourdieu, 1986).

The focus of the sessions with students on May 20th and May 28th was making sure that the leading students had time and space to work on Stage 4: Knowledge Construction. The authors opened Google Meets for synchronous conferencing during these slots; however, they were mostly unused, with students assured in their own knowledge construction and time use, occasionally dropping-in for support via either Hangout or Google Meet call. Choosing when to seek advice and feedback from adults indicated a change to the group's cumulative transformations (Mezirow, 2006 in Illeris et. al 2009) and also of the mutual trust between students and facilitators (Hooks, 1994).

The learners also showed creative responses to bringing the community together in an online environment. In transforming the 3-team inter-house festival into an online domain, students had to critically reflect on the ethical considerations of game usage; not just which ones to use for safety reasons, but also how to communicate the ideas to students and adults, some of whom are digital novices. They solved this imaginatively in their guiding documents for staff, showing that creativity was a strong part of them as thinkers at this point (Noddings, 1984).

In communicating with other students, the Leadership Team determined the size of their participating audience, which events were being taken part in by their peers and how they could finalise the schedule of their final project. Including the Year 11 Sports Leaders, the group had captured the interest of 114/209 (55%) Secondary School students in the month since beginning the project. This was always framed as optional, in keeping with the participatory nature of the project.

RESULTS

6 Development

On Tuesday 15th and Wednesday 16th June 2021, the six learners who had taken on the leadership role for the Inter-House Festival delivered their final product as a series of online games, hosted over the school's Zoom account. They were able to achieve this due to the collective uptake of the events they had provided for the school community, along with the clear instructions they provided for staff.

In the post-event reflection, the six student project leaders shared with the authors that they considered the event successful, due to the positive community feedback that they received, alongside their collective feelings of pride and joy (Noddings, 1984; Hooks 1994), at both being and creating on behalf of their school community. This could be considered to be phenomenological evidence that lasting social and cultural capitals and trust are the essence of the phenomena (Bourdieu, 1986; Siisiäinen, 2000; Husserl 2013).

This analysis shows that Salmon's 5-Stage Model (2013) is an appropriate pedagogical architectural frame for digital projects that eschew predetermined outcomes. In looking backwards at their collective and individual progress, these six learners expressed surprise at the progress they made over the duration of the project cycle. In addition, they were forthcoming in sharing that they came to

conceptualise the final product as they were developing their knowledge and understanding, indicating that they were successful in marrying their own reflection-action praxis (Freire, 1970) with the 5-Stage Model.

The final project was also successful in showing that the 5-Stage Model is one conducive to fostering learning that matches the 6 theses of Digital Critical Pedagogy (Morris & Stommel, 2014). To achieve this, though, required a significant time commitment from both the six student leaders who took on the project themselves, as well as from the authors. This was time afforded as a consequence of the school's online operating mode which would not have otherwise been available. The small working group, learner-led decision making and self-determined use of digital tools show a meaningful digitalization of the Inter-House Festival took place (Engestrom, 1987 in Illeris et.al 2009; Pettersson, 2020).

In line with hermeneutic, interpretivist epistemology the authors reinforce the lack of replicability of the study. Whilst this project was a successful means to produce cultural and social capital, as well as a means to call out the I-ness of the six lead learners (Biesta, 2020), it did so only for these six. The remaining students of Years 9 and 10 were not engaged with the 5-Stages of knowledge construction, instead with the final product of the event. This mode of operating, using digitalization as a means to transform a previously in-person cultural and social capital event gave rise to new structures of learning, in new forms(Engestrom, 1987; Pettersson, 2020).

CONCLUSION

This paper has explored the ways to construct new meaning using digital tools in an international school context. With the Covid-19 pandemic representing a significant rupture in how teaching and learning are conceptualised and organised ((Foucault, 1972; Lee, 2020) we have shown that Salmon's 5-Stage Model (2013) is an effective architecture for creating meaningful learning, on the proviso that learning is developed in a participatory manner with students and that outcomes are not predetermined. We recognise that this is a departure from traditional pedagogies, which we consider a success, as a means not to "return to the unities that we pretended to question at the outset" of the pandemic (Foucault, 1972).

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Design and Implementation of A Digital Storytelling Based Design Thinking Program in A Language Learning Community

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Abstract: This study analyzes the effect of a digital storytelling-based design thinking program in a language learning community. Participants from different countries joined a five-session program to explore local problems and prototyped solutions. Data were collected through reflection journals, interviews, and observation notes. As a result, this experience became an opportunity for authentic learning in language learning to address individual and collective interests. Digital storytelling is a tool for social engagement, teamwork, and increasing motivation to communicate creatively in different formats. However, some limitations were observed, such as lack of time, attendance, and technological constraints. The partnership between learners and the local community is vital for developing sustainable communities and active citizenship through new forms of participation. Incorporating people with different linguistic and cultural differences benefits working collaboratively, service-learning, persisting, and overcome social barriers.

Keywords: Authentic Learning, Community-based Learning, Design Thinking, Digital storytelling, Service-Learning

INTRODUCTION

There is a growing community engagement in response to the COVID-19 pandemic worldwide. Anyone can contribute within local communities to inform and take actions to solve everyday problems and inspire others to a more inclusive and sustainable world (Smith & Sobel, 2013; Aspioti et al., 2019). Social media is changing the way we collaborate and communicate. Also, these technologies enable citizens to express themselves, join communities, and work together for a particular purpose. Participatory culture has emerged in which people embrace the value of diversity and democracy through off and online interactions (Jenkins, Ito & Boyd, 2016). Digital storytelling is part of a wide range of forms of participation. Digital storytelling is a constructive practice of telling stories produced with different digital tools. People can capture what happens in real life, transform it aesthetically and creatively, and communicate through social networks. This practice allows people to be heard, express themselves, share their experiences and opinions, and shape identities (Kim & Li, 2021).

This study analyzes the experience of a five-session program between Japanese and foreigners that joined a language learning community to explore local problems and prototype solutions through digital storytelling and the design thinking process. Data were collected through reflection journals, interviews, and observation notes. With this research, we intend to generate insights for further research on community-based learning.

THEORETICAL BACKGROUND

Digital storytelling and design thinking

Jenkins et al. (2009) describe digital storytelling as a twenty-first-century learning tool to empower people in their own lives and social contexts. Digital storytelling is a constructive practice of sharing experiences, values, and ideas through digital media (Amancio, 2017). Stories take various forms, such as digital and visual storytelling, scenario generation, animations, opening possibilities for content analysis, discourses (use of language), and mental structures. Stories are structured principally in four narrative elements: actions, happenings, characters, and settings (Barthes, 1977).

Robin (2008) argues that digital storytelling cultivates higher-order thinking, such as problem-solving and critical thinking. On the other hand, Hung, Hwang, and Huang (2012) point out that this tool enhances motivation and learning achievement during projects. It generates questions that are solved through innovative thoughts and ideas. In addition, it becomes an effective tool for feedback, which is the basis of an iterative process.

Design thinking is a process that integrates people's needs, generates inquiry, and enables the use of technologies and creative tools to address problem-solving. This approach goes through divergent thinking based on personal interests and advances in convergent thinking to make concrete decisions and actions (IDEO, 2014). In design thinking, storytelling helps explain the interconnections between people in situations or problems and settings through listening and empathy (Collias, 2014). On the other hand, prototyping is an iterative practice to embody ideas and insights through building physical objects (Collias, 2014).

Digital media affords the creation of stories individually and collectively. For instance, Instagram - a popular social media mainly among young people (Gruzd et al., 2018)- allows users to create and share stories informally using semiotic resources, such as hashtags, images, texts, videos, emoji, doodles, and filters (Amancio, 2017). It also permits the public to participate in ongoing projects by commenting and feedback and to outline the entire process transparently to a broader audience (Nik-Bakht & El-Diraby, 2015).

Community-based learning

Community-based learning is an approach in education in which local communities become learning "places" that engage with different people, resources and strengthen both its members and the communities (Smith & Sobel, 2013). Tompkins (2005) argued that community-based learning connects learners in authentic experiences within the public domain, resulting in meaningful experiences that address personal and community needs, together with opportunities for reflection.

According to UNESCO (UIL, 2017), community-based learning is vital for developing sustainable communities and active citizenship. It empowers citizens to make informed decisions that can lead to transformative actions through taking ownership and responding to local and global concerns. In addition, incorporating diverse people with linguistic, cultural, or gender differences allows them to work collaboratively to overcome barriers (Codding et al., 2020).

Community-based learning can promote interest and motivation in participating in language learning (O'Connor, 2012). A language learning community is a group of people who meet regularly to communicate in a chosen language. The benefits of joining a language community are building shared interests when finding others with the same passion, employment opportunities, and language development (Brown, 2020).

Clifford and Deborah (2019) refer a community-based language learning as the interactions that take place between learners and heritage/native speakers of the target language and "a window onto their own culture" (p.9). Learners engage in activities to communicate and interact face-to-face. It includes service-learning and other solidarity-building practices that transform worldviews, highlight social issues, co-create knowledge, and foster authentic relationships based on connections. However, language learning communities have some challenges, such as time-consuming and efforts may not always be instantly recognized and rewarded, establishing a partnership with community members and matching each interest (Lee-Smith, 2018).

RESEARCH DESIGN & METHODS

Participants and context

The so-called Japanese Circle "Dushigua" (that means "friendship" in Okinawan language) is a local community created in 2010 that meets Japanese and foreigners residing in Okinawa, Japan. Fifteen members from various countries and cross-generational joined the program "Storytelling for Social Change." The design challenge consisted of prototyping solutions to local problems. This project was linked to the Sustainable Development Goals related to inclusion (SDG10.2) and participatory structures through good practices to engage the local citizen's voice to inform decision-making (SDG11.3) (McCandlish & McPherson, 2020).

Data collection and instruments

This study was carried out with a qualitative research method. After every lesson, participants reflected on their experiences by writing a reflective journal. As well, at the end of the project, three volunteers were interviewed. In addition, the research team made annotations based on participants' engagement during the workshop and final products (digital stories and prototypes). Three researchers collaboratively designed and evaluated the research instruments. The course of the project, set of instructions, content, and result analysis were discussed after each session to ensure reliability.

Research procedure

The program consisted of discovering, interpreting, ideating, experimenting, and evolving (see Table 1). Stories were developed in two parts. In the first part, participants figured out stories for informing through observations and explorations. Furthermore, in the second part, stories helped inspire the design team through concrete situations and target users. Narrations consisted of telling a purpose, a specific setting, a complicated action or events, evaluation, resolution, and a conclusion (Johnstone, 2008). Finally, ideas were embodied into concrete solutions through hands-on experiences.

Table 1.
Program design

Stages	Sessions	Activities
Discovering	Session 1	-Ice-breaking activity. -Storytelling to inform.
Interpreting	Session 2	-Discussing and exploring issues. -Role-playing activity.
Ideating	Session 3	-Defining an idea and planning a project. -Storytelling to inspire.
Experimenting	Session 4	-Building solutions through hands-on experiences. -Role-playing activity.
Evolving	Session 5	-Team presentations. -Reflection activity.

RESULTS

In the first week, participants built up teams and participated in a warming-up activity called the marshmallow challenge to explore ways to solve creative problems and collaborate. In the second activity, each team member introduced a personal belonging that gives them a good memory or feeling, such as a key holder, clothing, picture, or charms. Finally, one facilitator introduced the concept of storytelling and the journey map. A journey map is a tool in the design thinking process that helps designers tell a story in a narrative form (Walter, 2021). For example, teams created a story about the process of cooking cup noodles. Figure 2 shows a story visually and the oral presentation.

Figure 1.
The cup noodle story.

The second week consisted of exploring Instagram. It worked as a tool for documenting, editing and commenting. Teams converted their stories from the journey map to digital images, participating in a role-play activity and taking photos and videos. They utilized inexpensive materials such as cardboard, colored paper, scissors, colored pencils, and markers to create visual elements and customs that accompanied the story. Finally, every team posted their works on SNS, Instagram, and Facebook to receive feedback and comments. One participant wrote on Instagram and left one "like" on the post as follows:

Today was fun…The video looks great! The vid/reel, and the ramen!! (Stephen, teacher, 49 years old, Instagram).

In the third week, participants were challenged to start a new story. This session consisted of exploring problems and finding solutions. The theme was "the garbage problem," and one facilitator showed them images about the accumulation of garbage in public spaces around the city. Then, by teams, they analyzed some pictures and devised solutions to design a product or service. A worksheet was utilized to annotate their ideas, a brief description of a concept, and a target user's characteristics (persona). A persona is a tool in designing to focus on a real or fictional user based upon research to represent the user type and desires. Finally, they worked on the journey map to tell the story. Participants commented:

Defining a problem and giving a solution was challenging because many ideas emerged in multiple directions. (Juan, employed, 60 years old, Interview)

It was good to hear original ideas. I think it is necessary to prioritize first because it takes much time to discuss. (Brandon, teacher, 34 years old, Reflection journal)

In the design field, thinking about fictional or real users is a source of information. When empathizing with a target user, designers should iterate and improve a creative idea (So & Joo, 2017). Although this activity required much time, it helped to think about a problem, debrief it, understand it and figure out solutions. Interestingly, while foreigners found ways to communicate creatively, the Japanese supported them by providing resources (such as materials and linguistics), guidance, and linking civic values. As some participants commented:

[The project] made me think about how to throw the garbage correctly away (Sarah, Japanese student, 23 years old, Reflection journal)

We could think about the importance of having good manners about the garbage problem, such as being more responsible. (Yamada, Japanese retired, 60 years old, Reflection journal).

In the fourth week, their ideas were developed into concrete products. For example, one team created a fun character named *Gomi Moster*. This character invited young people not to litter during and after a sports event in the local basketball stadium. Even though teams failed to perform the story by role-playing, they presented their solutions in front of the classroom and posted them on SNS.

Figure 2.
Projects presentations

In the last session, the workshop venue had to be changed due to the temporary closure caused by the COVID-19 pandemic. As a result, the research team decided to meet in a coffee shop nearby to follow up on the final products, team reflections, and interviews among volunteers. Overall, digital storytelling activity helped participants to enhance creative communication and active engagement when collaborating in ongoing projects. Furthermore, agreeing with Green (2013), storytelling provides contextual use of language rather than basic vocabulary development. For instance, Brandon (teacher, 34 years old, Interview) mentioned that he could cooperate and negotiate the story's content and characters in Japanese language. In addition, Hana wrote in her reflection journal:

It was an exciting activity. It helped me communicate in Japanese, describe situations, add details to the story, and participate in group discussions. (Hana, artist, 33 years old, Reflection journal)

Regarding storytelling, it was necessary to think about real users, hear their needs, and document for exploring issues as an authentic design challenge (Yeh & Mitric, 2019). Instagram served as a novel tool for capturing and editing creative work. However, participants were not fully involved in the communicational process online. The problem lies in a lack of familiarity. Most of them were confused about social connections online, like Facebook works based on adding contacts and joining private groups. Instagram does not have these features, instead of following users and hashtags. A problem-solving activity becomes challenging when people ignore their daily connections and personal understanding of the problem. Authentic learning needs to ensure personal interpretations of problems to brings practical knowledge and imagination (Inoue, 2005).

CONCLUSIONS

This study aimed to examine the effect of digital storytelling-based design thinking in a language learning community. Participants explored local problems and prototyped solutions. As a result, this experience became an opportunity for authentic learning in the context of language learning to address individual and collective interests. Digital storytelling is a tool for social engagement, teamwork, and increasing motivation to communicate creatively in different formats, visually, written, and orally. The use of Instagram adds novelty to the learning process through digital features such as text, hashtags, filters, images, music, and short videos. However, it is necessary to get familiar and develop skills and understanding the complexity of the communicational process through digital media.

Some limitations were observed, such as a lack of time, attendance of participants, and technology constraints. Moreover, it is worth saying that this research was conducted in a cross-generational language learning community among foreigners and Japanese residing in Okinawa, Japan. Therefore, the results are not generalizable. Nevertheless, the following aspects should be considered when combining digital storytelling with design thinking: First, to bridge in-class activity with outside-class activities to explore issues, inquiry, and data collection in authentic contexts. Second, develop assignments and training sessions to develop skills and literacy to document, edit, share content online, and connect with others on social media. Third, during the COVID-19 pandemic, it is necessary to be flexible with time, available resources, and sudden changes.

Further research should be addressed to analyze participation in a language learning community about common interests and language skills. Moreover, it is necessary to research in-depth the integration

of digital storytelling and design thinking more effectively. The partnership between learners with local communities is vital for developing sustainable communities and active citizenship through new forms of participation. Incorporating people with different linguistic and cultural benefits working collaboratively, service-learning, persisting, and overcome social barriers.

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Evaluating Impact of Pre-Departure Training on Study Abroad Outcomes by Adapting Kirkpatrick's Evaluation Framework

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Abstract: Study abroad outcomes are complex and not easy to obtain. In the midst of these challenges, evaluation of pre-departure training for study abroad is needed, yet little is researched. How can we evaluate the effectiveness of pre-departure training when study abroad outcomes are intricate? In this study, by employing Kirkpatrick's training evaluation model and designing pre-departure training to promote training transfer, we evaluated training impact on study abroad outcomes. For evaluation, we employed both qualitative and quantitative measures, such as the Intercultural Development Inventory (IDI), showcase portfolios, and surveys. The findings suggested that training designed for training transfer enhanced attainment of our study abroad outcomes. Furthermore, our attempt indicates that Kirkpatrick's model is an applicable framework to evaluate pre-departure training for study abroad outcomes.

Key words: Intercultural competence, Instructional design, Outcome assessment, Showcase portfolios, Training transfer

INTRODUCTION

In the field of study abroad, merely sending students overseas is not enough for intercultural learning, and intentional intervention is considered important (Jackson, 2020; Vande Berg et at. 2012). It has been reported that students who are studying abroad have limited meaningful interaction with local students (Jackson & Oguro, 2017) and even when intercultural contact increases, one's bias may enlarge due to unpleasant experiences (Yashiro et al. 2009). Intentional interventions, such as pre-departure training, support sojourners' learning abroad, yet Halenko & Jones (2017) claim that its research is still undeveloped. To evaluate pre-departure training, we need to know its impact on study abroad (SA) outcomes. However, outcomes in international education are, as Deardorff (2015) defines, developmental, experiential, and complex in nature, and not straightforward to assess. How can we know if training is effective when SA

outcomes are complex? Is there any model or framework to be used? Blair (2017, p.122) reports, "there simply is no single instrument, method, or assessment moment that allows us to capture the complexity of the data." Our study focuses on this critical issue from the viewpoints of training evaluation and discussesevaluation framework of pre-departure training.

Training evaluation model and training transfer

In the field of training evaluation, Kirkpatrick's evaluation model has been the de facto standard and the model consists of four phases in evaluating: Level 1: *reaction*, Level 2: *learning*, Level 3: *behavior*, Level 4: *results* (Suzuki, 2015). Kirkpatrick & Kirkpatrick (2009) explains importance in an evaluation design to identify a few *critical behaviors*, which are "specific, observable, measurable behaviors the training graduates should perform" that will likely lead to expected results, emphasizing the criticality of bridging training to behavioral change *after* training. In the research of training transfer, positive training transfer is "the extent to which the learning that results from training experience transfers to the job and leads to meaningful changes in work performance" (Baldwin et al., 2009, pp. 41-42).

Training evaluation model for pre-departure training

A study by Cutting et al. (2020a) employed Kirkpatrick's model to evaluate the effectiveness of pre-departure training design for study abroad focusing on training transfer in Level 3 (behavior). They first found training transfer was *not* occurring after their initial pre-departure training, so they redesigned training to focus on training transfer utilizing Kirkpatrick's model. Through monitoring participants' daily reflections while abroad, the study suggested that transfer-focused training impacted training transfer (Cutting et al., 2020a). However, the study did not examine if training led to SA outcomes.

RESEARCH DESIGN & METHODS

Although pre-departure training is considered integral, it lacks evaluation research. Evaluating its impact is especially difficult when SA outcomes are experiential and complex. This research targets pre-departure training designed to enhance training transfer by Cutting et al. (2020a) and evaluates training impact on SA outcomes using Kirkpatrick's model.

Our research question is as follows:

RQ: *Does pre-departure training designed to enhance training transfer bring out expected SA outcomes?*

Pre-departure training for study abroad

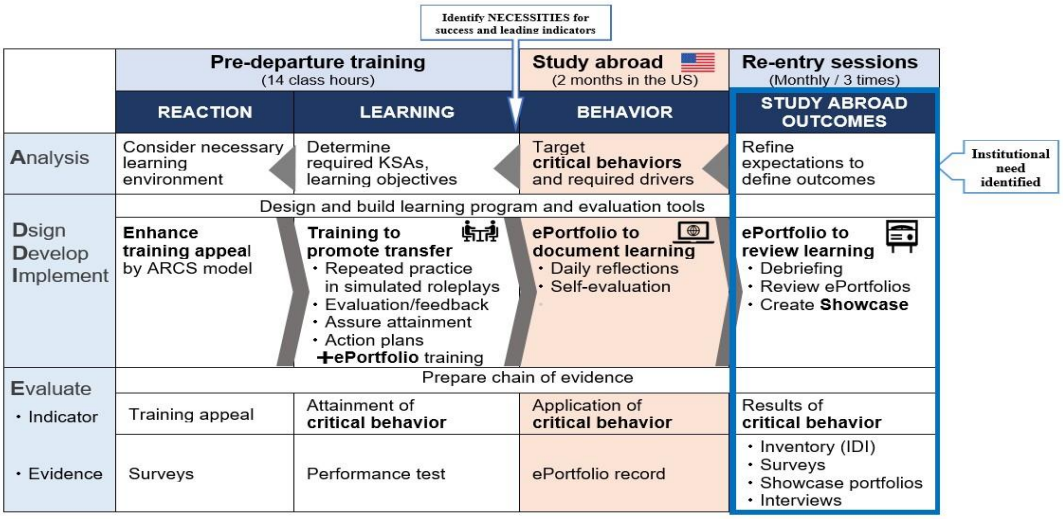
The study abroad program in this research is operated by a Japanese private university which sends a group of Japanese students to a US institution for 2 months to take credit bearing classes. The program aims to prepare students to work in a global society according to the mission of the institution. To maximize study abroad experiences, pre-departure training (7 weeks, 14 class hours) as well as re-entry sessions (3 times-monthly, 6 class hours) are offered. The participants are required to have completed an intermediate English course offered at the institution and their English levels range from TOEFL ITP 460 to 500.

Adapting Kirkpatrick's model to design training evaluation

We designed pre-departure training evaluation by following the flow of Kirkpatrick & Kirkpatrick (2019). According to Kirkpatrick's model, analysis starts from refining Level 4 (results), which is often an organizational impact such as ROI, after identifying organizational needs. This study focuses on evaluating training effectiveness on *SA outcomes* after training, thus adapting Level 4 for our educational context.

We first set SA outcomes considering the needs of the program. Then we identified critical behaviors in study abroad (Level 3) which are expected to lead to these outcomes. As learning goals in training (Level 2), we identified required knowledge, skills, and attitudes. This evaluation scheme is exhibited by adding our own study abroad context and using the ADDIE model in ID in Figure 1.

Figure 1.
Application of Kirkpatrick & Kirkpatrick (2009) in designing pre-departure training evaluation



Study abroad (SA) outcomes

To optimize students' learning in SA, our pre-departure training created goals for *intercultural communication*, *English communication*, and *perspective taking*. As mentioned earlier, preparing students to broaden perspectives instead of enlarging biases and enhance meaningful intercultural interactions are critical for maximizing the SA environment. Thus, *perspective taking* goal requires suspending one's own judgement of others and seeking others' viewpoints (Cutting et al., 2020b) to broaden perspectives as well as having meaningful interactions with local people. This goal was refined through previous research (Cutting, et al., 2020b) and employs the theory of DMIC (Developmental Model of Intercultural Competence) by Bennet (1986), which explains people's perspective shifts from ethnocentric views to more ethnorelative views in intercultural competence (Hammer, 2011).
Based on these, SA outcomes of perspective taking are set as follows:
SA outcomes: *Perspective development by suspending one's judgement and seeking others' perspectives.*

Critical behavior (CB) for SA outcomes

To enhance attainment of SA outcomes, pre-departure training aims that *student possess the knowledge, attitude, skills, and English ability to attempt to broaden their perspectives* and has sub-goals in knowledge, attitudes, and skills (Cutting et al., 2020b). Among these, we selected a sub-goal as a *critical behavior* in Level 3. Following Cutting et al. (2020a; 2020b), we selected the following sub-goal to monitor for training transfer and in this research, we call it *critical behavior* using Kirkpatrick's term:
CB: *Students can ask questions in English about culture, such as cultural differences and surprises.*

Pre-departure training was designed to enhance training transfer and assured the attainment of the goal by all participants by providing performance tests repeatedly through roleplays in simulated settings (Cutting et al., 2020a; 2020b). ePortfolio systems are used throughout the program to enhance, document, and evaluate students' learning (Cutting et al., 2020b).

Methodologies: Evaluation of SA outcomes

To evaluate the impact of pre-departure training on study abroad outcomes, we use Intercultural Development Inventory (IDI), surveys, and showcase portfolios. The methodologies are listed in Table 1.

Table 1.
SA (study abroad) outcomes and evaluation methods

	Explanation	Evaluation tools	Methodologies
SA outcomes	*Perspective development by suspending one's judgement of others and seeking others' viewpoints.*	IDI (Inventory)	Measured pre/post increase *-compared with a controlled group*
		Showcase portfolios	Analyzed if CB led to SA outcomes *-compared with a controlled group*
		Surveys	Analyzed perceived impact of training CB
		Interviews	Analyzed personal changes after SA

IDI (Intercultural Development Inventory)

To evaluate SA outcomes, we employed *The Intercultural Development Inventory* (IDI), since IDI has been created based on the DMIS theory which provided foundation for our goal. IDI is a 50-item questionnaire to assess developmental stages in people's worldviews towards differences. To see our training impact, we compared the results with a control group who took the previous training. The previous training had the same goal, but training did not focus on training transfer without assuring the attainment of the critical behavior and lack of training transfer was found (Cutting et al., 2020a). Here, we call transfer-focus training *T-focus training* and non-transfer-focus training *Non-T-focus training*.

Showcase portfolios

Since inventory does not indicate the causes of the results, we analyzed students' *showcase portfolios* in which they wrote about their attainment of SA outcomes and investigated if training of the critical behavior led to SA outcomes. Barret (2010) explains that in most showcase portfolios, students reflect on their achievement of learning goals by thinking over their selected evidence and write about their learning, its significance, and next learning goals. Our students created showcase portfolios in our re-entry sessions by reflecting on, selecting, and exhibiting their outcomes as well as their next goals. In their showcase portfolios, we examined how they developed their perspectives, especially the effect of the critical behavior. We analyzed their descriptions of outcomes in showcase portfolios following the deductive coding approach by Sato (2008) and examined whether outcomes were attained by the critical behavior. Then, we compared the results between T-focus and Non-T-focus training.

Surveys

To bolster our data, we conducted *surveys* to investigate if training of the critical behavior led to SA outcomes. We conducted closed questions as well as open-ended questions. Questions were a 4-point Likert scale from 4 (Strongly agree) to 1 (Strongly disagree). The survey, which was anonymous and consented upon, was given to all the participants in the T-focus training 6 months after their return. A limitation of this study is that the survey was created after T-focus training was designed and therefore we only presented the results of T-focus training.

RESULTS

IDI results

To understand training impact on SA outcomes, we conducted IDI before and after study abroad for students in T-focus training and Non-T-focus training. In Non-T focus training, 21 out of 22 students (95%) and in T-focus training, 15 out of 16 students (94%) completed pre-posttests. T-tests indicated IDI increase in both training. To compare effect of training onto post-test by eliminating effect of pre-test, we conducted ANCOVA to perform pre-posttest analysis where the pre-test is used as a covariate, the training types as an independent variable, and the post-test as a dependent variable. There is a significant effect of training type on the post-test after controlling for the pre-test, ($F [1, 33] = 4.29$, $p<0.05$) and students in T-focus training had statistically higher increase in post-test. Also 87% of students had an increase in IDI in T-focus training, whereas, 57% of students had an increase in the Non-T-focus training.

Table 2.
Results of IDI

IDI	Pre		Post		*t*	*p*
	M	*SD*	*M*	*SD*		
Non-T-focus (n=21)	85.3	(13.39)	90.5	(13.68)	-2.32	<.031
T-focus (n=15)	84.3	(11.51)	96.7	(12.82)	-4.72	<.0003

IDI	Non-T-focus		T-focus		ANCOVA
	Pre (SD)	*Post (SD)*	*Pre (SD)*	*Post (SD)*	
	85.3(13.39)	90.5(13.68)	84.3(11.51)	96.7(12.82)	F (1,33)=4.29, p=0.046

	Increase	*Decrease*	*Increase*
Non-T focus (n=21)	12	9	57%
T-focus (n=15)	13	2	87%

Showcase results

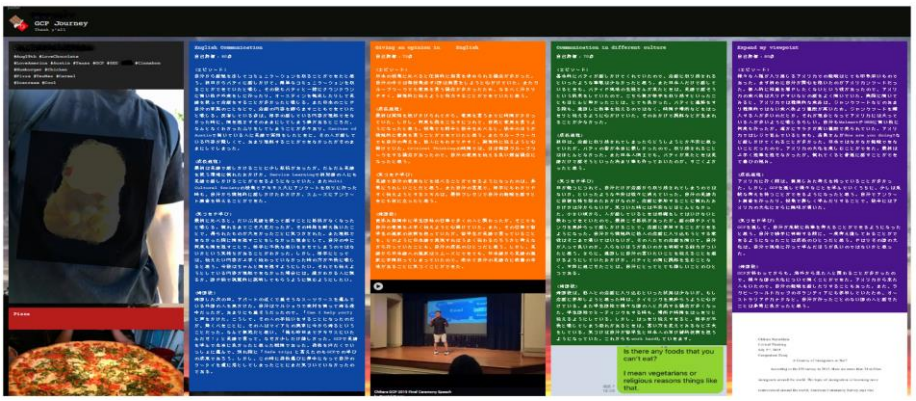
Showcase portfolios were submitted by 21 out of 22 students (95%) in Non-T-focus training and 16 out of 16 students (100%) in T-focus training. In Non-T-focus trainees' showcase, there was no evidence of CB, which is asking questions to seek others' perspectives. For example, this student explained his/her perspective development from observation: *Something I was able to notice as visible differences as, for example, some labor workers seemed to be black people, but I did not see such difference among students*. On the other hand, 8 T-focus trainees out of 16 (50 %) indicated their perspective change by seeking others' viewpoints by asking question as CB.

Table 3.
Results of showcase portfolio analysis: Evidence of SA outcomes obtained by the critical behavior

	Extracted descriptions of goal attainment in showcase portfolios
Non-T-focus	
	None
T-focus	
Student 1	When I encountered something different from myself or Japanese people, instead of feeling strange, I could accept it as a difference. And Igained an attitude to **ask and search** why there's such a difference.
Student 2	I **tried to ask questions** when I didn't understand or was curious. Well, mostly about music. **At the beginning, I was not asking questions much**, so I was often listening to others' questions. But what I am curious about is not necessarily what others want to know, so **I thought it ismyself who needs to ask. I think my questions to teachers increased recently. Self-solution and solution by friends decreased, I think.**
Student 3	I was feeling these volunteers (at the volunteer center) were volunteering as part of a school requirement. But **when I asked for reasons** whythey were coming, I heard lots of voices which surprised me such as, 'because it is fun,' 'because I can meet and talk with lots of people.'
Student 4	I told M that we learned about slavery systems in Japan like this and **asked him 'how is it really?'** Since I was naturally interested in other cultures, I think I was able to ask questions. But I was not as aware of my own culture as I thought, sowhen I was asked about my own culture, I looked into it.
Student 5	When I visited my buddy's house, his/her parents were saying they like sushi. **When I asked what kinds they like**, I was surprised that the mother said she likes sea urchins, since I saw on TV that foreign people do not eat sea urchins much. So, I was tempted to say, 'foreign people do not eat sea urchins, so you don't like them, do you?' But then **this question is from my assumption.** So instead, **I asked, do people here eatsea urchins?** Then she said, 'not so much.'
Student 6	I was curious about American food, since I did not want to gain weight. I often hear people say that American food makes people fat. **But whenI actually asked people about it**, healthy food tends to cost more than unhealthy junk food, and because of that reason, many people buy junk food. When I went to the supermarket, salads were indeed expensive.
Student 7	By going to America, I was able to change my stereotypes greatly (finding various views of policies and regulations, etc.) … By recognizing this, **I was able to ask questions with care** and to share my culture and values.
Student 8	I was talking (with a dorm resident) about how history is taught in each country. After listening to his explanation, **I asked about** the case of the Hiroshima atomic bomb. I was shocked at what he said and felt "What? Really?" After that, I researched to see if it was true. Then I found…

-Bold type shows identified segments that indicate when students sought others' perspectives by asking questions.

Figure 2.
An example of students' showcase portfolios of study abroad outcomes



Survey results

As survey results, 11 students (68%) completed survey and the mean of perceived effectivenessof training critical behavior ranged from 3.5 to 3.9 out of 4.0, highly positive in all questions.

Table 4.
Results of surveys: effectiveness of training critical behavior

Practice of critical behavior led me to… (n=11)		*M*	*SD*
Level 3 behavior in study abroad			
(3) Become more conscious to ask cultural questions		3.8	.39
(4) Ask cultural questions during study abroad		3.5	.50
(5) Use English more		3.9	.29
Study abroad outcomes			
(7) Broaden my perspectives	SA outcomes (1)	3.9	.29
(6) Learn new cultures with curiosity	SA outcomes (2)	3.8	.39
(8) Deeply communicate with local people	SA outcomes (2)	3.5	.66
(9) Mutually understand in a host country	SA outcomes (2)	3.6	.48

Next, data from open-ended questions in the same surveys were open coded to identify the impact of training. Table 5 shows the responses and coded impact. We found that skill training had impact on perspective development (n=4), suspending judgement (n=5), promote critical behavior (n=4), considering others (n=2), and arouse interest (n=2).

Table 5.
Students' comments in surveys: effectiveness of training critical behavior

T-focus	Students' comments about impact of critical behavior training	Coded impact
Student (a)	By asking and learning about cultures, **my views broadened.**	Perspective development
Student (b)	Through question practice, I noticed I was often making my own judgement unconsciously. Because of that, **now I can deal with things doubting my views** in a positive way and **thinking"what if…"**	Suspend judgement, Perspective development (attempt)
Student (c)	After study abroad, I came to think of ways to talk to each other **in a considerate manner for others. I really stopped feeling "no way!" or "that's weird,"** but instead, **I started questioning "why" and deepening my cultural understanding**. Not only cultural things, I cansee my persona change.	Consideration for others, Suspend judgement, Perspective development
Student (d)	I was able to **ask questions smoothly** during study abroad.	Promote critical behavior
Student (e)	By learning how to ask questions, I became **not hesitant to ask questions** to others.	Promote critical behavior
Student (f)	I was able to become **interested in cultures**, especially America and American nationality as a multi-ethnic country, and was able to **ask questions proactively**.	Arouse interest Promote critical behavior
Student (g)	Instead of making judgement only through my bias, **I think first before making judgement** to view things.	Suspend judgement
Student (h)	I stopped my self-conclusion. I **stopped my self-centered interpretation such as "maybe that's that,** and **started asking questions even about a small thing.**	Suspend judgement, Promote critical behavior
Student (i)	I became more **curious about other cultures**.	Arouse interest
Student (j)	Casual things can be totally different, so I **decided to be careful** of talking about it and started thinking that I want to learn how to **talk without leading to bias or prejudice**.	Consideration for others, Suspend judgement

Lastly, to understand the impact of the skill training, we conducted interviews 6 months after study abroad. The following interview of a student explains his/her personal transformation after training.

'After coming back, I often had a chance to talk to international students in English during my club activity and often acted as a translator. I tried to explain about cultural things and I tried to take initiative to ask them about it. I asked about their preference of timing of taking a bath and ways to take one and tried to explain how 'time' is viewed here. I became like this because I learned it is better to think before making judgements during the pre-departure training. Knowledge of intercultural understanding also helped. Previously, when some members said they could not do a task because they were busy, I often assumed that it was an excuse because everyone is busy. But now, without assuming, I came to work with the person by asking and discussing other ways. My thoughts became flexible. I had a fixed thinking before, but now I stop a second and think.'

DISCUSSION

Our study employed Kirkpatrick's framework to evaluate if T (transfer)-focus pre-departure training led to expected SA outcomes, which is *perspective development by suspending judgement and seeking others' views by asking questions. Asking cultural questions in English* was set as the critical behavior (CB). IDI results showed T-focus training had significantly higher impact on attainment of SA outcomes than Non-T-focus training. Moreover, in showcase portfolios, 50 % of T-focus trainees indicated their attainment of outcomes by CB, whereas Non-T-focus trainees showed no evidence of practicing CB for the outcomes. The survey after T-focus training indicated a positive perception of training impact on SA outcomes. Lastly, open-ended responses revealed that T-focus training produced various perceived outcomes such as considering others and arousing interest, in addition to the expected outcomes.

The limitation of this study was its narrow focus, but this was to manage the complexity of SA outcomes and trace learning evidence. Moreover, Level 4 in Kirkpatrick model was not examined, which involves organizational impact. Thus, future research is needed to understand training effectiveness in other educational contexts. Despite the fact that our study is limited in its scope, our adaptation of Kirkpatrick's model in pre-departure training gave us a pathway to evaluate training impact of study abroad outcomes.

CONCLUSION

In the field of study abroad, adequate preparation is necessary especially prior to intercultural experiences (Savicki, 2008; Deardorff, 2009), nonetheless, its effectiveness is rarely examined under complexity of assessing study abroad outcomes. Our study approached this issue by employing Kirkpatrick's framework and evaluated the impact of pre-departure training on study abroad outcomes. The findings from qualitative and quantitative analysis using different evaluation tools suggest our transfer-focused training impacted attainment of expected outcomes. Furthermore, we conclude Kirkpatrick's model is applicable in evaluating pre-departure training for study abroad outcomes. We believe our adaptation of Kirkpatrick's framework using ePortfolio systems can be utilized beyond study abroad settings, such as field trips, teaching internships, and many other programs which send students to a real-world experience after training. Future research is needed to examine organizational impact as Level 4.

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LEARNING EMERGES IN CREATIVE ACTIVITIES

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Abstract: In Activity Construction Design projects by Sannnomiya (2021), a designer collaborated with the users to design a tool as they use it in their workplaces. From analyses of the design process, we demonstrate that learning emerges in activities in which everyone involved collaborates creatively, rather than a process happening within each individual. Based on these analyses and a historical examination of human societies, we derive a model of learning that illustrates how modularization of modern societies has suppressed creative and collaborative learning and let efficiency dominate learning in workplaces and schools.

Key words: Creative Learning, Collaborative Learning, Efficiency Oriented Learning, Modularization of Societies

WHAT DOES IT MEAN TO LEARN?

We all know from experience the joy of learning in a creative process in which we create something new with our own ideas and with our own hands. However such an experience is hard to come by in our daily lives. This paper tries to understand the origin of this joy of learning, the reason why we cannot experience it often, and what we can do to regain it in our daily lives, workplaces, and schools.

According to Urge Theory (Toda, 1982), through more than two million years of hunter-gatherer societies after our ancestors started to create and use tools, which is more than 99% of our history, humans evolved a system of "urges" for our survival in natural environments with hand created tools. For example, humans create new tools with "curiosity urge" for new knowledge or "challenge urge" for new skills (Miyata & Ho, 2017). The joy of learning we experience in creative processes matches the Flow Theory (Csikszentmihalyi, 1990). In the next section, we derive two types of learning to characterize learning in creative processes from the standpoint of survival as a living organism in natural environments.

Efficiency Oriented Learning

In order to survive in natural environments, one must obtain food using the energy obtained in a previous success. Thus, our learning must have evolved to obtain as much food as possible using as little energy as possible. This leads to what we will call "**Efficiency Oriented Learning**".

Learning based on efficiency (Efficiency Oriented Learning): Learning tries to maximize the efficiency of tools we use.

By tools we mean a complex physical, mental, and informational system. This includes not only physical tools but also skills in using them, knowledge about the environment, and tools for communication in collaboration with peers. In the context of a hunter-gatherer society, a system is efficient to the extent that it uses less energy and information in order to obtain more energy and information. Therefore, the efficiency of a system can be measured by the negative entropy, or negentropy for short, that counteracts the law of entropy (or the second law of thermodynamics that states that the entropy of a closed system always increases, or the system is always disintegrated/destroyed).

It is important to note that if we define tools this way, learning is a process of improving a system as a whole, rather than learning by each individual person. Also, learning tries to optimize some value such as energy efficiency in the hunter-gatherer lifestyle, but the value optimized will change when lifestyles change as discussed later.

Creative Learning

Such an efficient system cannot exist unless it is created. However, the process of creating an efficient system is not efficient. It requires experimenting with trial and error using time and energy before a new system can be created. Thus, creation of a system goes against the **Efficiency Oriented Learning** we derived above, which tries to maximize the gain and minimize the loss of time and energy. This means that we cannot create new tools by efficiency-learning alone. This leads to the next type of learning:

Creativity Oriented Learning (Creative Learning): One is urged to create a new system when a potential to create one is recognized. It was necessary to evolve a strong enough urge and joy in order to motivate ourselves to create something new acting against the **Efficiency Oriented Learning**. Such an urge would encourage us to create a new, more efficient tool, even though the process of creating can be very inefficient. **Creative Learning** should work to create not only more efficient tools, but also to improve teamwork with our peers. This view of learning is consistent with the Constructionist Theory of Learning (Papert, 1993) as well as the "Growth Mindset" discussed by Dweck (2017).

THE HISTORY OF LEARNING

Let us consider how these two learning types have moved our history, focusing on the increasing modularity of our societies and transformation of values.

Modularization in Farming Societies

About 10,000 years ago, seeking a more efficient way to acquire food, humans started to shift from hunter-gatherer lifestyles, in which they adjusted actions to adapt to their environments, to farming lifestyles in which they changed the environment to fit their needs. This shift made their food more predictable without rich exchange of information as in hunting and gathering, the balance started to shift from creative to efficiency. Also, dense populations along major rivers suited for farming separated their societies into modules like cities and farming communities surrounding the cities. To manage the growing societies, modules are designed to minimize information exchange between them. Thus, **Efficiency Oriented Learning** tended to dominate the "between-module" interaction, making it difficult for the modules to creatively collaborate, leading to exploitation of weaker modules such as slavery and colonization. (Miyata & Ho, 2017; Miyata, et al., 2019; Diamond, 2011; Montgomery, 2017)

Suppression of Creative Learning in Industrial Society

Industrialization of societies began when new tools were invented that used fossil energies and many people started using it with **Efficiency Oriented Learning**. The new tools were so efficient that a few people could create products that could satisfy the needs of many consumers. As a result, the balance between the two types of learning changed drastically. Before industrialization, most people had to learn to create most things they needed for living. "To make a living" literally meant to create tools that were necessary for living. To learn with **Creative Learning** was the necessary condition for living. However, mass-production of daily necessities with machines allowed consumers to make their living more efficient (convenient or comfortable) by just selecting from industrial products. For consumers who are surrounded by finished products, it has become hopelessly difficult to recognize possibilities of creating by themselves. Their urge to create and improve their lives on their own with **Creative Learning** is suppressed. "To make a living" no longer implies being a **Creative Learner**, but instead implies being

economically efficient. Industrial societies have created the new value “save human power”, which has accelerated the monopolization of **Creative Learning** by a small number of professionals. (Miyata, 2021)

CREATIVE LEARNING IN ACTIVITY CONSTRUCTION DESIGN

Recently, some instances have been reported in which the balance between the **Efficiency Oriented Learning** and **Creative Learning** could be regained. In Activity Construction Design by Sannomiya (2021), a designer tried to create new tools while working with the people in a community. We observed **Creative Learning** in users who were involved in the design process working with the designer. In the following sections, we analyze the learning process in this collaboration.

Design process in the hand-made box studio.

We analyzed the process of designing a new tool, HACOSTA, for calculating the cost of making a box in a hand-made box studio. We first focus on the dialogue between the manager of the studio (M) and the designer (D) in which they found a possible new design. M is an experienced craftsman, who is also responsible for issuing invoices for their products. When D mentioned to M that he thought he could create an application to calculate the cost of materials, M confessed to D that he had been concerned about how to calculate labor cost. Our analyses of the process before and following this dialogue revealed the following.

1. M had been worried that their method of estimating the price of their products, especially the method of calculating labor cost, did not have a sound basis and had been thinking that they should find a more appropriate method. This suggests that M was interested in improving the quality of their work, and was not just trying to make it more efficient.

2. However, M had not tried to communicate his concern or improve the situation, because he had anticipated that a fair amount of time and energy was necessary to work with them to improve it. This suggests that M had suppressed his actions for efficiency reasons. Also, M mentioned that he could not imagine how to improve the situation, which suggests that M’s creative urge was suppressed.

3. M observed that the workflow was divided into two floors, and each floor was only visible to members of that floor. This suggests that interaction was not rich between the two floors.

4. M revealed his concern about labor cost in response to M’s mention of the possibility of creating an application to calculate the material cost. This suggests that M anticipated if D could create a material cost calculator, then a labor cost calculator could be created, which can be interpreted that M’s creative urge was active.

5. D recognized M’s implicit wish from the dialogue and started to collect information necessary to create a new tool. This suggests that D recognized the possibility to contribute his skills to the community, activating his creative urge.

6. D did not understand the detailed process of making boxes. Therefore, he started making relations with craftsmen in the community to learn the process from them and collect necessary information. Through this relationship D was able to learn and understand the detailed process of the crafts, come up with an algorithm to calculate labor cost, and to realize it as a new tool. We can interpret that D’s creative urge directed toward a new tool extended into making relationships with the craftsmen.

7. Initially, M had in mind a tool to improve efficiency by minimizing calculation time, but as the tool’s design took shape, he became aware of his wish to improve the calculation method. Also, M provided D with information useful for designing the new tool, especially to make it a learning tool for the community members. This suggests that he gradually realized the possibility to improve the workplace as a whole, not just the efficiency or quality of their work.

8. Most other members of the workplace were initially skeptical about the possibility of creating a useful tool, and unwilling to cooperate. However, when the new tool began to take shape, each member, seeing the new tool from their standpoint in the workplace, realized a potential to improve their work and started to cooperate. One by one, they shared their ideas and necessary information such as the time required to finish each part of the production process, which were then incorporated into the tool’s design. In the end, each member creatively contributed not only to the new tool’s design, but also to the workplace as a tool in the broader sense, including its relations with the customers.

a. Craftsmen with more experience and pride in their work hoped that the tool would help younger members to understand the crafts better.

b. Some craftsmen mentioned they hoped the tool would help the salesperson to better appreciate the value of their work.

c. The salesperson was happy that the tool helped him to better explain the value of the products to the customers.

d. Some of the customers, who could see the contributions of different craftsmen, became more interested in the products.

e. Some craftsmen and the salesperson discovered that they could now examine the production process in detail and possibly improve it, which they had never imagined they could do.

A Display Design in the National Museum of Japanese History

In the National Museum of Japanese History, the designer D collaborated with the researchers specializing in folk crafts to design and create a digital archive viewer that visualized the relationships between different types of artifacts. The materials in the museum have been divided into specialized areas such as lacquerware, ceramic, etc., each of which organized the data differently. Through the process of the tool design, the researchers realized that the meanings of the artifacts that they have been trying to study could be understood better when they are visually integrated in the same historical context in which they were used. This illustrates that materials originally used in a same meaningful life context have been divided into different modules of specialized researchers which made it difficult for them to collaborate across different fields in order to understand the meaning of the materials and to design exhibits for the museum audience.

A Tool Design for an Icon Design Project

Designer D collaborated with a team of designers who worked on an icon design project to create a new tool to support their icon design process. The new tool allowed the team to manage their project and the quality of the products while designing several thousand icons that they were responsible for. It is interesting that the tool was developed in the process of the project in which they used the tool and implemented new functions as they found necessary. The team initially requested a tool to show only the progress of each sebset in order to optimize efficiency by minimizing information, but as the design work progressed they realized that the initial tool design made it difficult for them to collaborate. Then, they collaborated with D to incorporate new functionalities that allowed them to compare icons with common motifs to secure the consistency of their design, even though it required extra work to tag every icon they designed. This indicates that their focus shifted from efficiency to creativity. Another project team who observed this process expressed their interest in designing their own tool, suggesting they also had their creative urge activated.

DISCUSSION

Modularization of a system for efficiency and suppression of creative learning

Based on the analyses of the three cases we discussed in the previous section, we derive a model of modern social systems to understand how modularization of a social system suppresses creative learning.

- In a workplace community, such as a company, a studio, a team of researchers or designers, **Efficiency Oriented Learning** often dominates. Especially when they focus on efficiency oriented values like profits, trying to make the system more efficient, by reorganizing it by modularization and minimizing the need for interaction between the modules**.**
- For example, members are divided into subgroups based on their work and specializations. These subgroups do their own work according to a predetermined schedule, so that each module can work relatively independently without knowing/understanding what's happening in the other modules.
- However, when the processes within a module are not visible to the other modules, even when some member recognizes an element that can be improved that recognition tends not to be shared. This makes it difficult for the modules to collaborate in order to improve the system as a whole.
- Such a system loses flexibility and becomes incapable of adjusting itself to changes in its environment.

Creative learning emerging in creative design

In the three design processes we analyzed, a new design is not created by a designer alone. Instead, it emerges during the activity process in which community members interact with each other to

reconstruct their workplace, finding new relationships among themselves and with their tools. In this sense, the design of a new tool was deeply embedded in the process of a community's creative learning. We derive below a model of this learning process in which a community whose creativity has been suppressed by its modularization reconstructs itself creatively**.**

1. Each community member has some concerns about the workplace, but it is difficult for them to share their concerns with other members due to a lack of communication between modules and pressures for efficiency in the workplace.

2. The designer joins the community as a new member, and tries to learn about the workplace by communicating and making relationships with the community members**.**

3. Through communication with the designer, some members start to reveal their concerns about the workplace that they have not shared within the community. Creative Learning is triggered by a member's recognition of a designer's potential to create something useful.

4. The designer proposes an idea of a new tool, and the member(s) recognizes a possibility to improve the situation. Creative Learning is triggered by a recognition of a member's own potential through the use of a new design.

5. The members, one by one, start to take positive actions to improve the workplace, interact with each other across the boundaries of the existing modules, and the workplace starts to transform itself**.**

SUMMARY & IMPLICATIONS

These analyses illustrate that learning can be better understood as a process in which a whole community transforms itself by reconstructing the relationships among its members and their tools and the way they do their work, rather than as something that happens only within each individual. Such learning/transformation is embedded in the process of collaboratively creating a new tool. When the members recognize possibilities in a potential new tool to improve some situation(s) that they have concerns about, their creative learning urge becomes active. This creative learning urge is often suppressed in workplaces by the way they have modularized to optimize efficiency. The three cases of "Activity Construction Design" analyzed in this paper illustrate that a new member who does not belong to and is not constrained by existing modules could recognize other members' concerns, visualize potential improvements through a new design, and help them regain a balance between **Creative Learning** and **Efficiency Oriented Learning**. The designers' learning was also embedded in the activity to make new relations within each community. No individual could have learned alone, and learning was an emergent phenomenon embedded in the activity in which all the members collaborated to transform their community.

This seems to have an important implication to our approach to education in which learning is often conceptualized as happening within an individual. In most educational contexts, activities are organized so that students can be evaluated individually with scores which are supposed to measure their individual abilities. Contents to be learned are modularized into subjects so that students' abilities in each subject can be individually measured and compared more efficiently according to standardized methods. These scores are optimized to efficiently make the selection to enter the next module in the educational hierarchy. The modularization of education seems to have similar consequences to those in social modules discussed above, suppressing **Creative Learning** and encouraging **Efficiency Oriented Learning**. For example, being forced to learn individually in modularized subjects and environments in which how they are evaluated is predetermined, it is more efficient for the students to learn how to get better evaluation, rather than learn the contents to be learned. If learning is embedded in collaborative and creative activities as we have demonstrated, students can better learn in activities in which everyone collaborates to create something that they feel meaningful.

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Concurrent 2

Development of 3D Computer Graphics Avatars for VR Communication Education System based on Gesture Unit Analysis

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Abstract: This study aims at developing effective computer graphics (CG) human avatars for virtual reality communication education system and verify the effect with an experiment. Nowadays, skills for public speaking have been gaining more focuses in language education. However, there are difficulties in both teaching and learning public speaking; securing adequate practice time in large classes is difficult and practicing alone generally cannot cause the same level of nervousness as in real performance. Therefore, in our previous research, we have been developing 360-degree immersive virtual reality training system for public speaking. This study focuses on developing VR training contents for formal speech practice, especially targeting on small group setting such as career interviews and business meetings. We first developed original CG avatars as virtual audience (control condition). Aiming at improving the avatars, we analyzed human motions based on video data recorded in simulated career interviews. People with acting experience performed as interviewers in the simulated interviews. By analyzing their motions quantitatively, we extracted indices for natural motions based on gesture unit analysis (cf. Hosoma, 2008), and reflected the results in the avatars (experimental condition). An effect verification experiment was performed to compare naturalness and effectiveness between the default avatars and improved avatars. 21 Japanese participants experienced simulated career interviews with the avatars and evaluated their experiences wih questionnaire. The result showed that the avatar in experimental condition received higher evaluation in naturalness. It also received positive feedback from participants in optional free comment columns in the questionnaire.

Key words: Virtual Reality, CG, Public Speaking, Speech Practice, Material Development

INTRODUCTION

In language education, there is a growing demand for public speaking instruction. For example, in the context of teaching English for EFL learners, the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) recently added “speech/presentation” as one of the major skill objectives for English module in secondary schools. The Common European Framework of Reference for Languages (CEFR) also lists presentation and speeches in production skills. In broader contexts, public speaking plays important rolls in our modern life; for instance, formal job interviews in career seeking and presentations in crucial business meetings require adequate skills in public speaking. It can be said that needs for public speaking education are pervasive in various generations.

In many Japanese universities, public speaking is taught in various modules such as compulsory English-related courses and small group seminars. However, it is generally difficult to teach public speaking in classrooms. First, for learners to improve their public speaking skills and gain self-confidence, it takes a certain amount of practice time, but in many cases, it is quite difficult to secure the necessary practice time in class. Second, public speaking is, by its very nature, difficult to practice alone. The reason behind it is that even if learners practice alone, they will not feel the same level of nervousness as in authentic performance. Furthermore, it will be difficult to notice their improvements themselves, especially regarding delivery skills, without feedback from others. In addition, the opportunity for face-to-face communication itself has decreased due to the COVID-19 pandemic since 2020, resulting in the decrease of opportunities for practicing and performing formal speeches.

Therefore, Fuyuno et al. (2014; 2016a; 2016b; 2018; 2020) have extracted quantitative indicators of effective pubic speakers regarding delivery skills. For example, the data included characteristics of the facial movement and speech rates. Fuyuno (2020; 2021) applied the results to develop 360-degree immersive virtual reality (VR) teaching materials. One of the characteristics of VR is high level of sense of immersion. Various VR contents have been developed for purposes of education and communication

(Akaike et al., 2021; Hartanto et al., 2014; Slater et al., 1999; Suzuki et al., 2021). Hartanto et al. (2014) and Suzuki et al. (2021) used virtual avatars created by computer graphics (CG) for communication practice. In Fuyuno (2020; 2021), CG and live-action virtual audiences have been developed for VR presentations/speech education material. The virtual audience was a large number of people sitting in an immersive virtual venue. Fuyuno (2020; 2021) performed experiments to verify the effectiveness of system; as a result, the VR teaching material was highly evaluated by the learners for its practice effects and producing feelings of nervousness.

In this research, we aim to develop an effective CG avatar as part of the development of the VR communication teaching material. Our previous studies aimed at educating public speaking skills to perform in front of large audience. In the current study, we will shift to formal speeches in smaller number of participants, such as formal career interviews and business negotiations. Focusing on the gestures of the CG avatar, we will analyze several motions suitable for teaching materials, develop CG avatars for formal speech practice, and conduct a verification experiment.

BACKGROUND

For the aim of educational VR content development, previous studies that analyzed the gestures by CG avatars as NPCs (non-player characters) were investigated. Nakano, Shioiri & Hoshino (2006) pointed out the importance of interaction between players and avatar characters in entertainment applications development such as online games, and they proposed a layered behavior synthesis technique for integrating mental behaviors and conversational gestures. In our current study, since the design of contents is for small-group communications scenes, the avatar characters are expected to show listener behaviors. Therefore, the author prepared a set of listener motions (e.g. nodding, vending neck, smile, frown, looking down, shaking head and holding arms) of the avatar.

The motion animations were made by an experienced professional CG creator with his sense and knowledge based on professional experiences. However, the motions were still mechanical and not sufficient enough from the viewpoint of naturalness. When learners practice formal speeches to a small number of avatars in the content of immersive virtual reality, the degree of attention by learners to the behaviors of avatars is expected to be quite high. If the gestures are unnatural, the immersive feeling may be hindered and that would result in the decrease of the educational effect. Therefore, in this research, we investigate characteristics of natural motions for developing effective CG avatars that act as listeners for speeches in the context of small-group communication scenes in immersive 360-degree virtual space.

METHODS

Creation of Avatar

The target learners of the VR communication education system are young generations such as university students and young workforces. Therefore, we designed two human avatars at their elderly age, which is thought to be relatively unfamiliar to learners and more effective in causing nervousness as in real formal speech settings than young avatars. The avatars are designed as wearing formal business suits. 3D modeling and rigging were performed, and materials and textures were created to complete the 3DCG avatar (Fig. 1).

Figure 1
A sample of our 3D-CG avatar

In the VR material, learners practice formal speeches with the avatar during the predetermined practice time (2 minutes or 5 minutes). According to the research by Slater et al. (1999), the avatar is set to show a negative attitude first then gradually become a positive attitude. We created animation files of listener motions such as frowning, shaking head, crossing arms, tilting neck as negative attitudes, and nodding and smiling as positive attitudes.

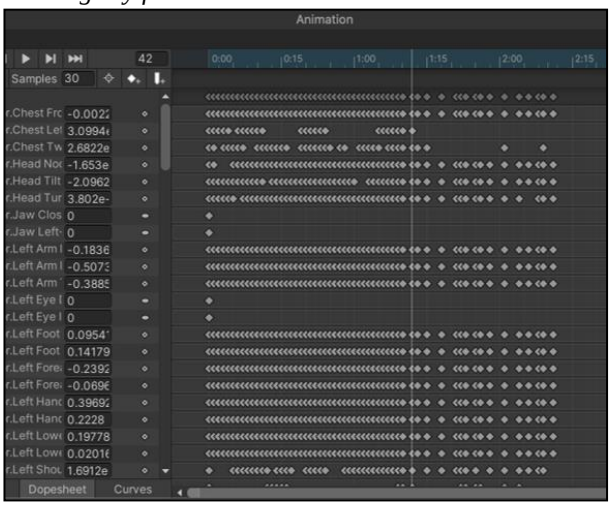
Development of Motions

The default motions were created by a professional CG animator who has more than 3 years of experience in CG creation and VR content development. The details of motions settings, such as timings and movements, were adjusted by the animator according to his sense and knowledge based on professional experiences.

As an experimental condition, we analyzed real-human motions and edited the time length of the internal structure of the avatar motions from default motions. Firstly, we asked two volunteers (male 1,female 1) who have more than three years of acting experience and other two volunteers (male 1, female 1) who have no acting experience to participate in simulated job interviews as an interviewer. They participated in the interview individually. Another volunteer participated in the simulated interview as an interviewee. The interviewee talked the same contents in every simulated interview. The simulated interviews were filmed with HD video camera. The data were analyzed by a multimedia annotation software ELAN along the four gesture phases (*preparation*, *stroke*, *hold*, and *recovery*) presented in Hosoma (2008). The average durations of gesture phases were obtained. The characteristics of the movements of people with acting experience were observed, e.g. the duration of *hold* in arm folds and neck bends was notably long, and that nodding had longer phases than the default avatar motion. Furthermore, the total duration for motions by people with acting experience were longer than that of the people with no experience in acting. The features found were reflected in the motion of the CG avatar and creation of animation movie. With 3D game engine Unity, we edited the duration of the internal structures of each gesture, mainly on the keyframe console (Fig. 2).

Figure 2

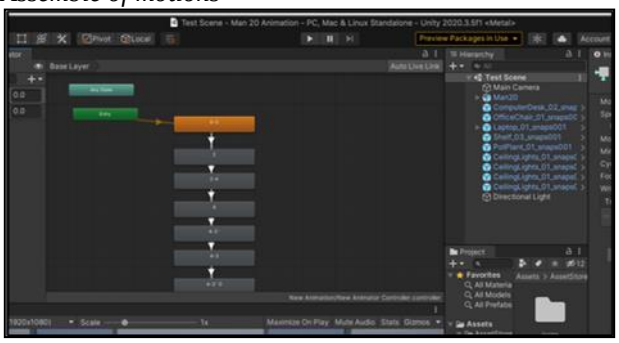
Editing key frames in avatar motions



Using the created motions, animation nodes were assembled according to the motion scenario (negative to positive) described above (Fig. 3). 2-minute animation movies were created for both default motions and experimental condition motions. In the control condition with default motions, the occurrence of motions is set at every 10-second, the same as the default setting set by the professional animator. For the experimental condition, the occurrence was set more randomly and more frequently at every 4-5 seconds, according to the characteristics of human behaviors analyzed above. We performed an experiment to compare the two types of animations; one with default motions as the control condition, and the other with edited motions based on human movements as the

experimental condition.

Figure 3
Assemble of motions



EXPERIMENT

A comparative experiment was performed during June-July of 2021. Participants in the experiments were 21 Japanese university students and young businesspeople. Their average age was 22.3. The experiments were individually conducted on a video conferencing system (ZOOM) since the experiment was performed during the COVID-19 pandemic.

Firstly, participants received explanations about a virtual situation by oral instruction and on-screen texts; they were asked to act as university students who were seeking a full-time position and that they were at the beginning of an job interview with an executive of a company with high hopes, and they were expected to introduce themselves for two minutes.

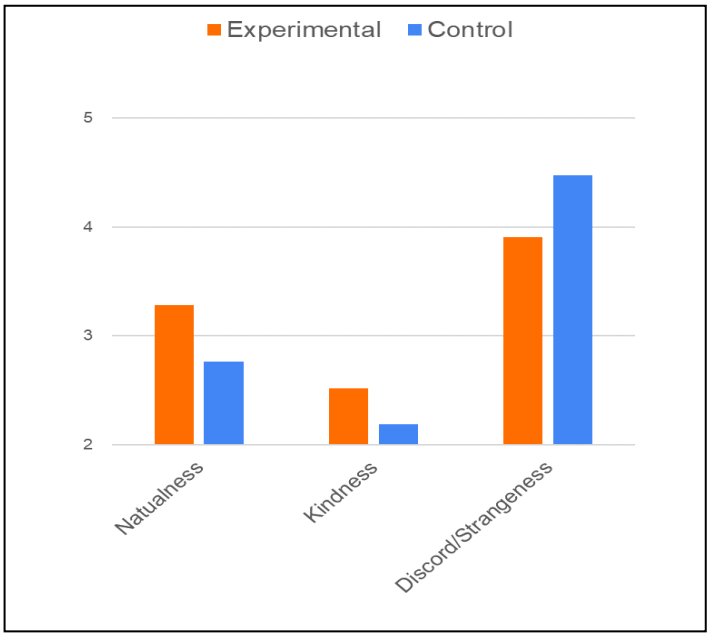
The self-introduction was carried out in front of the CG avatar animation movies twice; one is with the control condition, and another is with the experimental condition. The order of presenting the two types of avatar animations was randomized. Immediately before each self-introduction, a 30-second timer was displayed on the screen, and 30-second preparation time was given for all participants.

Immediately after each self-introduction, participants answered a subjective evaluation questionnaire about their experience with avatars. In the questionnaire, subjective evaluations on the animation movies regarding *naturalness, kindness,* and *sense of discord/strangeness* were investigated. Optional free description column was also provided. Regarding *kindness*, as explained above, we gradually increased the number of positive (kind) reactions in the animation in both control and experimental conditions. The subjective evaluation item *kindness* was prepared to verify that point because there is a possibility that the experimental condition, where the behavior of the avatar is considered to be more natural, can convey the intention of the avatar more effectively. The voice of self- introduction was recorded with permission by participants and the voice data were obtained. After two self-introductions, participants answered final questionnaire regarding the effects of practice. In this paper,we will report the result of subjective evaluations of avatars.

RESULTS

The answers for subjective evaluation questionnaire were analyzed and average values were obtained. Fig. 4 shows average scores for *naturalness, kindness,* and *sense of discord/strangeness* in both control and experimental conditions. Although there was no statistical significance, we can see that the experimental condition was evaluated to have more *naturalness* and *kindness*. On the contrary, the controlcondition was evaluated as with higher *sense of discord/strangeness*.

Figure 4
Results of subjective evaluations



In addition, multiple positive comments were found from the optional free comment columns only for the motions in the experimental condition. The answers were originally submitted in Japanese, so theywere translated into English. Notes in parentheses were added by the author:

- It (the experimental condition) was good because there was only little time when the interviewer (the CG avatar) has no reactions.
- I felt that the interviewer was smiling, so it was easy to talk to.
- Somehow the interviewer seemed to be a gentler person (than the control condition).
- The interviewer looked kinder (than the control condition).

These comments suggest that the edited movements and frequencies of avatar's gestures in the experimental condition had positive effects in making impression that was intended, though the motion scenario (negative attitudes gradually change into positive attitudes) was common in both conditions.

CONCLUSIONS

The purpose of this study was to develop an effective CG avatar as part of the development of VR communication training system for practicing formal speeches in small group meetings, assuming situations such as formal career interviews and business negotiations. Focusing on the gestures of CG avatars, we analyzed human behaviors filmed in simulated job interviews and applied the characteristics of the gestures into motions of CG avatars. From the results of the experiment, CG animation of avatar motions based on human behavior analysis were highly evaluated than CG animation of default avatar motions created by an experienced professional CG creator. The experimental conditions received a higher score in *naturalness* and positive feedbacks in optional free comment columns.

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A Systematic Review of Instructional Methods for Integrating Spherical Video-based Virtual Reality (SVVR) into Education

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Abstract: In the past few years, research on spherical video-based virtual reality (SVVR) has been gaining attention thanks to the popularity of 360-degree video and virtual reality technology. Although SVVR has been applied to support various learning activities, no systematic review has been conducted to summarize the SVVR-supported instructional strategies and techniques that can influence teaching and learning. To this end, this study aimed to systematically review the studies published from 2017 about the instructional methods when integrating SVVR into education. On the basis of inclusion and exclusion criteria set, 16 studies were included in the review. Further directions of future studies were provided.

Key words: SVVR, 360-degree video, Virtual reality technology, Systematic review

INTRODUCTION

Life has become more easy-going thanks to technology development and innovation. Similarly, education has also known several changes. For instance, teachers have started to implement online learning thanks to the wide range of applications that technology offers to its users. Mobile devices and virtual reality (VR) have also actively contributed to the improvement of education quality. Prensky (2001) shed the light on the emphasis of integrating technology in teaching contexts. Additionally, Chang and Hwang (2019) indicated that technology-assisted learning is an influential method to incorporate during education for instructors and learners.

VR is a technology-based tool that supplies real-life or simulated environment that students can implement to interact (Ghanbarzadeh et al., 2014). VR can supply learners with various unrealizable settings (e.g., flying with birds, diving with sharks) to virtually experience and understand various

educational situations (Choi et al., 2016). VR helps students evolve more intricate and higher order thinking (Chen, 2016).

However, in spite of the wide spread and implementation of VR seem enjoyable and enthusiastic, it is not easy to equip schools with VR equipment due to its manufacturing costs, and to train teachers and students to use this technology. Several researchers have reported the difficulties and challenges when applying VR to educational contexts in terms of application (Yang et al., 2010) and designing VR-based teaching materials (Merchant et al., 2014).

Recently, with the popularity of 360-dgree cameras, a new form of VR has emerged. Spherical Video-based Virtual Reality (SVVR) stands for a technology that applies 360-degree videos, enabling the users to look around using a smartphone and VR goggles (Rupp et al., 2019), allowing users to have the opportunity to have hand on what they want to see (Calvert & Abadia, 2020). SVVR represents an easy-to-implement technology so as to undergo the same experiential feeling thanks to SVVR's low technique and cost (Vettehen et al., 2019). SVVR has been applied in multiple fields, such as medical care, journalism, and education. As an example, Lin et al. (2019) stated that students with wearable SVVR had higher degree of interest in terms of Novelty and Challenge domains; that students' cognitive load did not increase while they were engaged in a library guide. Furthermore, SVVR shows an immersive environment that simulates the real world, and enables students to interact and be responsible of their own learning (Yang et al., 2010). In addition, SVVR can boost students' motivation and attitudes to deeply engage in learning activities and experience the interaction with multiple virtual characters and objects (Makransky & Lilleholt, 2018). Moreover, SVVR has remarkably helped learners reach significantly high achievement levels (Chang et al., 2019).

Although many studies have already conducted systematic reviews of immersive VR in education (Di Natale et al., 2021; Pellas et al., 2021), few studies have exclusively reviewed studies of SVVR in education. In addition, although SVVR has been applied to support various learning activities, no systematic review has been conducted to summarize the SVVR-supported instructional strategies and techniques that can influence teaching and learning. Therefore, the purpose of this study is to systematically examine and synthesize the prior relevant literature of SVVR in education in terms of the instructional methods embedded within SVVR. Thus, the current study tackled one research question: What were the instructional methods followed by SVVR studies?

RESEARCH DESIGN & METHODS

A collection of the relevant articles was extracted from several electronic databases including EBSCO, ERIC, Web of Science, and Wiley Online Library. The articles published from 2017 were considered. During the search, two sets of keywords was used as following: (1) keywords related to SVVR: "spherical video-based virtual reality", "SVVR", "360 video-based virtual reality", "360 virtual reality video"; (2) Keywords related to education: "education'' , "learning'' and ''teaching''. Therefore, the following query string applied: (spherical video-based virtual reality, OR SVVR, OR 360 video-based virtual reality, OR 360 virtual reality video) AND (education, OR learning, OR teaching). The string was modified in some databases when it is necessary. The last search was conducted on 30 June, 2021.

The search process resulted in 221 studies. After excluding the duplicates, 197 studies remained. The titles and abstracts of these studies were then scanned based on the inclusion and exclusion criteria. This process resulted in 49 studies left. The inclusion criteria were: (a) peer-reviewed journal articles, (b) available in full text, (c) articles written in English, (d) articles on empirical research, (e) articles focused on SVVR in education, and (f) articles focused on well-designed instructional setting. The exclusion criteria were: (a) articles focused solely on SVVR design, development, and evaluation, (b) articles focused solely on video viewing experience as opposed to learners' outcomes. Later, the inclusion and exclusion procedure was applied on the full text so as to come out with the most topic-related studies, and 16 articles finally included in the review.

RESULTS AND DISCUSSIONS

It is important to understand different instructional methods when integrating SVVR into education. An instructional method includes strategies and techniques. On the one hand, instructional strategies are the approaches that instructors make use of to fulfill instruction objectives (Akdeniz, 2016, pp. 57-105).

On the other hand, instructional techniques are the rules, practices, instruments and expertise used to diffuse the instructional strategies (Gündüz, 2016). First, the categories of instructional strategies and techniques are sorted. Then, one or two examples are followed to show the application of instructional methods in SVVR-based learning (Table 1). Besides, learner characteristics considered in SVVR-based learning were also summarized.

1. Instructional strategies

In accordance with the categorization of instructional strategies given by Akdeniz (2016), 16 studies were sorted out into 5 categories: instruction through presentation, instruction through discovery, instruction through inquiry, experiential learning and cooperative learning.

8 studies were guided by presentation strategy. Students were exposed to general knowledge and specific skills, and they had the opportunity to see in detail the SVVR technology-based learning content. Chang et al. (2019) presented two spherical videos about natural childbirth and Caesarean child-birth, while Theelen et al. (2020a, 2020b) provided 360-degree videos to get teacher students exposed to model behavior of expert teachers.

Discovery learning is a self-directed and constructivist strategy that allows learners individually build their knowledge. The teacher is allowed to prepare necessary information without organization for learners. Four studies followed the discovery learning strategy. As an example, learners engaged in four stages: concrete experience, reflective observation, abstract conceptualization and active experimentation; and thus, got inspiration and understood the organization and structure of writing by discovery (Huang et al., 2019; Yang et al., 2020).

Inquiry-based learning is also a self-directed and constructivist strategy, but differs from discovery learning. The former highlights not only the learners' self-reliant role but also instructors' scaffolding. Among the reviewed studies, inquiry-based learning was followed as an instructional strategy only in one study. Jong et al. (2020) put forward a pedagogical framework, named as Learner-Immersed Virtual Interactive Expedition (LIVIE). In this framework, learners used SVVR in immersive and interactive virtual inquiry-based fieldwork for learning physical geography.

According to experiential learning, students can "learn by doing" in various activities based on their individual experience. Two studies were considered to use experiential learning as instructional strategy. Instead of exposing students to already developed SVVR, students were asked to design and develop SVVR by themselves. Students learned natural science and English speaking through hands-on designing SVVR activities (Chang et al., 2018; Chen & Hwang, 2020).

Finally, one study applied cooperative learning. This strategy requires at least two peers work together. Chien et al. (2020) adopted peer assessment within the context of SVVR in English speaking course. Peer assessment is typically a cooperative activity that encourages leaners to evaluate their peers' work. Peer-assessment-based SVVR approach had more potential compared with non-peer-assessment-based SVVR approach in terms of learners' English speaking performance, learning motivation, and critical thinking, along with decreasing their English learning anxiety.

2. Instructional techniques

According to categories of instructional techniques (Gündüz, 2016), 16 studies were grouped in four categories: observation, role-play, project, and workshop. Observation was the most used instructional technique (12 studies). The studies were grouped in this category when leaners only observe digital information. 3 out of 12 studies deployed structured observation, wherein they were able to notice the content with the guidance of instructions. In the virtual environment for resuscitation training, learners explored the surrounding environment. Each video clip presented a variety of action options to the viewer. Learners had to select one of the presented options in the correct order to continue the training (Barsom et al., 2020). Yang et al. (2020) adopted different experience stages in SVVR learning system. There were question clues that assisted the learners to deeply observe the environment.

A study was considering role-play as an instructional technique when learners were asked to act different roles. Chien et al. (2019) claimed that students who played the evaluator's role had higher motivation, critical thinking skills, English speaking performance and lower anxiety.

In 2 studies, project was applied to develop a SVVR learning system. Project is an activity that students plan, control, carry out and assess so as to attain a specific goal (Garcia, 1989). By completing the SVVR project, students understood the terrain topic in natural science course (Chang et al., 2018) and strengthened their foreign language learning (Chen & Hwang, 2020).

Workshop stands for a group of people brought together who share specific interest; cooperate to improve their personal skills and capabilities of a subject via a thorough study, research, practice and discussion (Puri, 2006). In one workshop-based study (Sultan et al., 2019), undergraduate medical students were called to participate in a half-day workshop every week for 6 months. The workshop resulted in raising students' learning interest and motivation and effectively supporting knowledge retention and skills acquisition.

3. Learner characteristics considered in SVVR-based learning

5 out of 16 studies considered the learners differences. Chen and Hwang (2020) proved that cognitive style significantly influenced the English oral presentation and learning motivation. Furthermore, significant interaction effects were found between learning modes (SVVR vs. conventional multimedia) and cognitive style (field dependent vs. field independent) on students' oral presentation and speaking anxiety. Hallberg et al. (2020) found that neither negative nor positive ICT-attitudes changed how students emotionally experienced conventional or SVVR-based lessons. Jong et al. (2020) showed that all the students (upper/middle/lower academic-achieving students) benefited from the SVVR-based learning. Considering gender, one study revealed that women had significantly higher satisfaction rates than men when using SVVR (Sultan et al., 2019). In another study, learning behavior engagement (higher vs. lower) was considered one of learners' characteristics; but did not significantly influence writing performance (Yang et al., 2020).

CONCLUSION

A systematic review of instructional methods for integrating SVVR into education was conducted by reviewing 16 studies published from 2017. The goal of this systematic review is to provide a deep understanding of empirical research on what instructional strategies and instructional techniques are designed to support the teaching and learning process and on what learner characteristics should be considered in SVVR-based learning. The researchers who studying the application of SVVR in education tended to use presentation, discovery, inquiry, experiential learning, and cooperative learning as instructional strategies; observation, role-play, project, and workshop as instructional techniques; and consider learner characteristics such as cognitive style, ICT-attitudes, academic achievement, gender, and learning behavior engagement.

The present study has deepened our understanding of instructional methods in SVVR-based learning. However, it encountered some limitations. First, the studies reviewed were selected only in 4 databases. Some other databases including high quality journals such as Science Direct, Springer, Taylor & Francis can also be utilized in a further study. Second, the reviewed studies did not consider theoretical papers which hinder to know more about theoretical framework of SVVR application in education. Further study can include theoretical articles to explore more instructional methods. Third, this study only focused on the instructional methods in SVVR-supported teaching and learning contexts. Therefore, further studies can focus on students' learning outcomes and features of SVVR (e.g., development tools, viewing tools).

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Table 1

Instructional methods in the reviewed studies

NO.	Study (year)	Subjects	Educational level	Instructional strategies	Instructional techniques	Learner characteristics
1	Barsom et al. (2020)	Medical education	High school	Discovery	Structured observation	-
2	Chang et al. (2018)	Geomorphology	Elementary	Experiential	Project	-
3	Chang et al. (2019)	Medical education	Higher education	Presentation	Observation	-
4	Chen and Hwang (2020)	Foreign language	Higher education	Experiential	Project	Cognitive style
5	Chien et al. (2020)	Foreign language	High school	Cooperative learning	Role-play	-
6	Hallberg et al. (2020)	Teacher education	Higher education	Presentation	Observation	ICT- attitude
7	Huang et al. (2019)	Article writing	High school	Discovery	Structured observation	-
8	Johnson (2018)	Religious studies	Higher education	Presentation	Observation	-
9	Jong et al. (2020)	Physical geography	Middle school	Inquiry	Observation	Academic achievement
10	Repetto et al. (2021)	Foreign language	High school	Discovery	Observation	-
11	Shadiev et al. (2020)	Intercultural education	Higher education	Presentation	Observation	-
12	Sultan et al. (2019)	Medical education	Higher education	Presentation	Workshop	Gender
13	Theelen et al. (2020a)	Teacher education	Higher education	Presentation	Observation	-
14	Theelen et al. (2020b)	Teacher education	Higher education	Presentation	Observation	-
15	Yang et al. (2020)	Article writing	Elementary	Discovery	Structured observation	Behavior engagement
16	Yoganathan et al. (2018)	Medical education	Higher education	Presentation	Observation	-

Development of a Mobile Application Prototype for Adult English Language Learning using the theory of Productive Failure

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Abstract: The purpose of this study is to develop a prototype of an English learning mobile application for adults using the theory of productive failure. As considerable research demonstrated, adult EFL learners feel anxiety about learning and using English as a foreign language; they feel fear of failure to avoid making mistakes. However, learners can achieve some strategies for learning from failure. Unlike the existing English language learning process of presenting-acquiring-applying-understanding knowledge, the theory of productive failure(PF) argues that scaffolded processes can be efficient for short term benefits but for long-term learning gains the initial 'failure' could foster more successful acquisition of the target skills and increases learning effectiveness and maximizes long-term learning. This study aims to develop English language learning application with adopting the key mechanism and the design principles of PF and to conduct the empirical research on this innovative and un-scaffolded processes for sustainable practices in English language learning. This study also explores the possibilities of PF principles to design and develop of application in English language learning. In this study, an initial prototype was developed through prior research review and demand analysis by applying the design and development research methodology. This study was conducted the usability evaluations and summative test of prototypes to see the effectiveness of application in English learning. The findings of this study showed that learners were generally satisfied with most of the items such as usefulness, effectiveness, attractiveness, and ease of use in the evaluations of the effectiveness and perception of the prototype. And it was verified the pedagogical strategies of experience of productive failure was related to the possibility of success in English

language learning.

Key words: Productive Failure, English learning, Mobile Application Prototype

INTRODUCTION

The ability to communicate in English is a must-have capacity to respond to changes in the global era and the age of knowledge and informatization(Ministry of Education, 2015). Indeed, as the latest AI based technologies such as AI speakers, AI chatbots, and voice recognition technologies are developing, the number of English language learners who want to learn the target language via mobile applications has been increasing. In particular, Korean adult English learners with high smartphone accessibility prefer the method of learning English through their mobile applications and have generally satisfactory perceptions about it(Min, Park, & Lim, 2020).

In the existing applications for English language learning, many were designed to foster the EFL learner to practice English based on the 'presentation, learning and applying(PLA)' process. However, the 'PLA' process may lead learners to memorise only what they have learned and apply the expressions which the application presented to learners; for this reason, their 'transfer of the learning' may be limited and the communication in L2 can be easily aborted.

In addition, currently developing applications for English learning tend to pursue learners' successful learning experiences in a short time, and recognize the short-term memorisation as successful learning. This assum can pose the risk of achieving unproductive success by overlooking the learner's effective failure aspects in their learning process; it is necessary to utilise ad consider the characteristics and functions of mobile apps properly for developing more productive and effective learning based on communicative approached.

Therefore, this study aims to develop a prototype of a mobile English language learning application that can help learners participated in their learning process more actively so foster their learning transfer through the learner's failure experience by utilizing the Productive Failure theory(PLT) proposed by Kapur(2008). Productive failure(PF) provides learners with unstructured problem-solving opportunities before learning knowledge in the process of learning, so that they experience their failure in the learning process as one of their productive learning parts. According to Kapur (2008), productive failure experiences can increase learners' motivation to learn, helping them achieve transfer of learning, and facilitate learning. Many studies have also demonstrated the effectiveness of productive failures (Sinha, & Kapur, 2019). Most of these studies, however, have designed and developed the lessons in math and science education, and there are few studies are conducting on mobile applications in English education. Therefore, in this paper, we are exploring the implementation English conversation learning mobile applications by employing productive failure theory(PFT). Thus, the specific research questions of this study are as follows.

First, what is the prototype of the adult English communication/conversation learning mobile application using the productive failure theory(PFT)?

Second, what is the user's reaction to the prototype of the learning mobile application using the PFT?

LITERATURE REVIEW

Incommensurability between performance and learning lies at the core of Productive failure theory(Kapur, 2016). Productive failure refers to a case in which failure is achieved in performance, but learning is achieved through their failures. According to Kapur (2008), solving ill-structured problems before taking early instruction can offer learners experience lots of failure, but these experiences of failures rather increase the effectiveness of learning; learners try to solve problems by using their prior knowledge, and even if they fail, they learn to recognize and supplement their own shortcomings in failure. Kapur(ibid.) defined this as "productive failure". Since then, Kapur (2010, 2012, 2014a, 2014b, 2016, 2017, 2019) and many scholars have studied the productive failure, conducting largely on the utilization and effectiveness of productive failure in mathematics (Kapur, 2008; Kapur, 2019; Park, & Park, 2015), science education (Kapur, 2007), computer programming education (Savelson, 2020), health professions education (Steenhof, Woods, Van Gerven, & Mylopoulos, 2019), cultural learning classes (Zhuang, 2019), bowling classes in physical education (Hung, Chen, & Lim, 2009), and English

education (Song, & Yang, 2019; Xu, 2019). There have also been attempts to combine with class models such as flip learning (Kerrigan, 2018; Song, & Kapur 2017) and STEM education (Liu, Yang, Xu, Zhang, & Wang, 2020; Nachtigall, Serova, & Rummel, 2020). Through these productive failure utilization studies in each educational area, productive failure has led to high level learning compared to direct teaching, allowing learners to derive more diverse solutions and demonstrating the effectiveness of productive failure. As mentioned above, studies have been conducted to verify the effect of productive failure in many fields and aspects, and most of them have obtained positive results for productive failure.

When it comes to the English education, Xu (2019) designed an English vocabulary learning course based on the productive failure design principle of Kapur and Bielczyz (2012), and obtained effective teaching results. In addition, Song and Yang (2019) designed courses that exploit productive failure in the MCSCL environment in order to promote English grammar learning and collaborative problem solving. These studies not only show the evidence that can be used for productive failure in English education, but also show the possibility of the combination of productive failure and mobile devices; the researches focus on the application based on the school class setting environment, targeting K-12 learners. In the fourth industrial revolution era, the importance of using technology in educational sector and the life-long education are emphasized. Therefore, this paper aims to design and develop English language learning applications using the theory of productive failure to propose the prototype of mobile applications for adult English language learners.

RESEARCH DESIGN & METHODS

1. Procedure

As this study aims to design and develop a prototype of a mobile application utilising the productive failure theory for adult EFL learners to help them learn and practice English conversation, the research procedure's following the design and development research methods suggested by Richey and Klein (2005). The detailed research procedure is as follows <Table 1>.

Table 1

Research Procedure

Procedure	Details Contents
Analysis	▪ Prior literature analysis ▪ Learner needs analysis
↓	
Prototype design	▪ Derivation of prototype design principles. ▪ Prototype interface, structure, contents design.
↓	
First prototype development	▪ First prototype development ▪ Expert validation
↓	
Usability evaluation	▪ Survey ▪ Interview
↓	
Final prototype development and satisfaction survey	

2. Prior literature analysis and Learner needs analysis.

For the prior literature analysis, by using RISS (http://www.riss.kr/index.do) and Google Scholar Service (https://scholar.google.co.kr/) prior literatures were searched with keywords such as “Productive Failure”, “English Conversation”, “English Learning”, “ Adult English Learning”, “English Mobile Application”, and “English Application”. In addition, for the learner needs analysis, online questionnaire for adult English learners are conducted. Based on the survey results, the persona technique was applied

to create a learner's profile, and five interview subjects were selected by referring to the characteristics shown in the learner's profile. In-depth interview with the five participants was followed.

3. Prototype design

After synthesizing the survey results, in-depth interview results, and prior literature analysis results, the design principle of a mobile application prototype was derived. For the development of the first prototype including basic interface, core functions, and flow charts between functions were designed using PowerPoint.

4. First prototype development

Based on the initial prototype design, the specific interface, structure, and learning flow and contents of the mobile application were implemented by using 'AXURE'; each button was linked so that users can actually experience the functions of it. And then, we design the expert validation for reviewing whether the design principle was well reflected in the prototype design with five experts. The experts are consisted of theoretical expertise and practical experience in the productive failure design; two are Educational technology experts, other two are English teachers, and one computer science expert's participated. The first prototype was derived by reflecting on the opinions of experts.

5. Usability evaluation

For the usability evaluation of the first prototype, a questionnaire and interview paper was developed by modifying the Honeycomb Model proposed by Morville(2005). From the 7 evaluation factors the original Honeycomb Model, some suitable factors of a questionnaire was developed by extracting useful, usable, accessible, and desirable factors for conducting survey and interview according to the purpose of this study. For the usability evaluation, six adult learners were participated; for the details of the participants and the procedure, see <Table V-2>. Based on the results of usability evaluation, we modified the prototype and derived the final prototype.

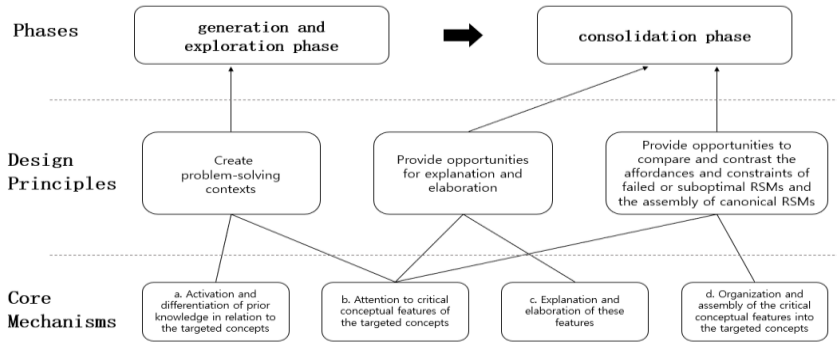
RESULTS

1. Design principles and guidelines

Regarding design principles for productive failure, Kapur and Bielaczyc (2012) proposed "two phases, three design principles, and four core mechanisms" through a long-term study of PF.

Figure 1

The design principle of productive failure by Kapur and Bielaczyc (2012)



Based on the design principle of productive failure of Kapur and Bielaczyc (2012), the design principles and guidelines for adult English conversation learning mobile application using productive failure were derived. The design principles consisted of 4 design principles and 13 specific prescriptive guidelines (see <Table 2>).

Table 2

Design principles and guidelines for prototype of adult english conversation learning mobile application using productive failure

Design principles	Guidelines
1. Present moderately complex problems	1.1. Consider the learner's prior-knowledge level and present a challenging problem that the learner can solve.
	1.2. Present interesting problems that fit the characteristics of the learner.
	1.3. Present problems that are relevant to real-life contexts.
2. Provide opportunities for reflection	2.1. Provide conversational text.
	2.2. Provide ample time for reflection.
	2.3. Provide search, underline, and memo functions for conversational text content.
3. Provide an opportunity to compare different solutions	3.1. Provide standard conversation.
	3.2. Use color differences to provide feedback on your painting practice.
	3.3. Give learners the opportunity to revisit or supplement their conversational content.
4. Provide a safe browsing environment	4.1. When the learner's negative emotions occur in the process of problem solving, give the learner confidence to solve the problem.
	4.2. Provide messages of encouragement to productive failure experiences.
	4.3. Provide a space to ask questions about things you don't know.
	4.4. Share your learning results with other users through social media, blogs, etc.

2. Mobile application prototype

1) The first prototype

An initial prototype was derived by reflecting the design principle of the adult English Conversation learning mobile application using the productive failure developed through the literature analysis and needs analysis results. The prototype was developed using AXURE. The prototype consisted of three parts: Conversation, Conversation Record View, and Question (See <Table3>).

Table 3

Contents of the first prototype

APP Structure	Contents
Conversation	1. Talk about today's topic. → 2. Check the conversation contents. → 3. View standard conversation records. → 4. Editing conversation contents. → 5. Share today's lessons.
Conversation Record View	Check the existing conversation records by date.
Question	Ask questions about things you don't know tutor will provide answers.

2) Results of the usability evaluation

For the usability evaluation, some processes including observation of the process of using the prototype by users, and gathering the results of questionnaire and interview were conducting and the results are as follows. First, it is necessary to design to offer various problem situations so that learners can select. Especially for adult EFL learners, offering autonomy of learning can be desirable, so learners select the content they want to learn from the various themes and situations. Second, when providing feedback, offering some example sentences are helpful for learners to understand the feedback. One reviewer said that it was difficult to understand the feedback without the examples. Third, in the phases of Conversation, considering the learning environment using mobile device, featuring difficulties of typing is needed; it is necessary to devise an efficient way of editing in a mobile learning environment in order to confirm the standard conversation and to modify the existing conversation contents. Fourth, it is necessary to add a dashboard page, which allows learners check their learning information. Users wanted to see their learning data and progress from the meta level in their learning. And finally, there was a request to modify buttons: names, size, location, etc. for enhancing users' comprehension and convenience.

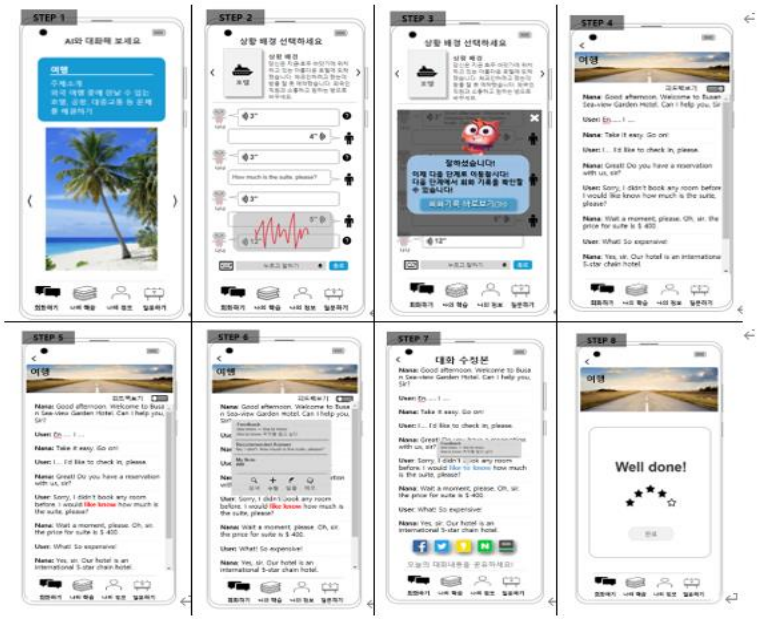
3) The final prototype

Based on the results of the usability evaluation, the final prototype of the adult English conversation learning mobile application was derived. The final prototype consisted of four main contents: Conversation, My Learning, My Information, and Asking Questions. In Conversation, learning themes such as travel, exercise, and work situation are provided for adult learners. After selecting a topic by

learners, problem-situations related to the topic are presented and the learner conducts a conversation with the agent based on the situation s/he selected. If there are any difficulties in the conversation process, learners can click the question mark in the upper right corner to get a hint related to the conversation. In the progress of the conversation, the agent takes into account the user's emotions and leads the conversation with some words of encouragement. After having the conversation with the agent, when the learner clicks the end button, the guide for the next reflection step is presented. Then s/he can see the recorded contents of the user's conversation converted into text. In this process, the user rechecks his or her conversation record, so the learner figure out what he doesn't know and what he needs to learn more about. And if clicking the “Feedback” button, some inaccurate parts of the conversation are marked, and feedback with examples is provided. In addition, if a user clicks the “Edit” button, the content he want to edit by reflecting the user’s opinion of conveniently modifying the user’s conversation record in the first usability evaluation is immediately changed to an accurate expression. After self-checking and correcting all the last contents, learners can share the contents through their SNS.

Figure 2

Learning Procedures in Conversation



All conversation records in Conversation can be checked right away when a learner goes to Classification by Subject in My Learning. And the learners are able to see their learning data and check the learning progress through 'My information'. If you have some questions, learners get to know by clicking 'Ask' button. When a learner posts a question, tutors will answer it immediately. The final prototype is shown in [Figure 3] below.

Figure 3
The final prototype

4) User satisfaction

Based on the result of the final prototype, a satisfaction survey was conducted. The satisfaction questionnaire was constructed using a Likert 5-point scale focusing on factors of prototype such as interface design and usability, intrinsic function, learning content, learning procedure, and verbal expression. According to the survey results, users gave a rating of 3.67 to the design of the interface, were satisfied with the prototype overall with a rating of 4 or higher in other content aspects and perceived the learning content and learning process to utilize productive failure positively.

Table 4
Results of user satisfaction survey on the final prototype

Questions	M	SD
1. Are you satisfied with the prototype overall?	4.50	0.50
2. Are you satisfied with the design of the interface of the prototype?	3.67	0.44
3. Are you satisfied with the usability of the prototype interface?	4.33	0.44
4. Are you satisfied with the intrinsic features of the prototype?	4.33	0.44
5. Are you satisfied with the learning content of the prototype?	4.67	0.39
6. Are you satisfied with the learning process of the prototype?	4.83	0.28
7. Are you satisfied with the linguistic representation of the prototype?	4.83	0.28

DISCUSSION

This research has developed an English conversation mobile application using the productive failure theory in order to improve the English conversation ability of adult English learners in the EFL environment. This study explored the application of productive failure theory in English conversation education, and tried to apply it to mobile application design. Through the research, the theory of productive failure can also be fully utilized in English conversation education, and is suitable for mobile application design. Participants of this study showed their satisfaction with a positive response to it.

Several implications from the research and development of the prototype of mobile application that used productive failures are as follows: First, the situation of productive failure should be set according to the actual context of the learner to increase their motivation. Since the key to the occurrence of productive failure is the problem situation, it is important to set appropriate problems in consideration of user characteristics and contextual factors when using productive failure. Thus various problems will be prompted to allow users to select according to their cognitive levels and interests. It is also important to ask questions of interest to the learner(Kapur, & Bielaczyc, 2012). In addition, adult subjects have a high level of cognition, and most of them contain basic knowledge of English, so they are able to judge and choose their own weak learning content. Therefore, it is possible and suitable for mobile applications to provide customized learning contents by presenting a variety of problem situations considering the diversity of adult learners allowing them to choose independently.

Second, after having a conversation with the agent, the learners should review the process of experiencing productive failure and take opportunities to reflect on their learning. Through these

processes, the next learning goals an be clear and it is important to have enough time to strengthen their learning and approaches (Zhu, Zou, 2019).

Third, mobile learning applications are an online environment where specialized teachers are not available. Therefore, feedback with details of their learning can be crucial, and opportunities and ways where learners can communicate with experts and/or teachers should be provided. In addition, according to the theory of productive failure, teacher's scaffolding is an important part of the stage of integrating learning content. In the mobile environment, the teacher's support must be integrated into the learning of adult learners.(Sinha，& Kapur, 2019）

As the limitation of this research, because designing and developing the application through this study is the prototype level, not an actual application software development, it is difficult to set the formation evaluation setting of the actual application of the software; verification of the effectiveness using the actual application program is insufficient. In addition, as conducting with a limited number of adult learners, difficulties of covering and considering the different traits and characteristics of adult learners with different learning backgrounds are limited. Therefore, through the purposeful sampling, a variety of participants should be invited for the future research to improve the prototype with varieties of results of research for adult learners. Furthermore, it is necessary to develop actual applications on the basis of design and development principles which this study suggested, and to verify the effects of mobile applications using productive failures pedagogical theory in the future.

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What Does the Process Look Like?: A Conceptual Framework for Designing a Virtual Simulation & Simulator for Employee Performance Development

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Abstract: Innovations in digital, interactive learning resources are being increasingly produced for online learning or e-learning (Wang, Liu & Yu, 2020) and one area growing, as a result of the increase in learning resources is computer-based simulators (Whitworth et al., 2018; Moosvi, 2019). Interactive computer simulators for education can offer similar, traditional hands-on opportunities for learners to perform learning activities. However, less is known about the design process for simulator creation using productive failure, as an instructional strategy, for employee performance developing. A conceptual framework using a mixture of DBR models offers a new perspective into the simulation and simulator design process. Simulator designers should consider end-user and organizational contexts, engage in multiple cycles of review and development, and consider integrating a range of experts to enhance the design and development process.

Key words: Simulator, Design, E-learning, Performance, Productive failure, Simulation

INTRODUCTION

Simulation-based learning is an instructional tool benefitting from digital advancements (Whitworth et al., 2018). One benefit of simulations are practice opportunities (Diwakar et al., 2015), as requiring individuals to engage in real-life problem solving without expert guidance and preparation can be problematic (Chernikova et al., 2020). Providing individuals ample practice opportunities that serve to reduce complexity can not only avoid confusion but also serve as valuable learning or teaching resources (Grossman et al., 2009; Chernikova et al., 2020). Interactive virtual simulations for performance practice can offer similar, traditional hands-on opportunities for learners to perform learning activities (Wästberg et al., 2019) and allow individuals to engage in the learning process (Diwakar et al., 2015). Virtual simulations have been used across industries. For example, the medical education field, in particular, has leveraged simulators and virtual reality laboratories to mitigate resources (i.e. logistical support, coordinated training times, training site availability, etc.), and simulators have also been used in other workforces to either recreated low-frequency events (i.e. mechanical failure), dangerous situations (i.e. law enforcement), or time-specific (i.e. weather-related conditions) (Carruth, 2017). Virtual simulations can particularly be a cost-saving by promising a safe and controlled environment for learners to practice applying skills (Carruth, 2017). While research suggests that virtual simulators can provide meaningful learning opportunities via knowledge application practice for performance (Grossman et al., 2009), the use and function of virtual simulations varies across fields. This paper defines simulation in light of the educational field. That is, a simulation is defined as a tool that replicates real-world characteristics of either an event or situation (Beaubien & Baker, 2004). Whereas, a simulator is defined as a specific type of technological tool (hardware and/or software) that individuals must interact with either physically or virtually. While research suggests a variety important elements for simulations including real-world situations (Davidsson & Verhagen, 2017), genuine interaction (Chernikova et al., 2020), real or virtual objects and persons (Chernikova et al., 2020), and infusing critical thinking and problem solving elements (Chernikova et al., 2020), less is known about the value of instructional support embedded into simulation. In a meta-analysis, scholars found mixed results related to the benefits of scaffolding as a method of instructional support in simulation (Chernikova et al., 2020). Only small effects were connected to scaffolding (Chernikova et al., 2020). It was also noted that, overall, there is limited research on designing simulations in relation to instructional strategies (Chernikova et al., 2020). One intriguing area of research on instructional strategies is productive failure. Research on productive failure suggests its value for

exploration and developing problem solving (Kapur & Lee, 2009; Schwartz & Martin, 2004). One quasi-experimental study with 140 participants found that individuals can solve problems through initial failure (Kapur, 2010). While this study focused on high school mathematics courses, it is intriguing to explore productive failure in the design of a virtual simulation. Research is needed on different courses using productive failure and simulation-based learning (Cernusca & Mallik, 2017).

Productive Failure

Several scholars have argued that discovery learning techniques are altogether ineffective when compared to direct instruction (Kirschner et al., 2006; Chen & Klahr, 2008), while other studies have found that productive failure can be a valuable strategy for learning (Kapur, 2008; Koedinger & Aleven, 2007). Research on product failure focuses heavily on two phases – knowledge and exploration. In both phases, prior to direct instruction, the goal is to expose students to problems but not expect them to successfully or completely solve them (Kapur, 2008). In fact, a quasi-experimental study with direct instruction and productive failure groups, it was found that designing productive failure performance conditions for the productive failure group, in their initial learning phases, lead to more productive learning experiences long term (Kupar, 2008). When designing an intervention for productive failure, research suggests that activities should be integrated to activate and differentiate prior knowledge regarding the topic of study and also target critical features of topic (Kapur, 2008). Other studies have also reinforced the value of productive learning for increasing problem solving competences (Song, 2018), procedural knowledge (Song & Kapur, 2017), curiosity (Kerrigan, Weber, & Chinn, 2021). One meta-analysis study exploring simulation and productive failure found that learners experienced negative feelings while making mistakes in a simulation (Palominos et al., 2019). Although, these feelings were mitigated with facilitator guidance on the value of lessons learned from the errors (Palominos et al., 2019). Research on productive failure and simulation mostly highlights outputs of simulation end-users, but little research is available on simulation design elements coupled with productive failure as an instructional strategy (Chernikova et al., 2020) for employee performance. One study identified the need for more research on design criteria when creating educational simulators (Badiee & Kaufman, 2015); hence, exploration in this area is needed.

Design-Based Research

Design-based research (DBR) is a research methodology that includes a number of iterative phases (Mafumiko, 2006). While there are several DBR models (i.e. Reeves, 2000; McKinney, 2001; Wademan, 2007; Mafumiko, 2006) that illustrate the design and development process, almost all models follow the same overarching yet cyclical phases: 1. Analysis and exploration, 2. Design and construction, and 3. Evaluation and reflection (Sahasrabudhe, Murthy & Iyer, 2012). While popular models follow the three stages and address educational research problems, each model emphasizes different parts of the DBR process (Sahasrabudhe, Murthy & Iyer, 2012). For example, Reeves (2000) focuses on refinement of the intervention during every feedback stage, but provides little clarity on research cycles; Wademan (2007) illustrates stakeholders at different stages but does not include information about participant size; McKenney (2001) provides a detailed number of participants, but does not mention stakeholders; and, Mafumiko (2006) illustrates various stakeholders but does not illustrate design guidelines for creating a prototype (Sahasrabudhe, Murthy & Iyer, 2012). Adapting segments of each model might fill in the gaps and provide a more holistic design approach for a virtual simulation and simulator.

Purpose and Context

The purpose of this article is to illustrate a conceptual framework for creating a virtual simulation and simulator tool with a productive failure strategy using a mixture of elements from four DBR models (Reeves, 2000; McKinney, 2001; Wademan, 2007; Mafumiko, 2007). Addressing the call for more scholarship on productive failure and simulations, this project also seeks to provide a roadmap for simulation creation for employee performance development. During 2020, the COVID-19 global pandemic unexpectedly forced corporate workforces online (Torrance, Bozarth & Jackson, 2020). This shift online also impacted learning and development organizations, as traditional-based learning settings transitioned to asynchronous, synchronous, or hybrid formats (Torrance, Bozarth & Jackson, 2020). Not surprisingly, the pandemic has increased the interest and use of e-learning (Gamage, 2020) and virtual simulations (Correa, 2020). This interest in emerging technology has expanded to a variety of fields (Torrance, Bozarth & Jackson, 2020). With the potential to engage in practice within online spaces, virtual simulations and simulators might benefit employee performance development. Drawing from

literature on simulation principles, productive failure theory, DBR models, and practitioner experiences, the following illustrates a conceptual process on strategies to design a virtual simulation and simulator.

CONCEPTUAL DESIGN PROCESS FOR SIMULATION

The following sections detail the components a conceptual framework for virtual simulation and simulator design using a DBR process. Refer to Appendix A for a visualization of the framework.

Phase 1. Analysis & Exploration

Several areas of analysis and exploration should be conducted in this phase to identify practical problems. This phases' output should include a detailed context analysis and expert opinions (Mafumiko, 2006) to assist in selecting an intervention that solves practical problems and not the other way around.

Front-end analysis of practical problems

Performance, cause, content, task, and end-user analysis – Conducting a performance and cause analysis provides a structure to understand the problem and uncover root-cause performance gaps. End-users (i.e. employees and practitioners) and internal and external stakeholders should be identified and involved in this part of the analysis, as they are often key holders of information. Questions should uncover evidence related to the problem and cause of the problem as well as performance gaps (Chyung, 2008; Harless, 1973). An evaluation of existing materials to identify potential gaps should also be conducted (Vanderhoven et al., 2016). Workplace conditions that end-users operate in and the tasks that they are required to perform can help to more accurately diagnose the problem and experiment with initial design solutions. Managers and end-users are ideal to collect data for organizational data. Refer to Appendix B for more details on performance, cause, content, and tasks analyses. Lastly, end-user or learner analysis is important to the work of designing. When designing for a particular environment, it is essential to obtain as much information from the end-users as possible, rather than relying on assumptions (Fulgencio & Asino, 2021). The focus of this type of analysis is to identify end-user characteristics, work experience, needs, etc. Refer to Appendix C for more details on end-user analysis.

Identify plausible solution(s)

Based on the results of the front-end analysis, identify one or more initial intervention solutions to meet the needs of the organization and end-users and also represent and address the problem identified. Per Wademan's model, this process should be done in collaboration with experts and practitioners (Plomp & Nieveen, 2007) and be iterative, as needed. When determining plausible solutions, technology (hardware and/or software) as well as end-user and practitioner access to required technology should be considered. A virtual simulation and simulator might appropriate in situations where there is a low-frequency of events, when resources need to be mitigated, when use-cases are time-specific (Carruth, 2017), or when preparing for performance on-the-job could lead to consequences (Chernikova et al., 2020).

Review literature

Once a plausible intervention is identified (i.e. virtual simulation), a focused literature review should be conducted to select appropriate principles for creating the intervention (Mufumiko, 2007; Sahasrabudhe, Murthy & Iyer, 2012). Principles related to important interventions should be identified. For example, simulation areas of interest should be explored (i.e. type, technology, interaction, duration [Chernikova et al., 2020]) as well as productive failure principles (i.e. knowledge and exploration phases [Kupar, 2008]). Virtual simulations can be completely immersive in a VR environment, or could include a mixture of role-plays while using a simulator to complete a series of actions or tasks (Chernikova et al., 2020), there are a number of options for simulation design and purposeful consideration is needed to create a simulation that aligns to the practical problems identified.

Phase 2. Design & Construction

The information in this phase was written based on the assumption that the results of Phase 1 indicated virtual simulation (scenario) and simulator (technological tool used for interaction in simulation) were valuable design solutions. There are several important areas related to design and construction that should be considered in this phase. These areas include the initial design elements, prototype

development, expert-review cycles, and number of iterations. This phase is the largest and most concentrated of the simulation project. There are outputs of this phase including focused literature review with clear-cut design principles and expert review used to develop the simulation.

Design an intervention map

Intervention or curriculum mapping is a strategy used to design and link outcomes with relevant learning materials (Harden, 2001). Creating a high-level intervention outline that focused on mapping the overall intervention goals and specific learning outcomes (LOs) and intervention materials can make proposed design solutions transparent for stakeholders, management, and expert review. A well created LO should integrate learner needs, produce achievable actions, and connect with organizational goals. A curriculum map should also demonstrate a link between the LOs, assessments, activities, instructional materials (Harden, 2001) and institutional or organizational goals. Learning objectives should be integrated into the map and directly connect to addressing employee performance gaps. The focus of the map should include details on the virtual simulation and relevant instructional materials, activities, and assessments related to the simulation. Refer to Appendix D for more details on designing intervention or curriculum maps.

Complete a review cycle with stakeholders

Obtaining stakeholder (i.e. management, experts, other stakeholders) approval can be an important element to any type of intervention. The point of review in an intervention development can vary, depending on need and function (i.e. Mufumiko, 2006). However, providing transparency early in the design process can help stakeholders gain a clearer picture of the initial solutions of the intervention (Harden, 2001). Relevant feedback should be integrated or considered before moving to the next step.

Outline design principles and functions

To ensure the identified design principles and theories are integrated into the simulation, an outline of strategies for use and function should be created prior to simulation development. This includes theoretical educational principles as well as principles specifically drawn from productive failure. Refer to Appendix E for an example of a design principle outline.

Curate real-world scenarios

Real-world scenarios are a major component for simulation design Chernikova et al., 2020). End-users or experts (i.e. previous end-users, practitioners, managers, etc.) can be valuable resources to curate real-world examples and should be levered to obtain real-world scenarios. Consider end-user (local or global) in scenario curation to align scenarios with end-users culture, language, policies, and practices.

Develop first prototype

Review *and interpret data for design* - Leveraging data collected during Phase 1 and elements collected in Phase 2, an intervention (i.e. simulation) should be developed. For example, the development of a simulation can take a variety of delivery formats (i.e. virtually-based or classroom-based or hybrid), require a range of elements (duration, authenticity, tools, etc.), and focus on one or a variety of tasks or actions (i.e. written feedback, communicative responses, diagnoses, troubleshooting, etc.) to achieve the desired outcomes (Chernikova et al., 2020). Informed decisions should be made, based on data, to develop a prototype or intervention.

Design/develop prototype – A simulation is defined as a tool that replicates real-world characteristics of either an event or situation (Beaubien & Baker, 2004). When considering productive failure and simulation development, it is clear that a simulation should be provided to end-users prior to direct instruction. Yet, there are a variety of options that might be experimented on with the simulation. In simulation-based learning, it is important for learners to complete a cyclical process of action, feedback, debriefing, and modified action, which aligns with the theory of productive failure (Dieker et al., 2014). While high-fidelity is not always required, what is critical is designing a simulation that show-cases real-life situations (Chernikova et al., 2020) and offers personalization by offering a flexible learning environment (Dieker et al., 2014). Other than specific items related to the medical field, Issenberg, McGaghie, Petrusa, Gordon, and Scalese's (2005) study recommended that a simulation contain opportunities for feedback, repetitive practice, be purposefully integrated in a curriculum, offer a range of difficult levels, safely experiment without consequences, and contain well defined learning outcomes. Once the simulation design is defined, begin developing either using a document, web-based or preferred tool for simulation prototype creation (Plomp & Nieveen, 2007). Relatedly, simulators seem to make a

difference in simulation studies, but more research is needed in this area (Chernikova et al., 2020). A simulator is defined as a specific type of technological tool (hardware and/or software) that individuals must interact with either physically or virtually (Chernikova et al., 2020). The technological need should also be considered, whether the simulator should be screen-based or not (Chernikova et al., 2020). Virtual simulators can be low or high fidelity, depending on the degree of authenticity required (Chernikova et al., 2020). If a virtual simulator is used, this might expand options for productive failure strategies. For instance, the timing of productive failure and facilitator of guidance or feedback could be interesting to experiment with in a virtual simulator. Feedback and guidance might be provided by: a virtual agent or condition within the simulator, a practitioner (Chernikova et al., 2020), or a mixture of both. Feedback and/or guidance could be provided after several incorrect steps, at the end of the simulation, or after the simulation and direct instruction. This is an ideal opportunity for iterations and collaboration based on feedback from experts, practitioners, and different end-user groups to determine ideal feedback agent, timing of feedback, among a number of other factors. Once the simulator design is defined, begin developing either using a document, web-based or preferred tool for simulation prototype creation (Plomp & Nieveen, 2007). Refer to Appendix F for more details initial processes for design and development.

Quality criteria - Quality criteria is also important in the design of a prototype. There are three criteria areas for prototype design: validity, practicality, and effectiveness (Nieveen, 1999; Mafumiko, 2006). Validity is defined by three areas: content validity - prototype based on knowledge, construct validity - linking of components in prototype, and task validity - prototype contains real-world practice (Mafumiko, 2006). Practicality is defined as the degree of usability of the prototype, and effectiveness is the degree alignment with the intended learning outcomes (Mafumiko, 2006). Arguably all three elements should be included in the development process.

Review and revision cycles with experts and end-users

Engage in iterative cycles and document feedback – Consistent with DBR research, the designed prototype should complete a series of cyclical iterations with different user groups (Reeves, 2000; Wademan, 20007; Mafumiko, 2006). Following Mafumiko's (2006) iterative cycle of four prototype versions reviewed with experts and learners seems to be a best practice when designing a new prototype. Given the fluid nature of DBR, it review cycles are expected to have a degree of flexibility and evolution (Kennedy-Clark, 2013). Duration of review cycles and amount may be contingent on project timeline. That said, documentation and integration of feedback is critical in the review cycles and prototype iterations, and the number of prototypes may differ depending on project duration. Regardless, detailing is central to this point and revisions serve to produce results of iterative evolution (Vanderhoven et al., 2016). Once reviews are completed, finalize the prototype for larger scale implementation. Refer to Appendix G for more details on prototyping cycles documentation processes.

Expert type and amount – The amount and type of experts might vary. One DBR study suggested including a variety of different kinds of users/experts (Sahasrabudhe, Murthy & Iyer, 2012). A strategy to determine type of experts is to consider the prototype evaluation criteria: content validity, construct validity, task validity, degree of practicality, and degree of effectiveness. Identifying individuals for both the virtual simulation (scenario) and simulator (technological tool) based on content or topic expertise; process, action, or task expertise; usability (UX) expertise, practical and real-world situation expertise, media or technological (hardware/software) expertise, and instructional design (LX) expertise might be beneficial in the review cycles. Internal or external stakeholders might also be valuable to incorporate in the review. Three experts (Mafumiko, 2007) may or may not cover the range of knowledge and skills needed to provide feedback based on the aforementioned items. Documenting the type of expertise involved in each review and the number of experts is valuable for increased transparency and better identifying function and feedback of experts (Sahasrabudhe, Murthy & Iyer, 2012). Similarly, conducting reviews with end-users is also a popular practice in DBR studies, and the number of end-users and implementation within each or specific review cycles may depend on scope and access to participants (McKenney, 2001; Mafumiko, 2007; Plomp & Nieveen, 2007). End-user participants might be asked to try out portions or the entire simulation (Plomp & Nieveen, 2007). Nevertheless, the number of end-user participants and cycles of review they participated in should be detailed (Sahasrabudhe, Murthy & Iyer, 2012).

Expert review strategies – Review or evaluation cycles can increase the quality of a prototype (Mafumiko, 2006; Sahasrabudhe, Murthy & Iyer, 2012). These cycles might be conducted asynchronously [i.e. surveys, questionnaires, diary, etc.] or synchronously [i.e. live review, interview, observation, etc.], or individually or in groups, depending on nature and scope of simulation and

simulator and availability of experts and end-users as well as stakeholder preference (Plomp & Nieveen, 2007). Regardless, experts should be purposefully select and participate in a number of review cycles (Plomp & Nieveen, 2007).

Phase 3. Evaluation & Reflection

Review and reflect on feedback from users

Reflection, post-intervention implementation, invites critical inquiry and analysis (Reeves, 2000). It also provides an option to explore how the intervention worked with an increased scope. Timelines may vary in this phase. Feedback might be collected and analyzed after several weeks or months, depending on end-user scope and evaluation methodology. There are several popular employee performance evaluation models used across organizations and industries. Kirkpatrick's model is, arguably, one of the most popular (Peck, 2019). Generating evaluation that collects data on end-users reactions, learning, behaviors, and results might be a value strategy in considering employee performance development. This form of evaluation can also assess LOs and determine alignment with organizational needs. After gathering and reflecting on feedback, creating a report on employee feedback and performance outputs can be a valuable, as organizations often require data to justify return on investment [ROI] (Leone, 2020).

Identify design principles

Making a theoretical contribution is a core part of several DBR models. This section can include design guidelines (Reeves, 2000), models (Wademan, 2007), design principles (McKenney, 2001), or final project with empirical data (Mafumiko, 2007). Arguably, empirical research on virtual simulation and simulator might benefit from highlighting one or all four options for theoretical contribution.

Iterate further

Based on the feedback received, further prototype iteration may or may not be necessary. Other types of iterations in this stage could also be related to language translation, globalization, or prototype expansion.

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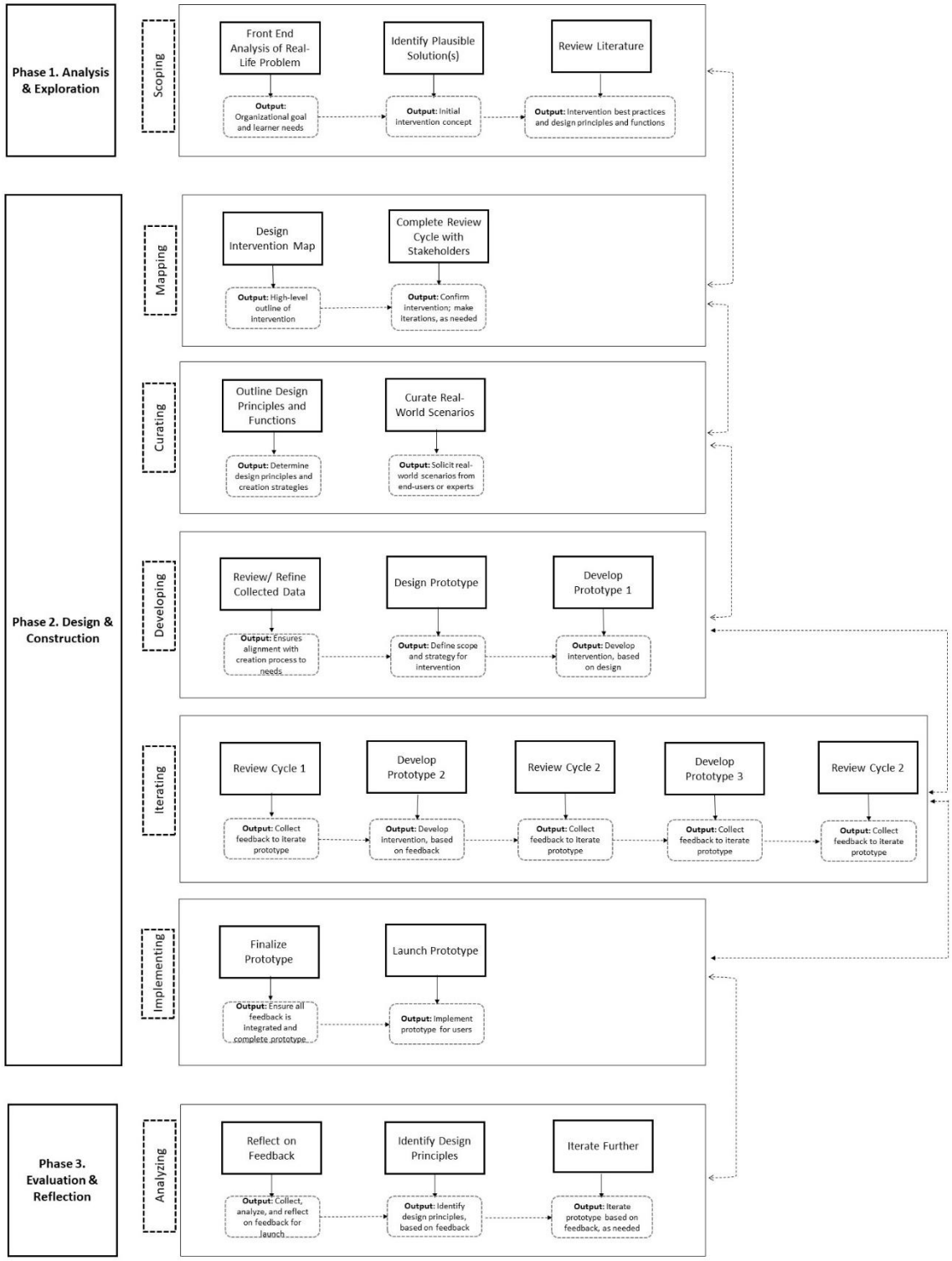
APPENDIX A

This model was adapted by four DBR models (Reeves, 2000; McKinney, 2001; Wademan, 2007; Mafumiko, 2007), and integrates practices for IDs across industries. Each phase is iterative constant movement between the phases is expected.



APPENDIX B

End-users and internal and external stakeholders should be asked a variety of questions to uncover information about the problem and potential performance gaps. A variety of data collection instruments can be used to collect this type of data (i.e. surveys, focus groups, semi-structured interviews, etc.). Table 1 was adapted from Chyung (2008).

Table 1

Front-End Analysis with Questions

The HPT Model (Van Item, Moseley, & Dessinger, 2004)	**Front-End Analysis Questions** (Harless, 1973; Dick, Carey & Carey, 2009; Fink, 2003; Herzberg, 1968)
Performance Analysis	Do we have a problem? Do we have a performance problem? How will we know when the problem is solved? What is the performance problem? How frequently does the task need to be performed?
Cause Analysis	What are the possible causes of the problem? What evidence bears on each possibility? What is the probable cause?
Needs Analysis	What is/are the intervention's instructional goal(s)? What gap in knowledge or skill does the intervention fulfill? How does the course integrate with the organization's or institution's goals? What are the skills and knowledge that students need to achieve the course's goal(s)? What is the nature of the subject? Are there currently any interventions related to the topic? What is missing, if anything, with the current interventions?
Task Analysis	What tasks are performed? How frequently are they performed? How important is each task? What knowledge is needed to perform the task? How difficult is each task? What kinds of training are available?
Organizational Analysis	What performance policies and expectations are in place? What type of supervision and support is offered? What type of interpersonal relationships building opportunities are available? To what extent is job security available? What motivational factors are offered (i.e. recognition, growth, advancement, etc.)?
Resource Analysis	What resources are available (technology, team, access to experts, etc.)? Should we allocate resources to solve the problem?

APPENDIX C

End-users should be asked a variety of questions to uncover information their characteristics and prior knowledge (Fulgencio & Asino, 2021). Depending on organization or institution, it may or may not be appropriate to ask demographic information. Before collecting demographic information, first ask yourself: Why are these demographics important for the material you design? A variety of data collection instruments can be used to collect data for the end-user analysis including surveys, interviews, focus groups, etc. Table 2 information adapted from Fulgencio and Asino (2021).

Table 2

End-User Analysis with Questions

Components of End-User Analysis	Questions for End-Users (Learners)	Questions for End-Users (Practitioners)
End-User Characteristics (Adams Becker et al., 2014; Dick et al., 2009; Jonassen et al., 1999; Fink, 2013)	Who are the learners? What personal characteristics do these learners possess? What are the dimensions of the learner? What contributes to the reason for learning about the topic? What is the reason for enrolling in the intervention/course? What is it about the topic that motivates the learner? How comfortable are learners with technology?	Who are the practitioners? What beliefs and values does the practitioner have about teaching and learning? What strengths in teaching does the practitioners have? What time commitment can the practitioners give to intervention development? How familiar with various technologies and delivery modes are the practitioners? How comfortable are practitioners using technology?
Prior Knowledge (Ambrose et al., 2010; Cordova et al., 2014; Dochy et al., 2002; Umanath & Marsh, 2014)	What do learners already know? How might this information contribute to the content and order of what is taught?	What level of knowledge does the practitioner have with the topic/subject? To what extent are the practitioners comfortable teaching the content/topic area?
Demographics (Young, 2014)	Where are the learners coming from in terms of their education level, ethnicity, demographic, geography, culture, hobbies, area of study, educational level?	Where are the practitioners coming from in terms of their education level, ethnicity, demographic, geography, culture, hobbies, area of study, educational level?

APPENDIX D

Curriculum maps are valuable tools to create initial solutions and share with stakeholders. These types of maps increase transparency and offer a broad overview for management and SME review. Refer to the following example of initial design solutions (Table 4) for an example of scoping initial design solutions. Once initial design solutions are decided, create a curriculum map to create a high-level outline of the initial design solutions. Table 5 provides an example curriculum map template adapted from Harden (2001).

Table 4

Initial Design Solution Questions

Initial Design Questions	What constraints are present? What type of intervention should be most valuable, given the end-users needs and business needs? What modality of intervention options are available? And, what modality of intervention would be most v aluable, given the needs of the intervention? What resources are available to build this intervention? What is the timeline for this intervention? What type of interventions can realistically be created, given the timeline?
Goals	What are long-term knowledge or skills that your end-users need? What broad knowledge or skills should your end-users be able to do or perform? What action verb(s) most clearly align with the performance needed by end-users, after the intervention is completed? Do the performance goals align with the operational needs?

Table 5

Curriculum Map Template Example

Curriculum Map				
Business Goals	**Learning Objectives (LOs)**	**Assessment**	**Activities**	**Instructional Materials**
Goal 1.	Objective 1.	[Describe assessment and include relevant resources and technology needed]	[Describe learning activities and include relevant resources and technology needed]	[Describe instructional materials and include relevant and technology resources needed]
Goal 2.	Objective 2.	[Describe assessment and include relevant resources and technology needed]	[Describe learning activities and include relevant resources and technology needed]	[Describe instructional materials and include relevant and technology resources needed]

APPENDIX E

The following Table 6 depicts the criteria for design principles and how they were used for the creation of a simulation. This table has been adapted from Vanderhoven et al. (2016).

Table 6

Strategy for Outlining Design Principles

Theory	Principles	Application to Materials
Theoretical concept 1	Attributed design principle 1	[Explanation of strategy or use of principle in the intervention].
	Attributed design principle 2	[Explanation of strategy or use of principle in the intervention].
	Attributed design principle 3	[Explanation of strategy or use of principle in the intervention].
Theoretical concept 2	Attributed design principle 1	[Explanation of strategy or use of principle in the intervention].
	Attributed design principle 2	[Explanation of strategy or use of principle in the intervention].

APPENDIX F

The following Table 7 depicts a design process map for designing a simulation and simulator intervention and begin process for first prototype. The items on this page have been synthesized from a variety of studies (Tamim et al., 2011; Chernikova et al., 2020).

Table 7

Design Process for Simulation and Simulator Creation

Simulation Design		
Component	**Content**	**Degree of Fidelity (Low or High)**
Learning Outcomes	[Insert LO(s)]	
Required End-User Tasks or Actions	[Define complex skills or actions related to learning outcomes (e.g. communication skills, troubleshooting]	
Intervention	[Insert intervention [e.g. simulation]	
Type of Simulation	[Define context and interaction (e.g. real or virtual object and real or virtual person)]	
Type of Simulated Environment	[Briefly detail the nature of the simulated situation and environment involved and describe the extent to which it represents actual practice]	
Creation Techniques	[Insert design principles]	
Instructional Strategy	[Insert strategy (e.g. role play, virtual reality)]	
Use-Case/Real-World Examples/ Scenarios	[Insert curated use-case from expert(s)]	
Duration of Simulation	[Insert duration and consider alignment with use-case timeframe (e.g. 1 hour, 1 day, etc.)]	
Role of Facilitator(s)	[Define role of facilitator in simulation]	
Role of End-User	[Define role of end-user in simulation]	
Simulator Design		
Function of Simulator	[Define type of interaction needed to complete simulation; physical or virtual interaction with people or objectives]	
Required End-User Tasks or Actions	[Define complex skills or actions related to learning outcomes that will be practiced with the simulator (e.g. communication skills, troubleshooting]	
Technology	[Insert technology for simulator creation (e.g. LMS, software, hardware)]	
Function of Guidance	[Describe if guidance will be integrated into the simulator and define the type of guidance (e.g. practitioner or virtual agent)	
Timing of Simulator	[Determine when simulator should be utilized within simulation (e.g. beginning, end, throughout)	
Duration of Simulation	[Insert duration of simulator vis-à-vis simulation, also consider alignment with use-case timeframe (e.g. 1 hour, 1 day, etc.)]	

APPENDIX G

The following Table 8 depicts a process for highlighting the evolution of prototypes, based on expert/end-user reviews. This table has been adapted from Vanderhoven et al. (2016) and Mufumiko (2006).

Table 8

Evaluation and Prototype Interaction Visual Representation

Prototype 1 (Review): Number of Experts: Areas of Expertise: Number of End-Users (if any):	**Prototype 2 (Revision 1):** Number of Experts: Areas of Expertise: Number of End-Users (if any):	**Prototype 3 (Revision 2):** Number of Experts: Areas of Expertise: Number of End-Users (if any):	**Prototype 4 (Revision 3):** Number of Experts: Areas of Expertise: Number of End-Users (if any):	**Prototype 5 (Revision 4):** Released to End-Users
[Provide a high-level overview of elements included in the first simulation]	[Provide a high-level overview of elements and list of revisions made from first simulation]	[Provide a high-level overview of elements and list of revisions made from second simulation]	[Provide a high-level overview of elements and list of revisions made from third simulation]	[Provide a high-level overview of end-product and list of revisions made from fourth simulation]
[Provide a high-level overview of elements included in the first simulator]	[Provide a high-level overview of elements and list of revisions made from first simulation]	[Provide a high-level overview of elements and list of revisions made from second simulation]	[Provide a high-level overview of elements and list of revisions made from third simulation]	[Provide a high-level overview of end-product and list of revisions made from fourth simulator]

Cambodia EDU-Port Project Against Covid19 (2019-2021)

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Abstract: EDU-Port Japan is a public-private initiative to introduce Japanese-style education led by Japanese Ministry of Education. we have been proceeding with this project applying ICT education in Cambodia from 2017.we Faced Covid Pandemic in 2019 and2020. With the full use of network and ICT functions, we could pave the way to install learner centered design advocated by Reigeluth (2016) while using Instructional Design theories. Cambodia have been seeking drastic reform in Education using ICT to reach one sophisticated country. Especially in the pandemic era,if ICT was not installed, school education will collapse and the environment will become worse and worse. This situation will affect the very survival of the country. Especially if they could not challenge the drastic reform of education, Learning without ICT stagnate this country. Based on our EDU-Port initiatives from2016, we have driven the collaborative learning including several universities focusing on Japanese Educational three pillars in course of study. Interactive, Independent and lifelong one. Provincial Teacher Training college and Phnom Penh Teachers Education Collage had also tried to find the new way for the future education.

***Key words*:** EDU-Port Project, World Youth Meeting, International Collaboration,

INTRODUCTION

EDU-Port Project and ICT Education

In 2016, Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT) planned to share the best of Japan with the rest of the world and to communicate education across the globe. As one of them, we, Uchida Yoko Co., Ltd, Japan Society for Educational Technology and Nihon Fukushi University, submitted an application for the ICT education category and it was adopted.

EDU-Port Japan is a public-private initiative to introduce Japanese-style education. As observed, some countries have a keen attention for Japanese Style of Education. In the field of education, Japan has great potential to contribute to the world particularly in primary and secondary education system because of its "ICT Education" which is well known worldwide.

IMPLEMENTATION

In 2016, we started a workshop on ICT education with the Regional Teacher Training College (RTTC) in Cambodia and followed by the Phnom Penh Teachers College. In this project, at first, learning computers and software was sometimes misunderstood. However later, in collaboration with organizations such as the Japan Society of Educational Technology (JSET), we conducted workshops on learner-centered teaching, interactive learning, and teaching that emphasizes each student's experience and exposure. We demonstrated in class, confirmed students' response growth in class research, and learned with Cambodian teachers about the advanced aspects of ICT education.

Cambodia 2016-2020

In the first three years of the five-year project, we used video clips for elementary school education. As in Japan, English is taught as EFL in Cambodia, and the Japanese video clips were adapted to the learners' conditions. Consequently, the need for elementary school to teach and learn English was also identified by local parents.

Figure 1 video clip

Based on this interest, videos that provide sound and movement were developed in a workshop format using the limited projector at the teacher training school, as videos are very valuable.

About 150 new students enter to RTTC every year. During the first year, students will undergo six weeks of educational training and eight weeks in the second year. After two years of training, they find employment as teachers in the community.

EDU-Port facing Corona Pandemic

In 2019 and 2020, EDU-Port was greatly affected by Covid19. We were not able to travel to that area and hold workshops as we had in the past. However, network-based trainings were developed constantly. In accordance with the original objectives, the promotion of ICT education was addressed. As an outcome of the training, the students were instructed to prepare teaching plans using video clips. In addition, a collaborative project with an overseas university, "Collaborative English Presentation Creation and Presentation," was undertaken using the network.

As of July 29, 2021, the Siem Reap Teacher Training College is in the process of lockdown. However, classes are still being taught through Google Classroom and support for Google Classroom is part of EDU-Port.

From July 2019 to the present, the network has been providing guidance on how to operate the system and assess learners' artifacts. The English collaborative presentations and participation in the World Youth Meeting discussed in this report were developed from the standpoint of promoting ICT education at EDU-Port.

Practice of Collaborative Learning

Nihon Fukushi University, Kansai University, and Kyoto Sangyo University collaborated to invite students to participate in World Youth Meeting (WYM), an event sponsored by the Japanese Ministry of Education, Culture, Sports, Science and Technology. In order to implement the event, we held a seminar for creating collaborative presentations with students from other universities such as Chonnam University in Korea and Wenzhou University in China, and set up an opportunity to learn together.

Promotion of ICT Education and Collaborative Presentations

Through the use of computers and networks, we have achieved fluent exchange and a high quality of collaborative learning that was not possible in the past. This is what information education is all about.

Until now, it has been expected that the internet would be of great help in international collaborative project, but not all the elements such as the framework, how to support students who need

help, and setting milestones for achieving the deliverables have been clarified. Therefore, instead of developing a new exchange, we approached international collaboration in the form of participation in WYM, which is now in its 23rd year. In this way, we were able to experience the educational use of ZOOM, Teams, and Team-Building.

We took advantage of the Corona disaster situation and designed the network training to be more effective than face-to-face training by taking advantage of the online platforms.

In the case of international collaboration, we always aim to overcome geographical obstacles, which always a major theme. The students worked on creating new works while introducing previous WYM practices.

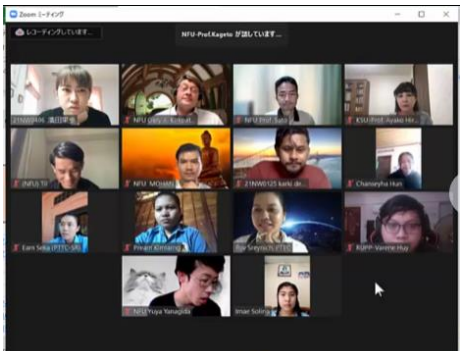

Figure 2 ZOOM

English in Asia

Both Cambodia and Japan are learning English as ESL. Even though they study in the classroom, when they step outside, whether in a convenience store or a department store, no one speaks to them in English. There are no opportunities to use English in daily life. In the Philippines and Malaysia, English is learned as ESL and spoken on a daily basis. Even in Asia, there are two types of English: English that is used in daily life and English that is spoken only in schools.

During the first four weeks of the seminar, Cambodian students will interact with EFL countries and ESL countries. They become interested in each other's English, learn about the existence of "Asian English" other than English Native, think about how to learn English, and decide to learn and use English for the rest of their lives. The faculty members also discussed with professors and teachers from overseas and became aware of the level of their students in the world, and in the discussion, they realized the next milestone for the students to learn as a member of Asia. Moreover, the Cambodian teachers learned that this kind of experience can be brought about by the practice of ICT education, and they will "train teachers" on how to shift from simultaneous teaching of knowledge and skills to Learner Centered Information Education.

Holding seminars

In addition to the conventional instructional design, it is necessary to share not only effective communication but also a supportive framework for interaction between different professions and cultures. As a framework that includes the RTTC, we created a faculty advisor system, mainly at Nihon Fukushi University, to provide effective guidance to the students.

A two-hour seminar was held every Sunday morning from 10:00 a.m. to provide an overview of the international collaboration project to be worked on together, as well as effective use of ICT and preparation of presentations. In addition to this, we also held seminars every Friday.

The seminars included: International Collaboration Project, Fascinating Presentations, Presentation Criteria, Communication in the Age of ZOOM, How to Conduct Q and A Sessions, and Basic Discussion Skills.

Group Activities

The Cambodian and Japanese delegates were formed into three teams to participate in the WYM and created a collaborative presentation for the overall theme.

The collaborative work of the team will be established on the scheduled presentation during the conference which will be held on August 5 and 6. Due to this, the team together with the delegates meet at least three times a day which started in July 2021.

We look at the previous models to determine the length, word level, and the nature of LINES (Scripts).

We divided into Cambodian side and Japanese side according to the basic format, and prepared 3-4 pictures of the topic, and shared the contents in bullet points.

We divided into groups to complete the LINES.

Review the photos and LINES from the listener's perspective.

In addition to the above, you can also use the following methods take video and change to short sentences and words that are easy to speak.

Delegates were also trained to always have a connection with the slides and facial expressions.

After the presentation, they are evaluated with a criteria of 60% of the participating college and high school students can understand.

The goal is not to stop at research and study, not to become an English bragging contest, but to inspire others with responsible speech. http://www.japannet.gr.jp/w2021/ej.pdf

We will reconfirm the evaluation criteria and comment on each other's work until the day of completion.

Teachers are using Google Translate to check important points in their own languages.

Example:
Speech rate is usually regarded as less than 110 words per minute.
អត្រានិយាយជាធម្មតា ត្រូវបានគេចាត់ទុកាតិចជាង ១១០ ពាក្យក្នុងមួយនាទី។

Criteria to evaluate presentation performance (2021.07)

	English Expression (no requirement such as native speaker of English)	Performance	presentation with responsibility	Content
5	Audience conscious. adequate analysis of the audience such as English levels or readiness. Good prosody. It is clear which part is stressed. English level is appropriate for Asian students.	Keeping good speed in delivery. Easy for the audience to follow. Good interaction with audience. Pauses are appropriate. Presenter's opinion is very clear.	・Expressing clear opinions and feelings, and getting strong empathy from the audience	Clear story. One core message and 3-4 topics. Successful in motivating the audience. Their own research data and opinions are used.
4	Good enough to deliver to Asian students. Good interaction and questioning with the audience.	It is clear which part has been emphasized.	・Expressing opinions and feelings, and getting empathy from the audience	Good research and organization. Too much contents. Few opinions.
3	Speaking in a loud voice.	Good collaboration to deliver.	・Only explaining the data	Mere results of google research
2	Not so good at handling the microphone or speaking in English overall.	Delivered in **a** monotone.	・Showing the search results on the net.	Just talking about the issue - lacking flow or structure of argument.
1	Incomprehensible.	"Mosquito reading"- hard for the audience to hear what is being said.	・Expressing no opinions or suggestions	Boring, Infringing copy rights, Complicated with too many photos.

CONCLUSION

What developing countries have gained through international collaboration

For the Cambodian teachers, it was their first time to use ICT such as LINE and Presentation apps in an international collaborative class. From the knowledge level of how to make a presentation, we were able to understand the perspective of middle-income countries and developed countries on the SDGs through the shared knowledge of the students and teachers.

This time, as part of the EDU-Port Project, we worked with the Cambodian teacher training college, PTEC, and three Japanese universities.

I was able to experience the development of a task-based class that drastically changed the traditional image of classes such as grammatical explanations and speech practice. This was a collaborative English presentation. This is a very new teaching method for Cambodia, as it involves active learning in which the students themselves eventually speak in front of an audience or their peers.

Although Cambodian teachers have been very interested in presentations, they have not been able to share with advanced teachers from around the world the key points that need to be followed in order to develop effective presentations. The Cambodian teachers, however, were very interested in EFL, but they were not able to share with the world's advanced teachers the key points that should be taken into consideration when developing effective presentations.

The group discussion, which is one of the network-based learning, was very new to the Cambodian teachers. The Philippine students spoke fluent English supported by ESL, while the students from Korea, China and Japan somewhat spoke slower in English as they did not have the opportunity to speak in English on a daily basis. I think the young people who will lead the next generation have grasped that the first step in a presentation is to speak slowly and with the minimum rules of communication. Using basic words and avoiding idioms are very important for real-life communication which was also confirmed by both teachers from developing and non-developing countries in Asia.

Making presentations

After attending the seminar and gaining knowledge on how to create effective presentations, the students will be working in groups using LINE messenger and Zoom to complete the task of creating an effective presentation by the day of the assigned task.

During the practice, there were some very interesting scenes for the teachers who monitored the activities such as seeing a big difference on the lifestyle of the students. Japanese students have a part-time job while the Cambodian students of RTTC do not have the opportunity to have a part-time job as they have to study all the required subjects from morning until evening without any elective subjects in order to obtain a teaching license in two years.

Also, as they were making the presentation, they recommended that the visual-first design of the presentation and the structure of the speech manuscript using dialogue, spoken words, bullet points, etc., would greatly enhance its expressiveness. This indicates that cognitive presence is enhanced by screen sharing.

In addition, the Cambodian students were able to experience active learning that incorporates these stages, and at the same time, they were able to experience a part of the new way of ICT education. The teachers have also been able to dispel the conventional image of ICT education as the use of computer projector networks and have gained the knowledge that learner-centered learning is what ICT education is all about.

Soon, these high schools will play a major role in educational reform in developing countries.

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The Effect of Pre-service Teachers' Mindset on the Use of Self-regulated Learning Strategy : The Mediating Effect of Failure-Tolerance

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Abstract: The purpose of this study was to examine effects of pre-service teachers' mindset (growth/fixed mindset) on their use of self-regulated strategies, and to confirm the mediating effect of failure-tolerance between their mindset and use of self-regulated learning strategies. A total of 303 pre-service teachers (198 female college students, 105 male college students) from a university in G City, South Korea, participated in the study. Data was collected through participants' self-reported survey responses about growth/fixed mindset, failure tolerance, self-regulated learning strategy. Results of this study showed that pre-service teachers' growth mindset had a significant positive effect on their self-regulated learning strategies and their failure tolerance, and failure tolerance had a significant mediating effect between their growth mindset and use of self-regulated strategies. Moreover, the fixed mindset had negative effects on their self-regulated strategies and their failure tolerance, and failure tolerance had a significant mediating effect between their fixed mindset and use of self-regulated learning strategies.

Key words: Mindset, Self-regulated Learning Strategy, Failure-Tolerance, Pre-service Teacher

INTRODUCTION

Self-regulated learning is importantly related to academic success (Seo, 2012). In order to achieve academic success, learners need to be self-regulated during their own learning process, that is, strive to stimulate and maintain appropriate learning motivation for effective learning (Schunk & Zimmerman, 2009). Self-regulated learners can effectively plan, monitor, and evaluate their own learning process and learning results (Schunk & Zimmerman, 2009).

In particular, pre-service teachers who want to become effective teachers in the future need to learn professional knowledge and skills during a teacher education program, and their knowledge and skills acquired during teacher education are a key factor to determine the quality of learning of future students. Therefore, to promote pre-service teachers' successful learning, understanding factors that influence their

self-regulated learning maybe necessary to help them become self-regulated learners. In this study, we focused on pre-service teachers' mindset and failure tolerance as factors influencing their self-regulated learning.

Mindset is defined as an individual's belief on his/her own intelligence and abilities (Dweck, 2006). A learner with growth mindset believes that intelligence and ability can be changed and grown based on his/her own efforts and experience while a learner with fixed mindset believes intelligence and ability cannot be changed (Dweck, 2006; Jang, 2021). Learners will experience success or failure in the learning process. In this regard, the growth mindset is based on the failed learning strategy, focusing more on the process and strategy rather than the result of failure, and adjusting the learning strategy to reconstruction. However, fixed mindset can bring a sense of negation and powerlessness towards one's own abilities and intelligence, leading to being caught in the results of failure and situations such as avoidance or fear that are overwhelmed by negative emotions (Choi & Oh, 2018; Dweck, 2000; Kim, 2020; Park & Jerome, 2016)

In addition, this research focused on the importance of academic failure-tolerance that affects the learning of pre-service teachers. Failure-tolerance is defined as the action of putting away negative emotions in the face of failure and actively responding to failure without avoiding failure (Cliford, 1988; Kim & Cliford, 1988). Learners with strong failure-tolerance, after experiencing failure, will choose challenging subjects which allow them to grow rather than those that can be easily completed in the past. Just like a learner with high resilience will choose to learn although the process of learning is difficult and challenged. Learners with strong failure-tolerance will not be frustrated even in the case of academic failure, but will refocus on learning and work hard for successful learning. Therefore, this study aims to help pre-service teachers achieve successful self-regulated learning and realize that the failure-tolerance on academic performance is one of the psychological factors of the effective learning. It also provides information for creating an educational environment that strengthens failure-tolerance.

The purpose of this study was to examine effects of pre-service teachers' mindset (growth/fixed mindset) on their use of self-regulated strategies, and to confirm the mediating effect of failure-tolerance between their mindset and use of self-regulated learning strategies.

RESEARCH METHOD

1. Participants and Procedures

The data was collected from 303 pre-service teachers from a university located in G City, South Korea. 198 female students (65.3%) and 105 male students (34.7%) participated in this study. Most of participants were sophomores (n=133, 43.9%) and juniors (n=34, 11.2%). Participants completed the surveys in approximately 15 minutes.

2. Instruments

1) Mindset scale

A total of eight items of the mindset scale developed by Dweck (2000) and translated by Kim (2015) were used to assess pre-service teachers' mindset. The subscales were growth mindset(4 items) and fixed mindset(4 items). In this study, Cronbach's alphas were, for growth mindset, α=.84, and for fixed mindset, α=.91.

2) Failure-tolerance scale

To assess the failure-tolerance of pre-service teachers, the failure-tolerance scale developed by Kim (2002) was used. There are 18 items in total. This scale consists of three sub-variables: task performance level (6 items), emotions (6 items), and actions (6 items). In this study, the Cronbach's alphas were as followed: for the level of task performance, α=.90, for affection, α=.89, for action, α=.73, for overall failure tolerance scale, α=.81.

3) Self-regulated learning strategy scale

Subscales (effort regulation, time and environmental management) of Motivated Strategies for Learning Question (MSLQ)developed by Pintrich et al. (1991) and translated by Kim (2006) were used. Scales of effort management (4 items) and time and environmental management (8 items) were used to assess pre-service teachers' use of self-regulated learning strategies. In this study, Cronbach's alpha were, for effort management, α=.71, for time and environmental management, α=.71, for overall self-regulated

learning strategy scale, α=80.

RESULTS

1. The effect of growth mindset on self-regulated learning: the mediating effect of failure tolerance

In order to verify the mediating effect of failure-tolerance on the relationship of growth min-dset and self-regulated learning of pre-service teachers, we use the PROCESS macro program using model 4 (Hayes, 2013).

The pre-service teachers' growth mindset had a significant positive effect on fail-tolerance (B=.20, p=.001). In addition, the pre-service teachers' growth mindset had a significant positive effect on the use of self-regulated learning strategies (B=.17, p=.001). Fail-tolerance had a significant positive effect on the use of self-regulated learning strategies (B=.35, p=.001).

Failure-tolerance had a significant indirect effects on the relationship of growth mindset and self-regulated learning. The results of Bootstrapping use a 95% confidence interval, and the indirect effect was significant when the interval does not contain "0" (Hayes, 2013). According to the 95% confidence interval of Bootstrapping BC (Bias-corrected), "0" is not included between LCI (.04) and ULCI (.11) It can be concluded that failure-tolerance has a significant mediation effect between pre-service teachers' growth mindset and use of self-regulated learning strategies, (see Table 2).

Table 1
The Effect of Growth Mindset on Self-Regulated Learning

Independent Variable	Dependent Variable : Failure-Tolerance				Dependent Variable :Self-regulated Learning			
	B	*S.E.*	*t*	*β*	*B*	*S.E.*	*t*	*β*
Constant	2.29	.19	12.08***		1.56	.25	6.20***	
Growth Mindset	.20	.05	4.40***	.25	.17	.05	3.39***	.19
Failure-Tolerance					.35	.06	5.61***	.31
*p<.05, **p<.01, *** p<.001	R^2 =.06, F =19.38, *p* =.000				R^2 =.16, F =27.89, *p* =.000			

Table 2
Bootstrapping Results of the Mediating Effect of Failure Tolerance

Variable	Indirect Effect	Boot SE	95% Confidence Interval	
			LLC	ULCI
Growth Mindset→Failure-Tolerance→Self-Regulated Learning	.07	.02	.04	.11

2. The effect of fixed mindset on self-regulated learning: the mediating effect of failure tolerance

The fixed mindset of pre-service teachers had a significant negative effect on failure-tolerance(B=-.14, p=.001). In addition, pre-service teachers' fixed mindset also has a significant negative effect on self-regulated learning(B=-.14, t=-3.59, p=.001.). Failure-tolerance had a positive effect on the use of self-regulated learning strategies (B=.35, p=.001). In the relationship between the fixed mindset and use of self-regulated learning strategies, failure-tolerance as a mediation variable presents a significant indirect effect (B=-. 05, p=.001). In the relationship between pre-service teachers' fixed mindset and self-regulated learning strategies, failure-tolerance had a significant indirect effect as a mediation variable (B=-.05, p=.001).

The results of Bootstrapping use a 95% confidence interval, and when this interval does not contain "0", the indirect effect is significant(Hayes, 2013). According to the 95% confidence interval of Bootstrapping BC(Bias-corrected), LCI(-.08) and ULCI(-.02) do not include "0", It can be concluded that failure-tolerance had a significant mediating effect between fixed mindset and use of self-regulated learning strategies (see Table 4).

Table 3
The Effect of Fixed Mindset on Self-Regulated Learning

Independent variable	Dependent Variable : Failure-Tolerance				Dependent Variable :Self-regulated Learning			
	B	*S.E.*	*t*	*β*	*B*	*S.E.*	*t*	*β*
Constant	3.42	.08	41.74***		2.57	.23	11.13***	
Fixed Mindset	-.14	,04	-4.00***	-.22	-.14	.04	-3.59***	-.20
Failure-Tolerance					.35	.06	5.69***	.31
*p<.05, **p<.01, ***p<.001	R^2 =.05, F =15.96, *p* =.000				R^2 =.16, F =22.64, *p* =.000			

<Table 4> Bootstrapping Results of the Mediating Effect of Failure-Tolerance

Variable	Indirect Effect	Boot SE	95% Confidence Interval	
			LLCI	ULCI
Fixed Mindset→Failure-Tolerance→Self-Regulated Learning	-.05	.02	-.08	-.02

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Transactional Distance Theory and Scaffolding Removal Design for Nurturing Students' Autonomy

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Abstract:This paper prorposes eight design principles to nurture autonomy of college students, based on re-conceptualization of Michael Moore's Transactional Distance Theory (TDT). After proposed in 1970's, TDT has been helping to concepturalize distance education in terms of psychological, not physical, distance among people involved. TDT, on the other hand, has been creating confusions and misinterpretations when utilized in the research and practices of distance education. COVID-19 has forced all educational practices to be offered as distance education, which made us realized the importance of student autonomy, when limited guidance could be offered. Utilizing the framework of TDT, this paper proposes eight ways to create and then withdraw scaffoldings to help learners more self-independent and autonomous.

Key words: Transactional Distance Theory, Design Principles, Scaffolding, Removal, Autonomy, Higher Education

INTRODUCTION: NEEDS FOR NURTURING STUDENTS' AUTONOMY

Campus shutdown caused by COVID-19 affected deeply to our ordinal education in every sectors in all the countries worldwide. This experience helped us realized how deeply we have been relying on direct contacts with students on a regular basis, for us to function well in helping students' continuous effort in keeping themselves engaged in their study. While most, if not all, of on campus professors and teachers felt uncomfortable not being able to have direct contacts with students regulally, it had been a normal practice for those who had worked in distance education programs, including the authors of this paper. It has long been a central theme in distance education, how to help its students to become more independent and self-regulated, so as to survive in a learning environment that requires autonomy on the students' side. It may have not much so, however, for those who are working in on-campus settings, where teachers and professors can expect that the students come to campus and allow them to get direct assistance to keep up with their continuing learning. Fox, et al (2021) pointed out, in a report by *Every Learner Everywhere*, that one of the evidence-based principles for after COVID-19 higher education to be "meta-cognition, self-regulation, and agency, incorporating practices that help students learn to be a better learner and take control of the learning process (p. 8)." Glantz, et al (2021) suggested "Student Experts for Learning and Technology Support" to be one of the five innovative practices observed under COVID-19 campus shutdown that should be continued to enhance student engagement in higher education's next normal: "As we move to the next normal, higher education leaders should consider expanded roles for undergraduate experts who assist with learning *and* technology support (*italic* original)."

With this sudden interuption by COVID-19, not only do we as providers of education need to be more functional to utilize online learning technology, but also we should re-capture our ultimate goal of higher education: i.e., to help the students to become independent learners. Suzuki & Mima (2018) have proposed that it should be a primary learning goal, especially at the very beginning of their college lives,

to acquire learning skills to become autonomous learners. In this regards, all educators can and should learn from the effort of teachers in distance education programs, as OECD (1996) pointed out even before the outbreak of e-learning around 2000 that we should make the best use of ICT regardless of the modes of delivery, not only in distance programs, but also in face-to-face programs.

It is obvious that the more self-directed the students are, the more likely to be successful in an learning environment that gives less support. We all learned this, by our own experiences during the campus shutdown, as expressed even by the students themselves in a recent survey conducted in Japan. Out of 1000 respondents in an 18-year-old Survey (Nippon Foundation, 2021), almost half (n=489) felt disparity, due to not only economic situation of the family (n=253) and school functionality (n=149), but also to their effort (n=121). Such reasons was stated as "study or not study depends on ourselves," "not motivated students didn't make the best of what they had," and "all dependent of firm mental willingness to study." To ensure meeting the needs of students after COVID-19, it is good to take a lesson from the research traditions in distance education so we can design better learning environment to foster autonomy of the students in all modes of higher education.

Therefore, the purpose of this paper is to introduce and re-interpret one of the major theoretical contributions in distance education research, namely Michael Moore's Transactional Distance Theory (TDT). Utilizing the framework of TDT, this paper proposes eight ways to create and then withdraw scaffoldings in the face-to-face education on campus after COVID-19, to help learners more self-independent and autonomous.

TRANSACTIONAL DISTANCE THEORY: CONTRIBUTIONS AND CONFUSIONS

Michael G. Moore proposed TDT in 1970's, introducing the concept of distance education, pedagogically defined, not by the physical distance between the provider and students, but that of psychological distance, i.e., transactional distance. We all know, from our own experiences, that even being in the same large lecture hall, a student may feel very far away from his/her professors, whereas an intimate relationship can be nurtured with a professor even when a student is taking a course from the other side of the glove. For education to produce any learning outcomes on the side of the students, it has been our effort to make phycological distance closer with students, known as teaching presence (Garrison, Anderson, & Archer, 2000).

Moore modeled that three key factors play in determining the transactional distance; (1) dialog, interaction with a teacher in the form of explanations, encouragement, and feedback, (2) structure, referring to the responsiveness of the course program to the needs and interests of the learner, first, then "rigidity or flexibility of the program's educational objectives, teaching strategies, and evaluation mothods (Moore, 1993, p. 26)", and (3) autonomy of students. TDT has long been utilized in the practice and research in distance education (Bray, 2007; Kumagaya, 2009; Shearer & Park, 2019), where much of the desired dialog was impossible or not feasible first, as in correspondence education; then gradually became more and more possible due to the advancement of the Internet technology. None the less, high degree of autonomy has always been required for a distance student to be successful in learning.

The lack of operational definition of structure in TDT, affecting transactional distance, however, has caused confusions and misinterpretations among practitioners and researchers since then. Kumagaya (2009) pointed out Moore's change of the use of terminology from individualization to structure may have caused confusion, which triggered misuses of the term even in the writings of Moore himself. Gorsky & Caspi (2005) accused that if, as Moore pointed out, structure and dialogue have an inverse relationship, then "(the) theory may be reduced to a single proposition: as the amount of dialogue increases, transactional distance decreases" and that "this proposition may be construed as a tautology, not a theory (p. 7)." Shearer & Park (2019) pointed out the need of clearer definition of structure and autonomy as three main themes of the future task of the research related to TDT.

Garrison (2000) stated: "In Moore's theory, the most distant program has low dialogue and *low* structure while the least distant has high dialogue and *high* structure (p.8; *italic* added)." Although structure is interpreted conversely from Moore's original definition, Bray (2007) agreed with Garrison by saying that "(Garrison's) summary seems more consistent with Moore's writings in general (p. 41)," and suggested more positive and broader interpretation of structure as student-content interaction: "Moore stated that as course structure increases, transactional distance would increase, but this idea was a product of times when distance education was mainly designed for mass education and course structure was rigid,

with little interaction with teachers and peers possible. Moore's view seems to be that course structure was essentially a negative feature of a program, perhaps more properly termed course rigidity, that when high, blocked students from expressing their self-directedness and creativity (p.38)."

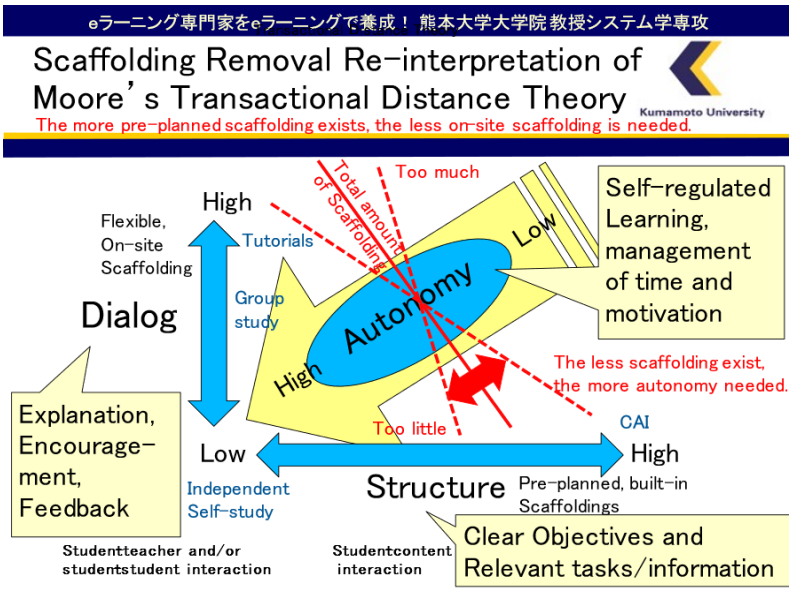
It has been the goal of recent instructional design to provide a clear set of learning objectives with relevant assignments and explanations so that learners would not be lost in accomplishing the required tasks to attain the objectives. We have learned many ways to facilitate individual learners' free choices of action, such as to make the order of learning up to individuals, to test mastery at earlier stages to avoid unnecessary learning, etc, even in learning materials with high degree of structure. Structure, when prepared well, should help the learners with lower autonomy, while more advanced learners may proceed by themselves without such clearly structured materials. With an advanced technology, high structure does not necessary imply that all students would be required to learn the same way, which may have been the case when Moore proposed TDT in its original form. Thus, high structure should help the learners feel transactional distance closer by having more help in learning.

RE-DEFINITION OF TDT USING SCAFFOLDINGS

In a hope that TDT will become a useful help in constructing after COVID-19 higher education on campus, Suzuki & Hiraoka (2021) has proposed a re-interpretation of TDT elements of dialog and structure in terms of the amount of scaffoldings given to the students, provided during and prior to the transaction, respectively. Structure, re-defined as the amount of scaffoldings prepared in the learning environment prior to the beginning of education, can be high, if the students were well-guided with no worries of what to do, and how to do them. This is one of the goals of what instructional designers would aim to provide to make their products effective and engaging, by enough amount of scaffoldings. Having a clear set of learning goals, assessment criteria, and structured series of assignments, as well as structured provision of relevant information with motivating examples, are some of the strategies to accomplish the goal. In a sense, the goal of well-designed pre-packeged instructional materials may reduced the needs of frequent dialogs to be provided after the learning started. If the structure provide less than adequate scaffoldings, then the students may be lost in learning, which would require more amount of scaffoldings during the course of learning, i.e., more demands of dialog would exist.

However, the amount of scaffolodings provided by the structure is independent of actual amount of scaffolodings provided by the dialog during learning. The amount of dialog may be very frequent and timely in a very kind provision of instruction on one hand, another provision of instruction may provide very rere and delayed dialog, on the other hand, using the same structure. The adequate amount of scaffoldings would depend on the degree of autonomy of the students: a student with less autonomy may feel the first provision very kind and fit with his needs, whereas another student with high autonomy may feel it annoying and destructive for her to go ahead and proceed her learning on her own. High degree of structure may also annoying to highly autonomous students, if it does not allow to skip some portion of instruction that they already know, or it does not require any creative or optional products for faster or higher acheivers. Thus, the optimal amount of total scaffoldings by both structure and dialog depends on student's levels of autonomy. If we aim at nurturing more autonomy for each student, then we need to design and monitor the scaffoldings being withdrewn, as the autonomy level increases. Figure 1 shows the relationships among the three factors with scaffolding removal to adjust to the optimal level.

Figure 1
Transactional Distance Theory Re-interpreted with Scaffolding Removal Design



DESIGN PRINCIPLES FOR AUTONOMY

Table 1 shows some examples of design principles for nurturing autonomy, proposed by Suzuki & Hiraoka (2021). If we intend to make changes in the after COVID-19 higher education on campus, with the aim of nurturing autonomy at the core, we must design fading the scaffoldings throughout the course of the entire curriculum. We must not be too kind, not to take away the responsibilities and independence of students, gradually toward the later part of the college life, if not from the very beginning of the first year. At any rate, some careful and considerate withdrawal of scaffoldings must be purposefully designed to make the college graduate independent learners.

CONCLUSIONS

This paper prorposed eight design principles to nurture autonomy of college students, based on re-conceptualization of Michael Moore's Transactional Distance Theory (TDT) that has served as the most heavily used framework in designing distance education. After introducing the three key factors determining the transactional distance, it was reviewed that TDT has been creating confusions and misinterpretations when utilized in the research and practices of distance education. Utilizing the framework of TDT, this paper proposed eight ways to create and then withdraw scaffoldings to help learners more self-independent and autonomous. COVID-19 has forced all educational practices to be offered as distance education, which made us realized the importance of student autonomy, when limited guidance could be offered. If we consider that all programs of higher education, regardless of the mode of operation, to fillful the function of making the graduates independent learners, then not only distance program, but also on-campus programs can make the best use of research findings and theories from distance education. It is the authors' hope that this paper will guide to create such practices in many higher education programs with our re-interpretation of TDT and suggestions in mind.

Table 1

Suggested Design Principle Samples with Examples

Design Principle	Example
1. Shifting from Final Exam Only to Multiple Assessments	Allow learners accumulate points toward the passing criteria by setting multiple tasks and multiple-choice quizes during the course
2. Shifting from Teacher Progress Management to Learner Schedule Management	Allow learners flexible self-management of learning pace by making learning schedule and learner progress visualized with flexible deadlines for accessing learning resouces and submitting assignments
3. Shifting from Learning from Teacher to Learning from Information/Materials	Allow learners learn from textbook and other resources on the Internet by making them required readings and/or setting an inquiry-based tasks
4. Shifting from Learning from teacher to Learning from Each Other	Facilitate corporative learning by making dialog records visible to others and/or making mutual commenting and checking a part of the required tasks
5. Shifting from Common Assignments for All to Adaptive/Selective Assignments	Allow individual learners construct their own learning by requiring an additional option to the common assignments and/or allowing flexible approach to the same common assignments
6. Shifting from Tasks with One Correct Answer to Tasks Requiring Originality	Allow learners express originality by assigning tasks to express own ideas and/or to appeal original outcomes in the tasks
7. Shifting from Assessment by Teacher to Assessment by Learners using Checklist	Allow learners self-evaluate, confirm, and making an appeal of their own learning outcomes by providing assessment method such as a checklist
8. Shifting from Teacher-Initiated Help to Learner-Sought Help	Allow learners deciding when to ask for help anytime as needed by creating such a mechanism and limitting teacher's initiation of helping

Note: Translation of Table 1, Suzuki & Hiraoka, 2021 by authors

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10 Dimensions Model for Quality MOOC Design

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Abstract: Rapid growth of Massive Open Online Courses (MOOCs) has called for instructional design for quality learning experiences. Responding to the needs, Ichimura & Suzuki (2017) have suggested the 10 Dimensions Model from the review of MOOC related literature, with a focus on critical elements of course design of MOOCs. This current study includes verification of the Model, analyzed with the quality guidelines of MOOCs available now. The quality criteria addressed in the guidelines are associated with each dimension.

Key words: Massive Open Online Courses(MOOCs), Instructional Design, 10 Dimensions Model

INTRODUCTION

Massive Open Online Courses (MOOCs) had rapid growth since right after it was launched. This phenomenon was often argued as disruption or hype (Shah, 2020). Since then, the quality and pedagogical design of MOOCs have been discussed as the area to be improved, with no consensus yet been emerged (Margaryan et al., 2014). Under these situations, responding to this concern addressed by the previous researchers, we sought a design framework for MOOCs and developed 10 Dimensions Model for MOOC design (Ichimura & Suzuki, 2017). Recently, the contribution of empirical research on Massive Open Online Courses (MOOCs) has been increased by instructors and designers around the world (Lu et al., 2021). In this current paper, we studied the available quality guidelines of MOOCs and verified our 10 Dimensions Model (Ichimura & Suzuki, 2017) with them.

10 DIMENSIONS MODEL

10 Dimensions Model (Ichimura & Suzuki, 2017) summarized and synthesized four works of literature that addressed MOOC design: Conole (2013)'s Learning Design Framework, Taxonomy addressed from Schneider (2013), Gover, et al. (2013)'s framework, and Mooc Canvas by Alario-Hoyos et al.(2014). When Ichimura & Suzuki (2017) developed this Model, we analyzed past systematic reviews of the literature on MOOCs, covering between 2008 to 2015, and carried out a forward reference approach. In addition, under the criteria, we conducted a database search. Peer-reviewed journal papers that covered design of MOOCs concerning instructional quality were scarce at the point, and the even existing papers did not fully explain the whole design components comprehensively, in particular, for the

massive and open online environment. The design elements addressed by the previous four models were identified, and a comprehensive model that covered all the underlying elements of the design of the various MOOCs was constructed in 10 Dimensions Model (Ichimura & Suzuki, 2017). In total, nine key elements were identified from the past models, and "support" dimension was added as a critical dimension, attributed to other literature reviews. (Fournier and Kop, 2015)

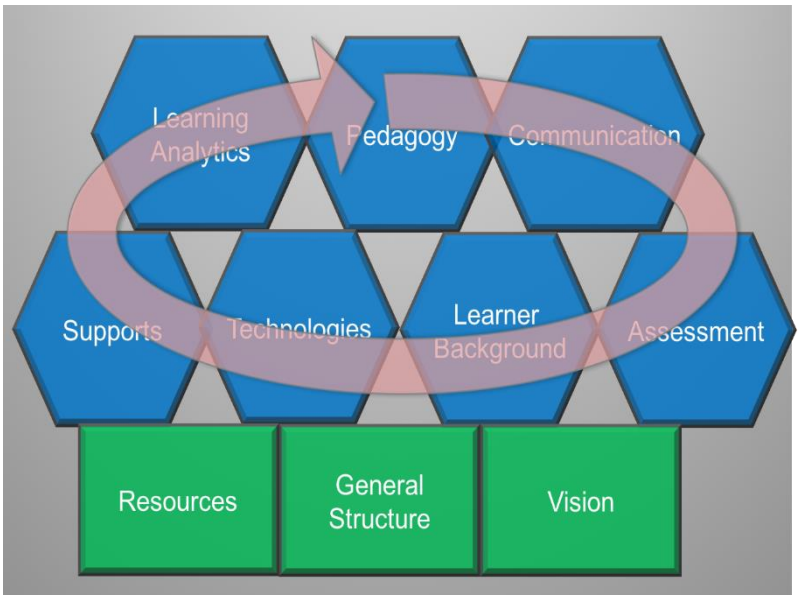
The features and forms of MOOCs have not ever been stable even in the past less than 10 years and a variety of versions exists. The 10 Dimensions Model (Ichimura & Suzuki, 2017) targets the use of MOOC design beginners, who are developing typical open and free access MOOCs in their institutions. Figure 1 illustrated the core 10 dimensions consists of MOOC design. The three elements on the bottom layer consist of "Basic Design Decisions", including "Resources", "General Structure" and "Vision". Each dimension includes multiple subcategories that were identified from the review.

Grover et al. (2013) proposed a MOOC design and evaluation framework, in which they suggested the core elements of the learning environment in MOOCs as Interactive Learning Environment (ILE). Their framework illustrated the mutual interaction of the elements. Above the seven elements, "Learning Analytics" that supports evidence-based improvement, "Pedagogy" that are core learning and instructional dimension, "Communication", "Supports", "Technologies", "Learner Background" and "Assessment" are interactive and act reciprocally (Ichimura & Suzuki, 2017).

Our studies after the first publication of the 10 Dimensions Model have been underway with the aim that enriching the framework of the Models. We have attempted to fill 10 dimensions with contents of design descriptions. We have conducted empirical studies related to pedagogy, assessment, vision, and support dimensions, thus far. The prescriptive analysis on the instructional structure of existing MOOCs examined sequential analysis, learning contents and assessment activities associated with cognitive levels (Ichimura, Noda, Suzuki & Nakano, 2020). The study on learning experiences of first MOOC learners examined the learning supports from the learners' needs (Ichimura, Nakano & Suzuki, 2020).

RESEARCH DESIGN & METHODS

Figure 1
Ten Dimensions Model (Ichimura & Suzuki, 2017)



In this current study, we verified 10 Dimensions Model (Ichimura & Suzuki, 2017) with four quality guidelines of MOOCs available now. The purpose of this study is to see if the 10 Dimensions Model can be confirmed and to reinforce the 10 Dimensions Model with the additional views of quality guidelines utilized in the realm of MOOC practices. We examined and identified how each dimension is addressed in the quality standards.

The following four quality guidelines and measures were analyzed: OpenupEd Quality Benchmarks for MOOCs (Rosewell & Jansen, 2014), MOOC Scan Questionnaire (Margaryan, Bianco, & Littlejohn, 2015), Guidelines for Quality Assurance and Accreditation of MOOCs (Commonwealth of Learning, 2016), Quality Reference Framework (QRF) for MOOCs from the European Alliance for the Quality of Massive Open Online Courses (Stracke, et al., 2018). The three guidelines, issued before our model was published, were not returned in the previous literature search criteria and our model was developed without inclusion of them. That was a limitation of our previous study, and the current paper investigated and reinforced the 10 Dimensions Model with the quality guidelines.

OpenupEd Quality Benchmarks (Rosewell & Jansen, 2014) included 32 indicators with the two main levels: institutional level and course level. MOOC Scan Questionnaire (Margaryan, et.al., 2015) had three sections that were 1) course details, 2)objectives and organizations, 3) instructional design, assessed with Merrill's (2002) First Principles of Instruction. 37items in total were included. The guideline from the Commonwealth of Learning (2016) covers multiple levels of guidance, including quality dimensions presented by presage, process, and product stages and checklist for accreditation. The checklist has eight focus topics with 38 items. Quality Reference Framework (QRF) of the European Alliance for the Quality of Massive Open Online Courses (MOOQ) (Stracle et al., 2018) provides the Key Quality Framework, Criteria, and the Quality Checklist. QRF was categorized by design phases: 1) analysis, 2)design, 3)implementation, 4)realization, 5)evaluation, as well as perspectives including 1,) pedagogical 2,) technological 3) strategic, and roles. The items and measures addressed in the four quality guidelines were mapped, using 10 Dimensions Model (Ichimura & Suzuki, 2017), and analyzed.

RESULTS

The analysis process is underway, and the initial report is presented in this paper. The common criteria across the multiple guidelines were detected. The open nature of MOOCs was particularly addressed in the guidelines that are associated with the Resource dimension. MOOCs are open access, and the materials and media in the course are a matter of copyright license. Attribution of copyright and intellectual property rights was strictly required (Rosewell & Jansen, 2014: Stracle et al., 2018). In addition, the use of materials licensed under Creative Commons and Open Educational Resources was highly recommended by the guidelines (Rosewell & Jansen, 2014: Commonwealth of Learning, 2016).

Clear definition, outline and direction were highlighted across the multiple dimensions. Clear course description, prerequisite knowledge and skills, course requirements, the purpose of the MOOCs, learning outcomes, were basic information suggested in the guidelines. The guidelines also suggested clear definitions and statements of direction for MOOC learning, including, learning and assessment processes, learning materials, locations and navigations in the courses, the requirements for communication, the purpose of the technological tools, and support (Rosewell & Jansen, 2014: Commonwealth of Learning, 2016: Stracle et al., 2018). Clarity was emphasized across the dimensions and design stages from definition to presentation. It might be seen obvious, however, for diverse MOOC learners who have diverse online learning experiences, it is crucial to maintain explicit presentation.

The guidelines commonly encouraged diverse learner's self-regulated learning. To encourage self-regulated learning, high quality materials and support were addressed to be designed. As a tool, a self-report survey asking motivations and goals for participating in the MOOCs was introduced(Commonwealth of Learning, 2016).

Although the basic progress is self-study that is participants' independent learning in MOOCs, the guidelines encouraged learners' mutual interaction and communication of their gained knowledge. Communication and collaboration encourage the active engagement of the participants. Due to the massive

class size, to enable interaction between participants in MOOCs, making use of online affordance, mobile apps and social media are necessary. Even synchronous interaction was encouraged in the guidelines.

For catering to a big population of learners, technology and learners' community functions for learning support. This way promoted community building and social learning, supporting the concept of community of learners.

Criteria addressed in the four quality guidelines were associated with 10 dimensions. The volume of items associated with each dimension was varied. Among 10, a great number of items were associated

with the pedagogy dimension. On the other hand, "learning analytic data" had fewer items. Some excerpts from the quality guidelines associated with the 10 dimensions are as shown in Table 1.

Table 1

Additional Elements Found in the Four Quality Guidelines

Dimensions	Excerpts from the 4 Quality Guidelines
1.Resources	"Course components have an open license and are correctly attributed." (Rosewell & Jansen, 2014)
2.General Structure	"Clearly outline the course requirements." (Margaryan, et.al., 2015) "Identify possible certification for different levels of completion." (Stracke, et al., 2018)
3.Vision	"The purpose of the MOOC is stated clearly." (Commonwealth of Learning, 2016)
4.Learner Background and Intention	There are "self-report instruments that measure learners' motivations and goals, prior learning experiences, demographic information, contextual information, learning behaviors" (Commonwealth of Learning, 2016).
5.Pedagogy	"Provide activity options for participants with various learning needs." (Margaryan, et.al., 2015) "Aid students to construct their own learning, and to share and communicate it with others" (Rosewell & Jansen, 2014). "Define learning pace, personalization and monitoring progress ."(Stracke, et al., 2018)
6.Communication	Give learners of "peer-interaction groups specific directions for interaction." (Margaryan, et.al., 2015) "Design interaction via blogs, forums & social media platforms to foster social learning" (Stracke, et al., 2018)
7.Assessment	"Assessment and evaluation are integrated throughout the course." (Commonwealth of Learning, 2016) "The course provides learners with regular feedback through self-assessment activities, tests or peer feedback." (Rosewell & Jansen, 2014)
8.Technologies	"The tools used in the course are readily available to students." (Commonwealth of learning, 2016). Integrate technological tools "to foster interaction, communication and experience sharing". (Stracke, et al., 2018)
9.Learning Analytics Data	"Provide documentation of findings , reviews, and analysis from learning analytics, other form of data obtained in the course of the MOOC" (Stracke, et al., 2018).
10.Support	"Provide community teaching assistants to render feedback and support to learners" (Stracke, et al., 2018) . "Students have clear routes to academic, technical and administrative support" (Roswell, & Jansen, 2014).

DISCUSSION

The initial phase of the results was presented. The results of the analysis on common criteria across the four quality guidelines supported the interactivity of dimensions, constructing the learning environment that was suggested in the 10 Dimensions Model. The design of learning activities to accommodate diverse learning needs and their self-regulated learning was encouraged. High-quality support design, pedagogy, learners' background and intention were associated with the criteria. Communication, technology, pedagogy and support dimensions were illustrated as that they functioned for other dimensions in the unique MOOC learning environment.

The association of criteria from the four quality guidelines enriched the 10 Dimensions Model. The results suggested the views on the quality for each dimension, required from the different focuses. Overall, 10 Dimensions covered the items suggested in the four quality guidelines. We will continuously explore additional inputs for the contents of dimensions. The current 10 Dimensions Model was developed for MOOC design beginners. For advanced designers who have more discretion in the institution, the improvement for an advanced version of the Model might be needed.

The guidelines had a small number of statements about learning analytics. This dimension might be an area to be explored. Among these, the use of analytic data for evaluation of the course was addressed in the guideline (Stracke, et al., 2018). In the cycle of design, evaluation and improvement is the phase that is considered evidence-based improvement, using learning analytic data (Grover et al., 2013) in the 10 Dimensions Model.

CONCLUSION

10 Dimensions Model (Ichimura & Suzuki, 2017) was developed when the research on MOOC design was still limited. The Model synthesized the elements that construct MOOCs, that would provide an understanding of the mechanism for quality design. The current paper introduced the analysis of the Model using four quality guidelines available now to verify the Model. The analysis is still underway, and some important common attention on the design has emerged from the analysis. Those criteria were responding to the characteristics of massiveness and open learning environment of MOOCs, and crucial for independent learning of the participants who have diverse learning experiences and needs. In the guidelines, interaction and knowledge sharing of learners were encouraged with the use of technology, despite the great number of participants. Further analysis will investigate how each dimension is designed to meet the criteria addressed in the guidelines.

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Improvement on Online distance education: based on the Students' insights, advantage and disadvantage with each, online education and Face to Face education

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Abstract: In Osaka Electro-Communication University, we conducted all class online distance education from the Spring semester of the 2020 academic year in order to prevent the spread of Covid-19. In the beginning when we started online education we had real-time online class, on-demand class and mixed class (record the real-time online class and share the recording video as on-demand contents). In the middle of 2020 Spring semester when both teachers and students were getting used to online class we researched what students felt the online class.
This study we researched students' insight what they think advantage and disadvantage with each, online class and face to face class. The results show the online class have some advantage over face to face class and also some points to improve. Therefore, we tried to improve our online class 2020 Fall semester and 2021 Spring semester. In this paper we report our approach to improve and results of the research.

Key words: Online distance education, Online Education, Students' insight

INTRODUCTION

The World is still in a state of Covid-19 pandemic, and the virus is still spreading. At the beginning this situation many universities in Japan but also in the World had to change the class to online distance education from face to face education from around March 2020. Since then, many universities have tried to suite this situation online class, face to face class and HyFlex (Hybrid-Flexible) class.

In Osaka Electro-Communication University, we conducted all class online distance education in the Spring semester of the 2020 academic year. When we started online education we had real-time online class, on-demand class and mixed class (record the real-time online class and share the recording video as on-demand contents). And teachers selected their own what style of online education as of spring semester 2020. Why we had to select our own we did not have guideline of online education and we did not make environment for it. We had to manage to get done with the class by ways that are suitable for each.

We have 15 classes (weeks) in a semester for each subject in Japan. In the middle of Spring semester 2020, which is the 8th, when both teachers and students were getting used to online class we researched what students felt the online class. This survey targeted 249 students who were taking the author's course. From this research we got students' insight. Therefore we tried to improve our online class Fall semester 2020 and Spring semester 2021.

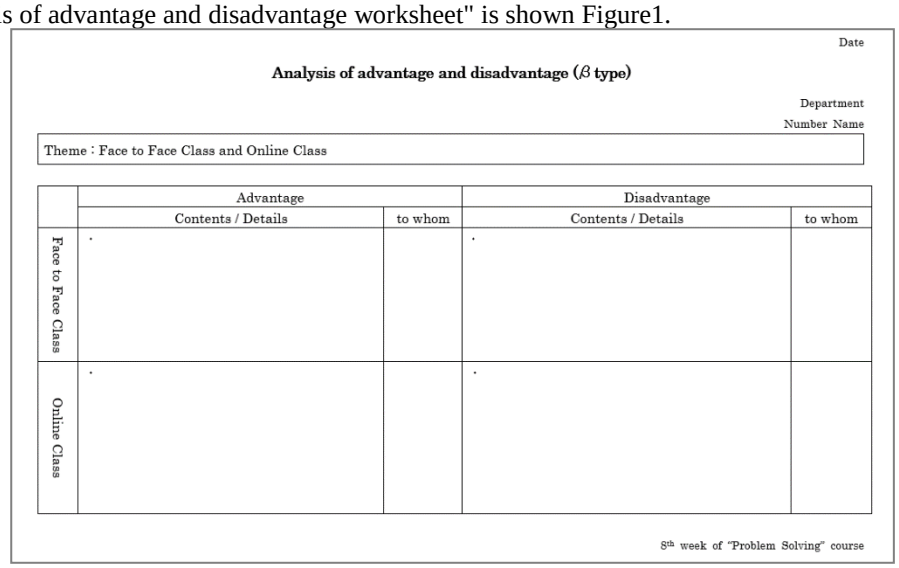
We asked students "advantage and disadvantage" with each, online class and face to face class instead of improvement plan of online class. By asking students' insight not direct question, we consider that we can find points to improve from a different perspective.

RESEARCH DESIGN & METHODS

We researched what students felt the online class. We targeted 249 students who were taking "Problem Solving" course, the author is taking charge. This course targets for 1st year, 209 students were 1st year and 40 were other year in 2020. The number of valid answers was 240 students for this research.

The 8th week topic in this course is "analysis of advantage and disadvantage". The author lectured overview about this analysis first, this analysis is useful way for problem solving and marketing. Further

explained how to use the analysis worksheet. After that students practiced the worksheet. It's report for this topic, and theme was "the advantage and disadvantage with each, online class and face to face class". The "analysis of advantage and disadvantage worksheet" is shown Figure1.



Date

Analysis of advantage and disadvantage (β type)

Department

Number Name

Theme : Face to Face Class and Online Class

	Advantage		Disadvantage	
	Contents / Details	to whom	Contents / Details	to whom
Face to Face Class	.		.	
Online Class	.		.	

8th week of "Problem Solving" course

Figure1: analysis of advantage and disadvantage worksheet

This work (practice) is just practice for students understand how to analyze. The point is, that student did not know this worksheet to be used to improve online class when they worked. The reason is that we thought we need to draw out students' insight / real intention. That makes students can think anything without bias which they need to think improvements of online class. Next week, 9th week in this course the author told students the work was practice for them but also we use to improve online class, in addition asked students to understand that we use the data.

On average, 240 students listed 3 to 4 advantages and disadvantages with each, online class and face to face class. We sorted out the data, so that we find some advantage over face to face class and also some points to improve.

RESULTS

The table1 shows that advantage of online education students thought. We classified the data by situation.

Table1

advantage of online education

place	details		comments	number of students
in class	on-demand	late for class	easy to recover if be late for class	1
		pace	can proceed at own pace	8
		preparation	easy to prepare for the class	2
		review	easy to review / the documnts and videos again	77
		subtitles	easy to get subtitles (for international students)	1
		timing	easy to join the class whenever students want	33
	learning	documents	easy to get documents and information	6
		materials	easy to prepare the materials for the class	13
		presentation material	easy to read presentation materials	25
		recover	easy to check / search things not understanding by internet	15
		screen shot	easy to get screen shot presentation materials	3
		support	easy to get support of IT from teacher	2
	Condition	Body Condition	can join the class bad health / poor physical condition	10
		Mental Condition	can concentrate on studying without anyone	5
	classroom	number of students	no need to concern about maximam capacity of classroom	4
		seating plan	no need to concern about seat (feels quite different depends on the seat)	5
	feeling	camera	no need turn on the camera (we don't mandate students to turn on their camera for protecting privacy in our university)	2
		casually	easy to join the class without being nervous	15
		stress	easy to join the class without being nervous	20
	Friends	casually	no need to get nourves to make new friends / communicate with someone	3
		communication	easy to communicate by DM / cellphone in class	7
	IT	skill up	can get the IT skills	22
	Place		easy to join the class from everywhere	33
	Manner	dress	no need to change cloth	17
		grooming	no need to make up / grooming	8
		posture	no need to concern about posture	21
	question	casually	easy to contact / ask questions / speak in the chat box	35
		review	easy to review the comments / questions in the chat box	3
		timing	easy to ask questions / speak 'anytime' in the chat box	4
	others	eco	no need paper documents (eco)	3
at home	environment	learning environment	easy to provide environment to learn	38
	homework/ report	casually	given to simple homework / report sometimes	5
		data management	easy to manage homework / report digital data	8
		hadnwriting	no need to handwriting / no need to feel messy handwriting	6
		submission status	easy to check submission status	9
		time	easy to get the time for homework / report	2
		timing	easy to submit homework / report anytime	12
		way to submit	easy to submit homework / report by class system	2
	feeling	casually	no need to get nourves to attend the class	37
		restroom	easy to go restroom	12
		skip	easy to other things (teacher can not check)	9
	learning	actively	want to study proactively	3
	Manner	Snack	join the class with snack / meal / drink	11
at university	commute	time	no need to rush to next class	12
	Cost	Lunch	no need the lunch box / lunch cost	7
on the way to university	commute	time	can save own time	75
	time management	morining	no need to get up earlier	51
	Cost	Travel Cost	no need travel cost	63
	feeling	physical	no get tired on commute	8
		rush hour	no need to get train rush hour	4
	weather	traffic	can join class if traffic has some trouble	3
		weather	can join class if weather is not good (in Japan we sometimes have temporarily closed by Typhoon)	6
other place	safety	infection	can prevent the spread of infection	23
		traffic accident	lower the risk of a traffic accident	4
others	for guardian	check	easy to know attendance status of student	4
	system	check	easy to know attendance status	2
	feeling	casually	no need to go University	76
			total	895

IT should be noted students found many advantages of online class. Among these they said they can easily to review when the class is on-demand style or mix-stile. 77 students said that. In our university teachers selected the style of class when it started spring semester 2020. Therefore students had chance to join the online class, on-demand class and mixed class.

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Recommendation System Design for AI-Integrated Educational Applications: Focusing on Learning Styles

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Abstract: Recently, AI-integrated educational applications have tremendously increased with the advances of AI technologies. In this flood of AI applications, however, learners may experience difficulty in choosing appropriate learning tools. This paper aims to propose a recommendation system that is based on learners' characteristics such as learning styles and their preference for a specific educational application. The study was implemented in three steps: (1) developing learner profiles based on learning styles; (2) building a database of AI-integrated language applications; (3) developing a collaborative filtering mechanism. This study found that learning styles are correlated with learners' preferences for specific AI-integrated language applications. Thus, the collaborative filtering and K-nearest neighbors' algorithm were used to provide learners with top-3 recommendations of applications in their learning-style groups. The contribution of this study is that it provides a new recommendation system based on learning styles to help learners choose a mobile AI application consistent with their preferences.

Key words: AI-Integrated Educational Applications, AIED, Learning styles, FSLSM, Recommendation system

INTRODUCTION

AI learning applications such as Santa TOEIC, Duolingo and Super Chinese have increased in the past a few years(Lee et al., 2020). With the advances in emerging technologies such as voice recognition capabilities and neural network translation that integrate mobile technology and artificial intelligence, learning difficulties can be reduced through adaptive learning platforms and may reduce excessive costs for private education (Lim et al., 2018). However, it is difficult to select appropriate applications in a meaningful way. In this regard, a well-structured recommendation system can provide better learning opportunities with individuals who lack sufficient experiences in a specific field or do not have the competence or time to evaluate the potentially relevant items among the overwhelming number of alternative items that are available online(Dascalu et al., 2015).

Meanwhile, the relation between the Learning Styles (LS) and Recommender System (RS) has attracted many researchers in the last decade. Chen and his colleagues(2019) suggest that learners with similar learning styles have similar preferences and learning behaviors in adaptive learning. The learning style model by Felder and Silverman (1988) refers to the preference of approaching learning as a unique characteristic of each learner. However, as several studies regarding recommendations of learning style-based adaptive learning have been heavily biased toward web-based learning environments, there is a lack of studies on mobile learning environments (Murad et al, 2018). Therefore, this paper aims to suggest a recommendation system of language learning applications so that the learners can benefit from this system for effective and efficient learning based on their own learning styles.

LITERATURE REVIEW

The Felder- Silverman Learning Style Model

Psychologists have been interested in the different learning preferences of each learner and the individual differences in learning approaches as learning styles(Klasnja Milicevic, 2011). Felder and Silverman(1988) developed a model to understand identify learners' learning styles. By following the model, learning styles can be classified and their implementation rules were defined. This model divides personal learning style preferences into four dimensions: Information Processing, Information Perception, Information Reception, and Information Understanding. Each of the four domains has two categories: (1) Active – Reflective, (2) Sensing – Institutive, (3) Visual – Verbal, and (4) Sequential – Global. In the four domains of learning styles, one category out of two is applicable to every learner, which means a total of 16(24) combinations of learning style preferences can be derived: ASLG, AIBG, ASBQ, ASLQ, ASBG, AILG, AIBQ, AILQ, RSLQ, RIBQ, RSBG, RSLG, RSBQ, RILQ, RIBG, RILG. <Table 1> presents the dimensions of learning styles.

Table 1
Learning Style Dimensions by Felder-Silverman

Dimensions	Learning style	Definitions
Information Processing	Active(A)	Do it
	Reflective(R)	Think about it
Information Perception	Sensing(S)	Learn facts
	Intuitive(I)	Leaning concepts
Information	Visual(L)	Require Pictures

Reception	Verbal(B)	Require reading
Information Understanding	Sequential(Q)	Step by step
	Global(G)	Big picture

Source: Kinshuk, T. L., & Lin, T. (2004). Application of learning styles adaptivity in mobile learning environments. *In Third Pan Commonwealth Forum on Open Learning* (pp. 4-8).

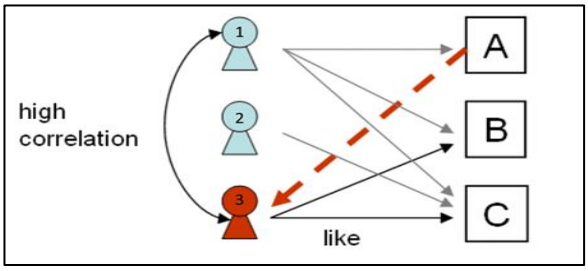
Collaborative Filtering in Recommendation Systems

Collaborative filtering (CF) is a method for predicting users' interest in new items based on other users with similar preferences (Ekstrand et al., 2010). CF recommends a highly preferable item to the user with similar preferences. While CF has been widely used in the field of-commerce and entertainment, the use of CF for educational applications remains limited(Recker, M. M et al.,2003). There are two methods of recommendation used in educational contexts: collaborative filtering and content-based filtering. Since the learning styles relate to the groups of learners based on their preferences for processing certain types of information or for processing information in certain types of way, CF was employed in this study to suggest a recommendation system for educational applications.

Figure 1 visualizes the user-based collaborative filtering mechanism. Learner 1 prefers items A, B and C, Learner 2 prefers an item C, Learner 3 prefers items B and C. Under this situation, Learner 1 and Learner 3 have similar preferences and are likely to prefer an item A that has never been used for Learner 3

Fig 1

User- Based Collaborative Filtering Recommendation



Recommendation System Based on FSLSM

The Felder-Silverman Learning Style Model (FSLSM) is the most widely used framework about learning styles since the model combines other classical theories and can be easily integrated in computer programs with its data measurement method called the index of learning styles(Chen et al, 2019）.

Saryar and his colleagues(2019) developed a mobile learning recommendation system based on FSLSM.. The recommendation system was designed to help learners to find suitable courses in the mobile application based on the learner's learning styles. Milićević and his colleagues (2011) designed a personalized recommendation system for e-learning by measuring learners' learning styles. This system proposed adaptive and customized e-learning contents based on the learner's learning styles, knowledge, and preferences. The personalized e-learning system was able to adapt the habits, interests and knowledge levels of learners and had a high effect on self-directed learning.

While there are some studies on learning style-based recommendation in the existing literature, most systems are web-based systems and little systems were developed for mobile learning environments. This number is still relatively low when it is compared to the papers about the use of recommendation systems in web-based system. We observe there is still a research gap here.

RESEARCH PROCEDURE

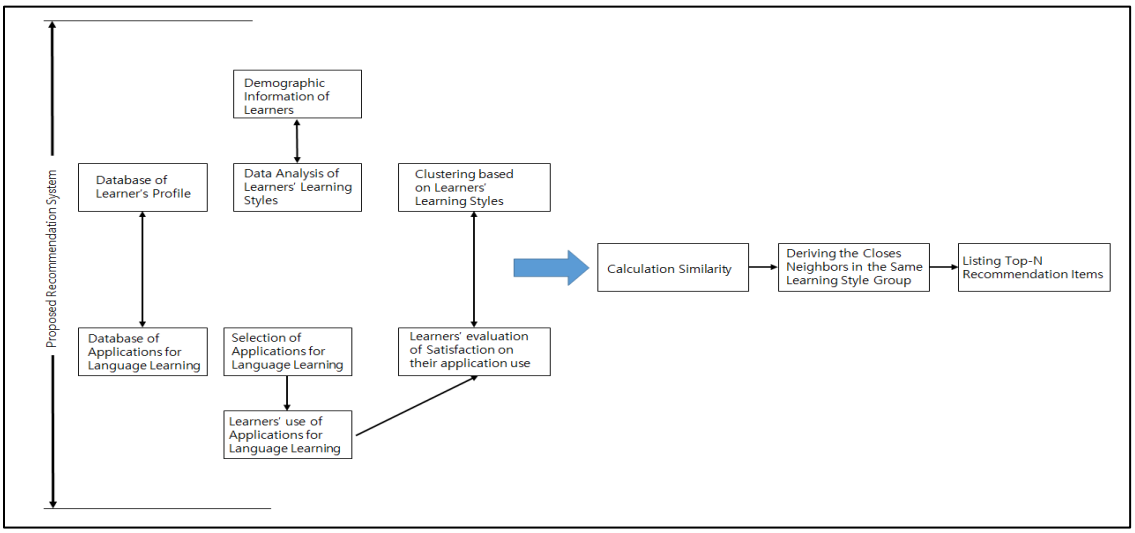
Architecture Overview

The recommendation system consists of four main modules as follows.

First, learner profiles were developed based on the learners' learning style and their demographic information. To implement learner profiling, 40 participants were recruited, who were aged from 20 to 39. Second, a database of AI-integrated language applications was built. In this step, we collected data on AI Language Applications and had the participants use and evaluate the applications for learning purposes. Third, a collaborative filtering mechanism was developed by constructing the Closest neighbors in the same Learning style groups. Similarity between the Learner's Evaluation after using applications was calculated and Top-N recommendation list was derived based on the similarity. Fourth, the mechanism of the proposed system was evaluated through the learners' satisfaction survey. The overall architecture of the proposed system is described in Figure 2.

Fig 2

The Architecture of the Proposed System



Step l: Developing Learner Profiles

The participants of this study were 40 adult learners who have an intention to learn a foreign language through AI-integrated mobile applications. They (a) completed an ILS(Index of Learning style) survey instrument（Felder& Soloman, 1991） to measure their learning styles (b) used randomly-selected four AI applications for language learning, and (c) completed a satisfaction survey about the used applications. The participants were grouped according to their learning styles.

Thirty-nine participants were distributed across nine learning styles as shown in Table 2. There was only one participant in the ASBQ group, which was impossible to apply CF. The learner profiles, hence, include nine learning styles from 39 learners who used 16 AI-integrated mobile learning applications for language learning. The total number of instances for learner profiles is 39· 156 (number of learners* number of applications used).

Table 2

The Distribution of Participants based on Learning Styles

Learning style	ASLG	AIBG	ASBQ	ASLQ
Number of Instance	8	0	1	5
Learning style	ASBG	AILG	AIBQ	AILQ
Number of Instance	0	2	0	3
Learning style	RSLQ	RIBQ	RSBG	RSLG
Number of Instance	6	0	2	9
Learning style	RSBQ	RILQ	RIBG	RILQ
Number of Instance	0	2	0	2

Summary Data

Group Distribution	Number of Applications	Number of Learners	Number of Instance (Learner*Number of Application Used)
9	16	39	39*156

Step 2: Building a Database of AI-integrated Language Applications

We selected 16 AI language learning applications (see <Table 3>) based on the following criteria: (1) applications for language learning; (2) applications with AI technology such as voice recognition, adaptive learning system, learning data analysis etc; (3) applications which clearly indicates the use of one or more AI technologies; (4) applications with no errors; and (5) applications available in Korea.

In this stage, the satisfaction data about the AI language learning app was collected from the learners by randomly providing four apps to each learner to understand the learner preference. The app rating was composed of a scale of 5. If an app was rated 3 or more, the app was categorized to be preferred.

Table 3

AI Language Learning Applications

APP	Name	APP	Name
APP1	Duolingo	APP2	Opic up
APP4	Bigple	APP4	Elsa English Speaking
APP5	Riid Tutor	APP6	Plang

APP7	Youbot China	APP8	Ef Hello
APP9	Memrise	APP10	Rosetta Stone
APP11	Youbot English Speaking	APP12	Cake
APP13	AI Tutor	APP14	Andy English Bot
APP15	Super Chinese	APP16	Mondly

Step 3: Developing a Collaborative Filtering Mechanism

The participants in the same learning style group were identified with the nearest neighbors of learners. Python3.8 was used to make the nearest neighbor group with similarity calculation. As indicated earlier, the participants were classified into ASLG, ASLQ, AILG, AILQ, RSLQ, RSBG, RSLG, RILQ, and RILG learning styles. Then, Top-N recommended list was derived for each group of participants through collaborative filtering.

The ILS survey data were analyzed to identify the participants' preference and the level of satisfaction on the applications they used. The results of this analysis were used to recommend the lists of the applications based on the collaborative filtering algorithms for each learning-style group, as shown in Table 4.

Table 4

Learning Style-based Recommendation List Results

Types	1st	2nd	3rd
ASLG	Bigple	Opic up	Bigple
ASLQ	Plang	Youbot China	Opic up
AILG	Mondly	Elsa English Speaking	Opic up
AILQ	Youbot China	Ef Hello	
RSLQ	Mondly	Memrise	Youbot English Speaking
RSBG	Cake	Duolingo	Plang
RSLG	Memrise	AI tutor	Opic up
RILQ	Rosetta Stone	Cake	AI Tutor
RILG	Super Chinese		

Step 4: Effectiveness Verification of the Proposed Recommendation System

Mean Absolute Error (MAE) was used to evaluate the recommendation performance of

the learning style-based recommendation system. MAE value ranges from 0 to infinity. When the prediction error is smaller, the quality of the recommendation system would be better. Therefore, in order to measure MAE, it is necessary to calculate the actual rating of the user and the prediction value of the recommendation system. To identify the actual satisfaction of the learners, a total of 12 learners were selected by the stratified sampling, and the highly preferred application from the recommendation list was used and the satisfaction survey was conducted. The result of the satisfaction survey and the MAE less than 0.5 of the recommended prediction score can be considered as a recommendation method with high performance. The accuracy of the actual verification value and the prediction value of the recommendation system below 0.5 had a high accuracy rate of 83.33%, and the satisfaction survey of recommended applications shows 3 or more scores (see table 6). This result proves that the recommendation system design proposed in this study has high performance.

Table 5

Effectiveness Verification Results

Performance	LS-Type	User	MAE	Accuracy (%)
High Performance (≤0.5)	ASLG	U04	.00	83.33%
		U10	.15	
	ASLQ	U21	.25	
	AILG	U14	.30	
	AILQ	U35	.50	
	RSLQ	U16	.35	
		U30	.30	
	RSBG	U23	.15	
	RSLG	U31	.15	
	RILG	U03	.30	
Low Performance (>0.5)	RSLG	U12	.80	16.67%
	RILQ	U38	.70	
Total	-	-	-	100%

CONCLUSION

Implications

The implications of this study are as follows. First, the system proposed in this paper broadened the perspective in recommendation of AI learning applications by adopting a novel way of filtering systems. The previous studies were primarily based on content-based recommendation, which could only identify users' past preferences, recommending similar types of items. This paper aims to overcome the limitations of the previous studies by proposing a recommendation system using collaborative filtering.

Second, this paper employed learning styles in recommending learning applications, which was rarely investigated previously. Although Felder and Silverman's learning style model has been used to recommend some content in several web-based learning environments, there have been little studies on recommending mobile learning apps. This study identified learners' preferences on learning styles for the recommendation for AI language learning application. This means that it went beyond the previous studies which focused only on recommending learning content in the web environment when it comes to the learning style theory (Klašnja et al., 2011).

Limitations and Suggestions for Future Research

Some limitations of this study and the future research can be suggested. First, this paper provided a static method of constructing learner's profiles rather than a dynamic method in

adaptive learning. We analyzed the learner's learning styles and then used collaborative filtering for recommendations. However, a recommendation of learning applications could be more precise and meaningful for the learners when it captures static as well as dynamic characteristics such as tracking learning behaviors. Second, although this study focused on learning styles for designing a recommendation system, learners who participated in this study were classified into only nine learning styles, not reflecting all 16 learning styles. In the future research, it is necessary to increase the number of participants to include all learning style groups. Finally, the recommendation system of this study targeted only 16 AI applications for language learning. Future research needs to extend the results of this study to the AI learning applications of other subjects or topics.

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Research on deep teaching strategies for the cultivation of computational thinking: Take graphical programming teaching as an example

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Abstract: With the continuous development of information technology, the Internet, cloud computing and other technologies have penetrated into people's life, affecting people's lifestyle and way of thinking. Computational thinking, as a way of thinking that uses the basic knowledge of computer science to solve problems, is particularly important. Graphic programming provides a suitable tool and carrier for the cultivation of computational thinking, but teachers often pay attention to programming learning content. Deep learning points to higher-order thinking and requires teachers to adopt deep teaching strategies to cultivate students' computational thinking. Through literature research and based on graphical programming learning activities, this paper designs depth teaching strategies to promote the development of abstraction, decomposition, algorithm, evaluation and generalization of five elements of computational thinking, thus promoting the cultivation of computational thinking, and explains each strategy one by one. The design of specific teaching cases is expected to provide some practical guidance for the cultivation of computational thinking.

Key words: Computational thinking, Graphical programming, Learning activities, Deep teaching strategy

INTRODUCTION

With the continuous development of informatization, technologies such as the Internet and cloud computing are integrated into people's lives and are inseparable from people's lives. In the age of information and digitalization, it is particularly important for students to master a certain core competence of computational thinking. At present, the domestic and foreign countries have attached great importance to the cultivation of computational thinking for elementary and middle school students. For example, in 2011, computational thinking was included in the US "CSTA K-12 Standard (2011 Revised Edition)".

The new curriculum plan of the United Kingdom in 2013 and several new curriculum plans of Australia in 2015 take computing thinking as an important content of their new information technology courses. In China's newly revised Information Technology Curriculum Standards for General Senior High Schools (2017 Edition), it is clearly pointed out that information technology classroom should help students learn to use computational thinking to identify and analyze problems, abstract, model and design systematic solutions. In January 2018, China's Ministry of Education listed computational thinking as one of the core discipline qualities. It can be seen that cultivating students' calculation thinking is the need of the times.

Graphical programming is based on the principle of "what you see is what you get", to avoid the high-level programming language tedious and obscure, so that programming becomes interesting and easy to understand.

At the same time, graphical programming has won the love of children with its vivid and flexible interface characteristics. Graphical and modular programming languages are most popular with computational thinking workers. Computational thinking is very important to the innovation and training of talents in the information age. Graphic programming has gradually become an effective way to cultivate computational thinking.

2. Literature review of deep learning and computational thinking

Computational thinking is a learning result that students need to obtain. As a key factor affecting the effectiveness of learning, students are undoubtedly the most important way to obtain computational thinking literacy. Teaching and learning are two inseparable parts of teaching activities. To promote students' deep learning, teachers' teaching strategies must be changed. Therefore, in order to promote the cultivation of students' computational thinking, it is necessary for teachers to adopt deep teaching strategies to promote the development of computational thinking and problem-solving skills in the process of programming teaching.

2.1. Computational thinking

In March 2006, Professor Zhou Yizhen, who was the dean of the Department of Computer Science at Carnegie Mellon University(CMU) in the United States, first proposed computational thinking: Computational thinking is the use of basic concepts of computer science for problem solving, system design, and understanding of human behavior. It covers computer science. The breadth of a series of thinking activities. The International Association for Educational Technology (ISTE)and the Association of Computer Science Teachers(CSTA) believe that computational thinking is a process of problem-solving. The newly revised high school information technology curriculum standard defines computational thinking literacy as: the ability to use the disciplinary methods of the computer field to define problems, abstract features, establish structural models, and organize data reasonably; through judgment, analysis and synthesis of various information resources, the use of reasonable The algorithm forms a solution to the problem; summarizes the process and method of using the computer to solve the problem, and migrates to the solution of other related problems.

Among the related research on the elements of computational thinking, the more widely accepted ones are the five elements of computational thinking proposed by Dr. Cynthia Selby and Dr. John Woollard of the University of Southampton, including algorithms, evaluation, decomposition, abstraction, and generalization. Decomposition is the decomposition of a thing into multiple components. For example, if we want to know the structure of a computer, we can disassemble the internal structure of the computer and have a comprehensive understanding of the computer through disassembly. Abstraction refers to thinking about a problem in another simplistic and generalized way, ignoring the subtle details, making the problem easier to understand without loss. For example, if we want to study the trajectory of a diving athlete, we can ignore his body movements and treat it as a mass point for research. Algorithms are specific methods and steps to solve a problem. There is no fixed answer. Students can have different methods to solve the same problem. For example: the process of using dichotomy to solve problems in mathematics is the use of algorithms. Evaluation refers to obtaining the best way to solve a certain problem by comparing different algorithms. For example, students plan to play in the zoo route and find the shortest play route by comparing different routes. Generalization refers to the process by which students realize rapid transfer between two related or similar knowledge points. Students apply the previously learned methods of solving certain types of problems to new problems to achieve quick solutions. For example: Oxidation and reducibility in chemistry are descriptions of the ability of a

substance to gain and lose electrons. After students understand that the oxidizability of a substance is the ability of a substance to gain electrons, it is easier to understand the reducibility of a substance through migration.

2.2. Deep learning

2. 2.1 Definition

From the perspective of learning results, the scholar An Fuhai believes that deep learning is a kind of learning based on understanding, which means that learners aim at the development of higher-order thinking and solve practical problems, with integrated knowledge as the content, actively and critically Learning new knowledge and ideas sexually, and integrating them into the original cognitive structure, and a kind of learning that can transfer existing knowledge to a new situation. From the perspective of the learning process, scholar Sun Yinli believes that in-depth learning is that learners combine the knowledge they have learned with the original cognitive structure under a positive learning attitude, focusing on actively acquiring and applying knowledge under the premise of understanding. After continuous reflection, the process of reconstructing the cognitive structure. This research believes that in-depth learning based on visual programming means students actively participate in the acquisition of programming knowledge and skills, focusing on the understanding and application of programming knowledge rather than simple acquisition, focusing on the transfer of programming knowledge, and students are

experiencing, sharing and discussing, displaying results, and reflecting on learning. It is a kind of meaningful learning to promote the acquisition of computational thinking and the improvement of problem-solving ability.

2.2.2 Deep teaching strategies

Students' deep learning needs teachers' guidance and help. Therefore, in classroom teaching, teachers need to adopt certain teaching strategies to promote students' deep learning. Using "deep learning" and "teaching strategy" as keywords, a total of 235 academic papers were searched out on CNKI. These documents were read, summarized, and extracted from the perspective of learning environment, learning content, learners, and learning methods. From the five perspectives of learning evaluation and reflection, the following deep learning teaching strategies are derived.

Table 2-1

Deep teaching strategy

Angle	Content of the strategy
Learning environment	Create real situation and guide students to experience deeply
	Take the question as the orientation, stimulate the student's question consciousness
Learning content	To connect new knowledge with old knowledge and guide students to construct critically
	Integrate multidisciplinary learning content and enhance problem-solvingskills across disciplines
	Based on the unit learning subject, the unit learning content is integrated to achieve deep understanding of knowledge points
Learners	Stimulate students' learning motivation and promote deep participation
	Establish a learning community and promote in-depth exchanges
Learning method	Independent inquiry learning, promote deep thinking
	Cooperative learning in groups to promote deep communication
	Continuous evaluation and timely feedback

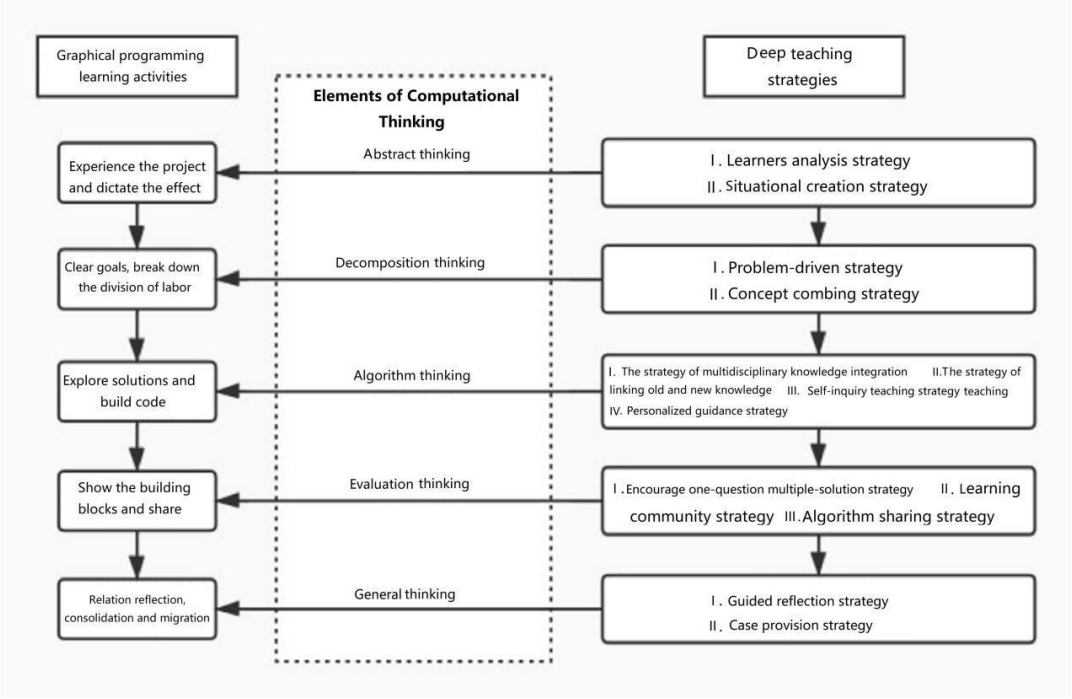
Learning evaluation and reflection	to improve learning persistence
	Positive evaluation, cultivate students' self-confidence
	Pay attention to process evaluation and realize learning in evaluation
	Guide students to reflect on the learning process and promote the development ofmetacognition

3. Deep teaching strategies under the cultivation of computational thinking

Using "graphical programming" and "learning activities" as keywords, a search was conducted on CNKI, 8 documents were searched, and the remaining 7 documents unrelated to graphical programming were eliminated. Summarizing, comparing and extracting the learning activities in these articles, it is concluded that the classroom learning activity process based on graphical programming is roughly divided into five stages, which are experience projects, oral effects; clear goals, dismantle and divide labor; explore plans , Build code; display building blocks, exchange and share; associate reflection, consolidate migration.

Relying on graphical programming learning activities, design in-depth teaching strategies that promote the development of five computational thinking elements of abstraction, decomposition, algorithm, evaluation, and generalization, and explain each strategy one by one.

Figure1.
The deep teaching strategy chart of graphical programming learning activities



3.1 Experience the project and dictate the effect stage

Abstraction is the process of abstracting, simplifying, and generalizing the problem. Students ignore the details of the problem, grasp the main links of the problem, and abstract and characterize the problem, so that the problem becomes easy to understand without losing any influence on the problem solving. This stage includes 2 strategies.

3.1.1 Learner analysis strategy: Teachers comprehensively consider students' learning

interests, abilities, needs and other factors to design programming projects that meet the cognitive level and cognitive needs of learners, inspire students to be fully engaged, and promote students to participate in the learning process in depth.

3.1.2 Situation creation strategy: Teachers create gamification situations to stimulate students' learning motivation and interest in learning. At the same time, teachers repeatedly broadcast the effects of the project to deepen students' understanding of the project. Finally, the teacher guides students to analyze events, analyze role actions, and guide students to describe in detail the triggering events and effects.

3.2 Clear goals, dismantling and division of labor stage

Decomposition is the process of decomposing a problem into multiple component modules and thinking about each component module separately. This stage includes 2 strategies:

3.2.1 Problem-driven strategy: Teachers are oriented to solve project problems, stimulate students' problem awareness, and exercise students' ability to analyze and disassemble problems.

3.2.2 Concept combing strategy: Teachers use mind maps to conduct visual thinking training, which is helpful for students to sort out the problem context. The teacher leads the students to analyze the effects to be achieved by each role, and breaks down the complex problem into multiple problem modules according to the role, reducing the difficulty of the problem, and the difficulty of solving the problem for the students.

3.3 Exploring the plan and building the code stage

An algorithm is a series of operating procedures or steps that need to be taken to solve a problem. This stage includes 4 strategies:

3.3.1 Multi-disciplinary knowledge integration strategy: Graphical programming teaching involves knowledge of multi-disciplinary fields. When organizing learning content, teachers pay attention to the integration of subject knowledge such as mathematics, physics, and programming to improve students' ability to solve problems across subjects.

3.3.2 New and old knowledge linking strategy: Before the students conceive the algorithm, the teacher will present the old knowledge related to this lesson to the students in the form of resource packs or ppt resources to activate the students' existing cognition and promote the construction of students' meaning.

3.3.3 Self-inquiry teaching strategy: After the teacher explains the building blocks, the students think independently and initially construct the algorithm.

3.3.4 Individualized guidance strategy: Teachers provide targeted guidance for different students'different problems and help students complete the production of the project.

3.4. Show building blocks, communicate and share stage

Evaluation is the process of comparing different algorithms to arrive at the optimal algorithm. This stage includes 3 strategies:

3.4.1 Encourage one problem multiple solution strategy ： The teacher encourages students to use different algorithmic processes to cultivate students' divergent thinking.

3.4.2 Learning community strategy: students clearly obtain the teaching goal of the optimal algorithm, communicate and share algorithms under the organization and arrangement of teachers, and promote in-depth communication.

3.4.3 Algorithm sharing strategy: The teacher organizes students to show the algorithm, and obtains the optimal algorithm by observing and comparing the advantages and disadvantages of different algorithms.

3.5 Relevance reflection, consolidation and migration stage

Summarization is the ability to apply the methods of solving certain types of problems to new problems, so that new problems can be solved quickly.

3.5.1 Guide reflection strategy: Teachers guide students to reflect on the cognitive process of programming through questions, reflection record sheets, learning summary sheets, etc., to promote the development of metacognition.

3.5.2 Provide case strategy: The teacher provides another real situational case, which is closely related to but not the same as the knowledge learned in this lesson. The case promotes the development of

students' general transfer ability.

4. Case design and analysis

Taking " Flowers Blooming " as an example, the above-mentioned deep teaching strategy of graphical programming learning activities is specifically explained and applied.

4.1 Preliminary analysis

First, analyze the teaching content, teaching objectives, learner characteristics, teaching methods and other elements of this lesson.

4.1.1 Teaching content: Make a beautiful animated work of beautiful flowers.

4.1.2 Teaching objectives: (1) Students can tell the role of stamps and use stamp tools to turn petals into flowers. (2) Students can build a complete use process of the brush tool. (3) Students can program a complete blooming effect.

4.1.3 Learner characteristics: The teaching object is the fifth grade students. The students at this age are in the early stage of the concrete calculation stage and the formal calculation stage. The students' thinking activities still need to be supported by image things. They have strong learning motivation. Active thinking and operation can be carried out under the guidance of the teacher in class. At the same time, students have mastered the basic operations of programming after a period of study.

4.1.4 Teaching method: a teaching method that combines problem-driven and explanation and demonstration.

4.2 Teaching process

Esigned with graphical programming learning activities as the main line, while focusing on the cultivation of students' computational thinking.

4.2.1 Experience the project and dictate the effect stage

The teacher selects the appropriate project content according to the learner’s interest, needs and learning level, creates a project context, and plays a small video about the growth of flowers before the start of the course, attracts students’ attention with real life cases, and enhances students’ interest in learning. Repeatedly play the effects of the "Hundred Flowers Striving for Beauty" project to connect with the real situation. The teacher starts with the role, guides the students to describe the growth process of rhizomes and flowers in detail, and verbally praises the students who actively speak.

The process of observing and dictating the effects of projects under the guidance of teachers exercises students' problem awareness and ability to analyze problems, and abstracts and generalizes complex projects.

Figure 4-1

Real scene video of flower growth

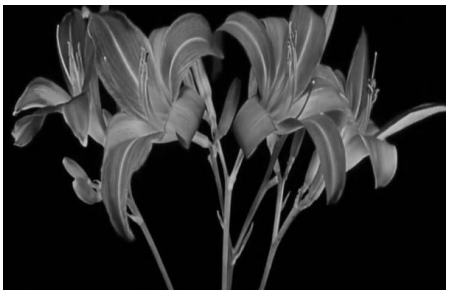


Figure 4-2
Project renderings of "Flowers blooming"

4.2.2 Clear goals, dismantling and division of labor stage

The teacher describes the complete project effect and promotes students' thinking and decomposition of the problem in a problem-driven way. For example, the teacher asks: What are the two parts of a flower? What are the characteristics of rhizome growth? What is the composition of flowers? Are the size and shape of the flowers the same, and if not, how can they be achieved? The teacher decomposes the process of drawing flowers by way of mind maps to simplify and modularize the project.

Figure 4-3
Problem driven method

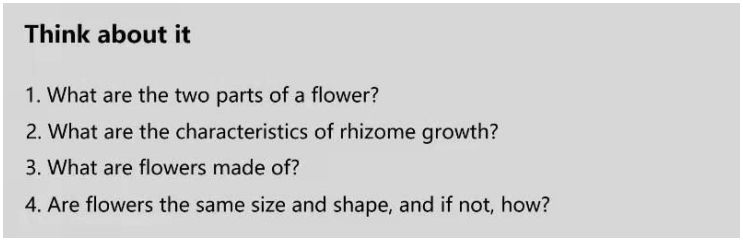
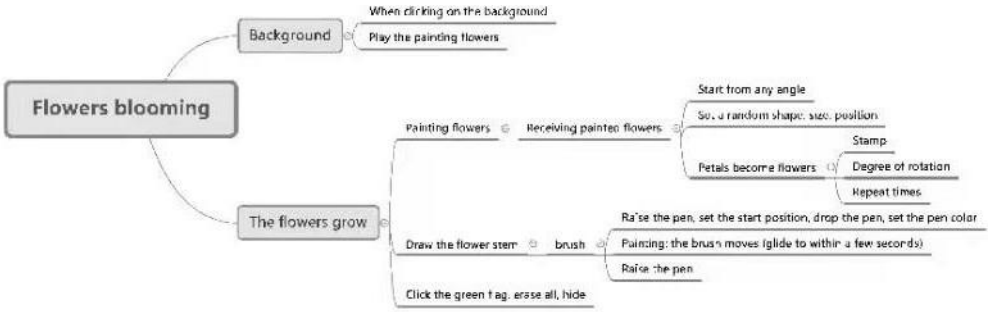


Figure 4-4
Mind mapping analysis of project effects



4.2.3 Exploring the plan and building the code stage

The teacher first conducts a knowledge review, reviews the old knowledge needed in this lesson, and promotes the connection between the new and the old knowledge. For example, lead students to recall the stamp tool they learned last semester. Deep learning emphasizes the integration of multidisciplinary knowledge. In this case, the mathematical knowledge that the angle of the circle is equal to 360 degrees is involved. The teacher informs the students that the product of the number of rotations of the petals and the number of rotations is 360 degrees.

At the same time, teachers guide students to carry out self-inquiry learning, preliminarily conceive

the algorithm program of "Hundred Flowers Striving for Beauty", give individual guidance to students, and answer different questions of each student.

Figure 4-5
Review the Stamp Tool

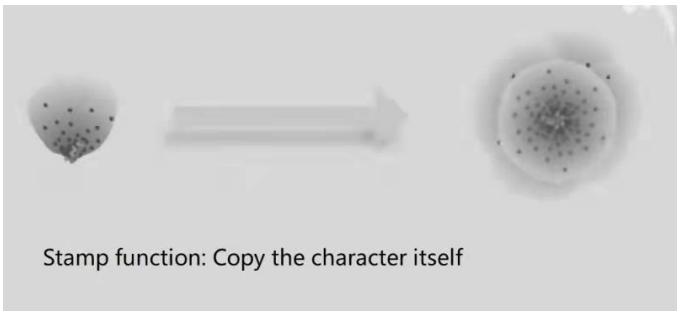
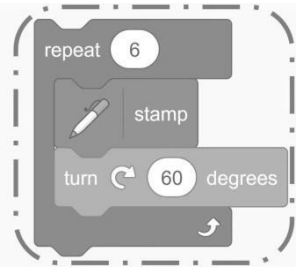


Figure 4-6
Review stamp tools to integrate math and programming knowledge



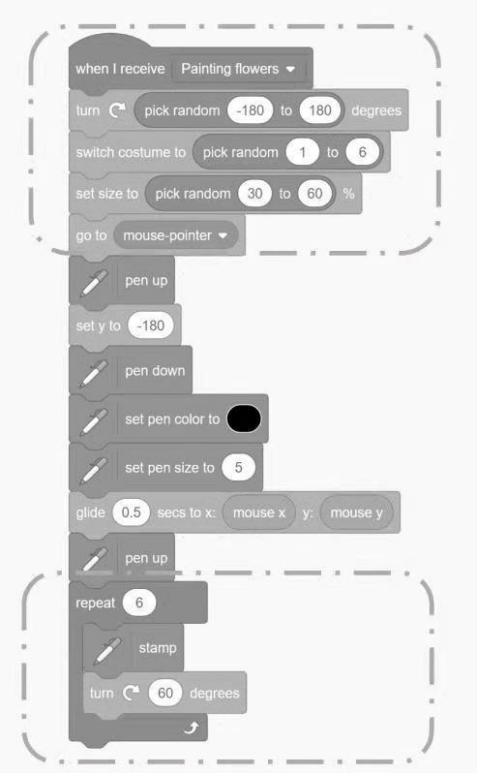
4.2.4 Show building blocks, communicate and share stage

Teachers encourage students to use different algorithms to build building blocks, inform students of the teaching goal of obtaining the best algorithm, so that students have a unified learning goal and form a learning community. The teacher invites 3~4 students to show their code,and others observe, compare and think to obtain the optimal algorithm.

4.2.5 Relevance reflection,consolidation and migration stage

Teachers provide procedural materials such as task lists and reflection record sheets for students to conduct procedural reflections. The process of students' reflection is a kind of regulation and supervision of the process of self-cognition, and promotes the development of students' metacognition. In addition, in order to consolidate programming knowledge and programming skills, teachers prepare project games similar to but different from this lesson project for students to learn. Students apply the problem-solving methods mastered in this lesson to outreach training projects to promote the development of generalization ability.

Figure 4-7
Show the code



5. Conclusion

Computational thinking is the need for the development of students' information technology literacy and the need for students to improve their problem-solving ability. Based on graphical programming learning activities, this research explains the deep teaching strategies adopted in the activities one by one, and promotes students' computational thinking by promoting the development of the five elements of abstraction, decomposition, algorithm, evaluation and generalization. This paper is expected to provide some teaching methods and suggestions for the cultivation of computational thinking.

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A study on metacognitive structure and problem solving design of children's programmingd

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Abstract: With the development of science and technology, modern society is more eager for talents with information literacy. "programming ability" has the same important position as "reading, writing and computing" in the 21st century. Metacognition is closely related to the process of solving child programming problems. Based on the three-point structure of metta-cognition, this paper finds out the specific performance of metta-cognition in child programming, depicts the structure of child programming, and then puts forward the process of child solving programming problems,design and display the problem-solving pre-cognitive development of programming for children in the form of cases.

Key words: Child programming; metacognitive; problem-solving

Research background and questions are presented

Children 's metacognitive level plays a decisive role on the self-monitoring of their learning ability and the perfection of their composition. . If students' metacognitive level fails to keep up with the change of learning requirements, it will lead to poor academic performance. Therefore, finding appropriate ways to promote students 'meta-cognition is of great significance to improve students' thinking and learning ability and help them learn to learn.

With the development of science and technology, the requirements for talents in the future have also changed, and modern society is more eager for talents with information literacy. As a bridge of human communication with computer, programming language has become an important survival tool of intelligent society. Child programming is a micro-world created by computer systems, providing the materials needed for children to construct knowledge results and the appropriate environment to support

children to construct learning. — — Pepert, the central character in the history of children 's programming, shared Piaget' s view that "children are the builders of his own intellectual structure". Inspired by Piagay 's constructivist theory, he worked with his team to design the idea of the world' s first LOGO, Pepper and the LOGO programming language in 1968, which was a theoretical source for many subsequent studies of children 's programming tools and children' s programming education. The process of children's programming is the process of students to solve problems. Programming can provide students with a lot of opportunities to practice and timely feedback on the implementation results of the program. In the process of students constantly debugging and modifying the code, students constantly monitor and adjust their cognitive activities. In the end, students are improving their cognitive ability, but also improve their metacognitive ability. Thus it can be seen that children's own concept and children. The structure and development of child children's cognition are closely related. So specifically, what is the metacognitive structure of children's programming? How does each programming meta cognition reflect in the process of problem solving for students? How to design the programming teaching for metacognitive development? These are further questions to be clear that will help better design child programming teaching and promote metacognitive development of students.

Analysis of child programming metacognitive structure

From the perspective of meta-cognitive consideration, the learning process is not only an understanding process of the identification, processing and understanding of the learned materials, but also a metacognitive process that actively monitors and regulates the process. Powell believes that metacognition is cognition, it includes three aspects: one is metacognitive knowledge, that is, individual knowledge about themselves or others, process, results, and related knowledge, cognitive experience, associated with cognitive activities, cognitive monitoring, that is, individuals in the process of the cognitive activities actively monitor their cognitive activities and adjust it accordingly to achieve the predetermined goal. Metacognitive process is actually the process of guiding and regulating our cognitive process to choosing effective cognitive strategies. Actual thinking is individual self-experience, self-observation, self-monitoring and self-regulation of thinking activities.

In order to find out the programming metacognitive structure, it is also necessary to specifically consider the goal of programming learning, which can refer to Brennank And Resnicnk established a 3 D framework of computing thinking from the characteristics of Scratch interactive media design activities, including computing thinking concepts (concepts that the designers use in programming), computing thinking practice (what the designers develop in programming), computing thinking concept (what the designers formed about the world around them and them). These three aspects of run through the process of child solving programming problems, implicit in the cognitive and metacognitive activities of child programming, and are important rely on the formation of children's metacognitive structure of programming.

Specifically, the children's programming meta-cognitive structure in the conceptual dimension of computing thinking is the cognition of their own programming ability and the cognition of programming tasks. The cognition of their own programming ability refers to the students ' ability to correctly measure the programming knowledge and skills they have and do not have, and the comprehensive cognition of whether they can complete and how to complete the programming. The cognition of programming tasks refers to the students ' cognition of the various attributes and elements of the task, such as the task presentation mode, characteristics, familiarity, logic, difficulty, objectives, etc., including the cognition of the task itself and the strategic cognition in the process of completing the task. The computational thinking is programming process monitoring, mainly referring to the monitoring ability of core programming process and self-programming behavior. In terms of computational thinking concepts, children represent the expression of their own thoughts and the interaction with others throughout the programming problem-solving process. Finally, the programming metacognitive structure also includes the programming experience, which is its own cognitive, emotion, and value experience accompanying the entire programming learning process.

Therefore, the study makes the following definition of child programming metacognition refers to the cognition of themselves and the whole problem solving process in the process of solving programming problems. They include cognition of their own programming capabilities, cognition of programming tasks, programming process monitoring, and programming experience, as shown in Table 1.

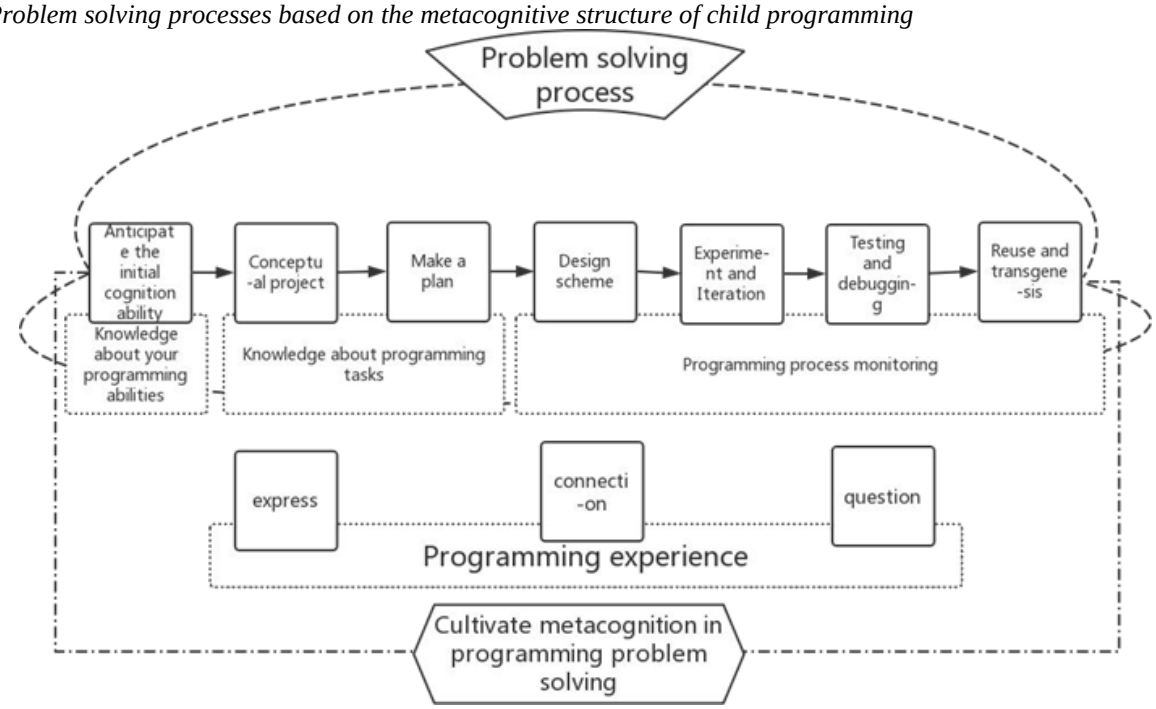
Table 1
Programming meta-cognition based on computational thinking

The bracket promotesreciprocity		**Meta-cognitive structure for children**
metacognitive knowledge	Knowledge about differences within individuals	Recognition of your own programming capabilities
Metacognitive monitoring	Knowledge about the task	Cognition of the programming tasks
		Programming process monitoring
Metacognitive experience		Programming experience

Problem-solving process design based on the meta-cognitive structure of child programming

The International Association for Educational Technology points out that the core of computational thinking is CPS (computing program solving), the ability to computational solve problems. The process of child programming problem solving is the main process of students 'programming learning. Therefore, according to the connotation and specific structure of children' s programming metacnitive, learn from three steps of CPS: characterization problems, building algorithms, testing and debugging, formed a problem solving process starting from the programming metacognitive structure of children, as shown in Figure 1.

Figure 1.
Problem solving processes based on the metacognitive structure of child programming



Among them, "predicted initial ability" mainly corresponds to the met-cognition of their own programming ability, "conceptualization project" and "making a" plan "corresponding to the cognition of programming tasks," design scheme "," test and iteration "," test and debugging "and" reuse and

innovation "corresponding to programming process monitoring," expression "," connection "and" doubt " with the whole problem solving process.

A. Problem-solving process based on the metacognitive structure of child programming

1.Preate initial capabilities

Refers to the students understand the task of this class, on the basis of integrating their previous programming knowledge and skills, whether to complete the project prediction, and how to complete the task (form) prediction, related to the students ' confidence and motivation strength of programming learning;

2. Make your plans

Refers to the students taking the programming problems to solve as the specific goal based on the previous steps, plan various activities and select strategies before designing the program, conceive various possible methods to solve the problems, and estimate their effectiveness;

3. Conceptual projects

Refers to the students through teachers to explain or observe the effect of the project, abstract and clarify the core problems to be solved, and form the overall understanding of the role, events, rules and the whole operation logic of the project;

4. Design scheme

Refers to the students from the project itself, layer by layer stripping of the problem to solve, the big problem is small, and then determine the relationship between each problem, sort out the way to solve the problem;

5. Test and iteration

It refers to the students try to build procedures according to the revised plan, first develop part of the programs to try, and then further develop according to experience and new ideas, each iteration can get feedback and new ideas to provide opportunities;

6. Test and commissioning

It refers to the students need to ensure the normal operation of procedures, and solve problems;

7. Reuse and reverse innovation

Referring to students creating on the basis of existing projects or ideas;

8.Expression

Refers to the students by creating programming products to express their views and ideas, enhance the programming learning experience, occur in the whole programming learning process;

9. Connection

It refers to that students communicate with peers and teachers during the whole programming process, create programs together or create programs for others, and occur during the whole programming learning process;

10. Do you know about it

It refers to the students ' technical problems on the tools used, which occur in the whole programming learning process;

The problem of promoting student programming metacognition problem-solving learning support design

Programming metac-cognition itself can make learners to judge the initial ability to solve programming problems according to their own and actual situation, make plans and choose appropriate strategies, adjust and control the programming process and their programming behavior in this process, reflect and improve their programming process, and solve programming problems in the future. Therefore,

the research designed programming metta-cognitive support from the perspective of students, mainly including programming ability prediction support, programming plan support, programming monitoring support, programming adjustment support, programming reflection support, programming experience support,provides different programming metta-cognitive support in the form of teaching activities, tasks or problem list, provide support for the development of student metaccognition through programming learning, detailed in Table 2.

Programming of a metacognitive support type	**instruction**
Programmingcapability prediction support	Help students toclarify their own programming ability, and give students scientific guidance in confidence and motivation ；
Programming planning support	Explore informationabout programming problems, understand tasks; develop scientific strategies tosolve them, and help them act accordingly；
Programming the monitoring support	Monitor the programming learning process, check progressand understanding of tasks, help students successfully perform programming learning tasks and quickly achieve goals;
Program the adjustment bracket	Adjust the resultingproblem by checking the completed code；
Programming a reflect ion support	Verify the implementation effect of programming and promote learners to evaluate and improve the programming problem solving process and self-performance ；
Programming experience support	By sharing communication with partners and teachers during programming learning, they express ideas and realize ideas, while forming their own experience judgment about the use of programming tools ；
Programming a reflect ion support	Verify the implementation effect of programming and promote learners to evaluate and improve the programming problem solving process and self-performance ；
Programming experience support	By sharing communication with partners and teachers during programming learning, they express ideas and realize ideas, while forming their own experience judgment about the use of programming tools ；

Summary and outlook

The article mainly sorted out the programming met-cognitive structure and based on the programming problem solving process, designed six kinds of teaching support for programming metacognitive development, finally show how to design the teaching, for the front line teachers design programming teaching to provide the part of the programming basis, so as to more scientifically play the role of programming teaching in improving the student metacognitive development. However, there are many shortcomings in the research, such as the research does not further involve the contribution of each programming metacognition to student programming problem solving, which is also the direction you can continue to explore next.

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Concurrent 3

Research on Features and Strategies of English Mobile Learning for Local College Students

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Abstract: Since the 21st century, the Internet and mobile devices have developed rapidly, and mobile learning has been gradually introduced into the stage of higher education as a new learning model. However, many local college students have some problems in the process of using mobile learning to carry out their studies, some problems are: (1) College students became more and more rely on mobile devices; (2) Entertainment functions and spam have negative effect on college students while they are learning; (3) The convenience functions of Internet of mobile devices has caused students' mental inertia, and cause to plagiarism in academic research. Based on these reasons, this research investigates the overall situation of English mobile learning based on smartphones, the selection of mobile learning resources, the purpose of developing mobile learning, the constraints encountered in mobile learning, and the factors together with attitudes towards mobile learning method, by investigating the students of English majors in F college. It aims to put forward constructive opinions and develop mobile learning strategies to promote students' learning.

Key words: English, Mobile Learning, Current Situation Research, Strategy

INTRODUCTION

Language is the key to opening the door to the new world. English is the first foreign language of school education in China. Its influence on people involves all aspects, so its importance is self-evident. At the same time, in the wave of informatization, how to apply information tools to English teaching and learning and, how to make students enjoy the convenience of digital - this issue is particularly important. Therefore, the teaching mode and learning model of English which is an international language should also be improved with the development of economic globalization and educational informatization. In 1973, Motorola's engineer Martin Cooper first used a mobile phone to make a call, and it symbolized the

birth of the phone. CNNIC has delivered a report in June, 2018. The 42nd report which focus on the Internet development said that there are 802 million who use Internet in China. Meanwhile, there are 788 million of mobile Internet users emerged. That is to say, people who connected with mobile Internet are in the majority, which has reach 98.3% of the proportion of the entire netizens. Needless to say, this number is growing in its high speed. However, among these people, the student group is the largest. This report which delivered in June said that there is 24.8% of Internet users' career is students. Nowadays, almost all the college students have mobile devices, such as mobile phones. The economy and science are developing in its own way, smartphone-based mobile learning is a new learning model that keeps pace with the times and is emerging on the stage of higher education.

Mobile phone has its own merits such as portable and resource-free, which attracting students' interests. Because of that, it is a wise way to take the advantage of mobile phones and introduce it to the classroom. Sadness, the informatization was in the turning point where need much innovation. Therefore, when students use smart phones, they will meet problems such as blindness, fragmentation and dependence. In order to further understand the role of smart phones in college and university classes, this research was conducted.

RESEARCH DESIGN & METHODS

This study uses the literature research method, questionnaire survey method, and interview method to investigate English majors in colleges. The questionnaire survey was focus on English majors of 2015, 2016, 2017, 2018 in Foshan University. Totally, there are 153 objects from 4 grades in English Department attending this survey. The interview was conducted by 2 volunteers (1 alumnus and 1 alumna) from grade 1 to grade 4, and there are 8 volunteers in total that attended this interview.This study used an online questionnaire survey platform to distribute questionnaires and received 153 questionnaires, of which all questionnaires were valid, with an effective rate of 100%. Use SPSS to carry out reliability analysis, and use Cronbach's alpha reliability index to test the internal consistency of the questionnaire for reliability test. The results show that the alpha coefficient is 0.79, and it was between 0.7 and 0.8, which shows that the reliability of the questionnaire is relatively high.

Table 1

Case processing summary of the survey

Case Processing Summary			
		N	%
Cases	Valid	153	100.0
	Excludeda	0	0.0
	Total	153	100.0
a Listwise deletion based on all variables in the procedure.			

Table 2

Reliability statistics of the survey

Reliability Statistics	
Cronbach's Alpha	N of Items
0.780	81

Literature Research Method.

Through reviewing relevant literature at home and abroad, a large number of papers and cases on mobile learning has been collected, carefully studied and summarized. It provides a large number of theoretical foundations and cutting-edge research reports, and helps to know the research status, and provides theoretical basis for this topic.

Questionnaire Method.

This thesis used questionnaire method by distributing online questionnaires to obtain relevant data. In this survey, the research object was selected form four grades by a random order. The students of English major in Foshan University were split into 4 parts. Students were selected randomly. 153 questionnaires were gave out, and the questionnaire returns-ratio was 100%. English departments have 400 students, while the sample accounts for 38.25%. Thus, it made the survey more convincing and representative. After the questionnaire was collected, the entire questionnaire was analyzed by SO JUMP. In addition, the last open question was also analyzed, reflecting the students' initial thought about English mobile learning.

Interview Method.

As a supplement to the questionnaire method, the interview method can deeply understand the inner world of the research objects and understand their ideas and meaning construction from their words. Not only can you gain an in-depth understanding of the authenticity of the data already in the survey, but you can also expand what is not mentioned in the survey. In this survey, two volunteers were randomly selected in each grade, including 1 alumnus and 1 alumna, and there are 8 students attends this interview. After converting their interview content into text, the complete sentence with clear expression were select as the supporting material for the thesis, by means of content coding and text analyzing.

RESULTS

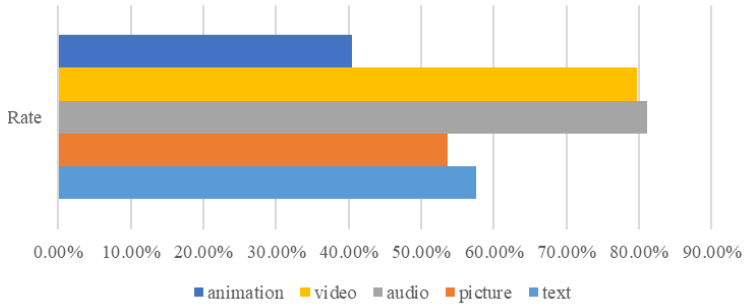
1 The overall situation of English mobile learning based on smartphones

1.1 The selection of mobile learning resources

When investigating the selection mobile learning resources, students have a higher propensity for audio and video, accounting for 81.05% and 79.74% respectively. Students express their interests to the text accounted for 57.52%. What's more, 53.59% of students love pictures as learning material. However, 40.52% of students love animation as learning material (Figure 1).

Figure 1

Students' inclination of choosing learning resources



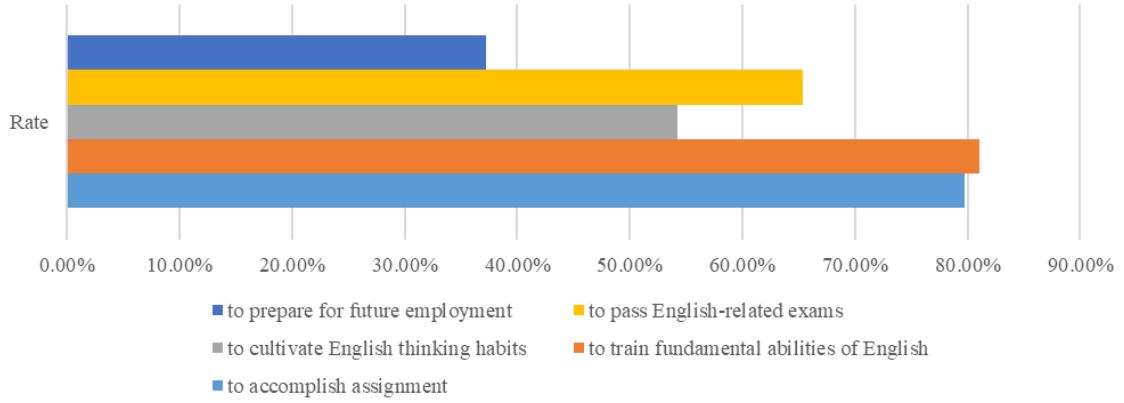
1.2 The purpose of developing mobile learning

There is a question aimed at asking students' purpose of using English mobile learning. The data shows that 79.74% of students are attending English mobile learning in order to accomplish assignment that were arranged. Also, 81.05% of students are engaged in English mobile learning to train fundamental abilities of English. 54.25% of students are engaged in English mobile learning is to cultivate English thinking habits. Moreover, 65.36% of objects are engaged in mobile learning to pass English-related

exams. In addition, 37.25% of students are engaged in English mobile learning to prepare for future employment (Figure 2).

Figure 2

Students' purposes of mobile learning

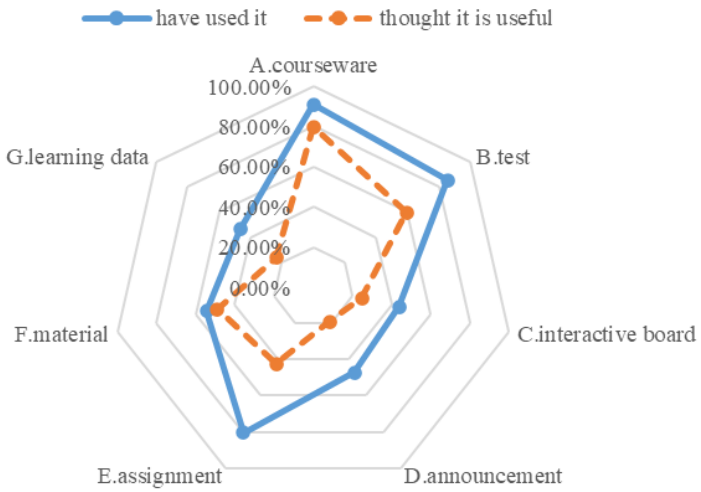


1.3 Students' current use of learning platform

Almost every online learning platform has some regular functions, and students use these functions in a different way. The data shows that 90.85% of students have access to the courseware. Also, 85.62% of the students have access to the test. Meanwhile, 43.79% of students have access to interactive board. Moreover, 47.06% of the students have access to the announcement. Needless to say, 80.39% of students have access to assignment. In addition, 54.25% of students have access to material (including resources such as videos). Besides, 46.41% of students have access to learning data. However, for the functions of these platforms, the students showed different levels of recognition, and 79.74% of the students believe that the courseware was the most useful. 59.48% of the students said that the test was the most helpful. 24.84% of students believe that interactive board help the most. 18.95% of students believe that the announcement helps the most. 42.48% of the objects thought that the homework the most beneficial function. 49.02% of students believe that material help the most. 23.53% of students believe that learning data was the most helpful. We can compare the two data of "functions used by students" and "functions that students think the most helpful" and find that they are almost proportional to each other (Figure 3).

Figure 3

Students' opinion about different functions of a learning platform



1.4 The constraints encountered in mobile learning,

In order to understand the problems students encountered in the process of English mobile learning, a question set up to ask the factors that restrict English mobile learning. The data shows that 40.52% of objects thought that the constraints of English mobile learning are related to smartphone configuration. Also, 38.56% of the objects believe that smart phone fee is too high. What's more, 45.75% of the students believe that there are limited resources for learning English. In addition, 40.52% of the students believe that there is a lack of teacher supervision and couple back. Needless to say, 75.82% of the students believe that there is a lack of self-management and self-control. At last, 54.9% of students believe that they are lacking of awareness and habits of mobile learning.

1.5 The attitudes towards mobile learning method

In this part, there is a question that is employing Likert scale. The theme is "I have a very strong interest in English mobile learning", fully agreeing will be given 1 point, and completely disagreeing will be given 5. The computing method of median is as follows:

$$(1+2+3+4+5)\div 5=3$$

The average score for this question is 2.46, which is lower than the median of 3 (Table 3). Students from different grades have different degrees of favorite for mobile learning. Seniors have the highest level of interest in mobile learning, with a score of 2.66. The freshman has the lowest level of interest in mobile learning, with a score of 2.17. (Figure 4)

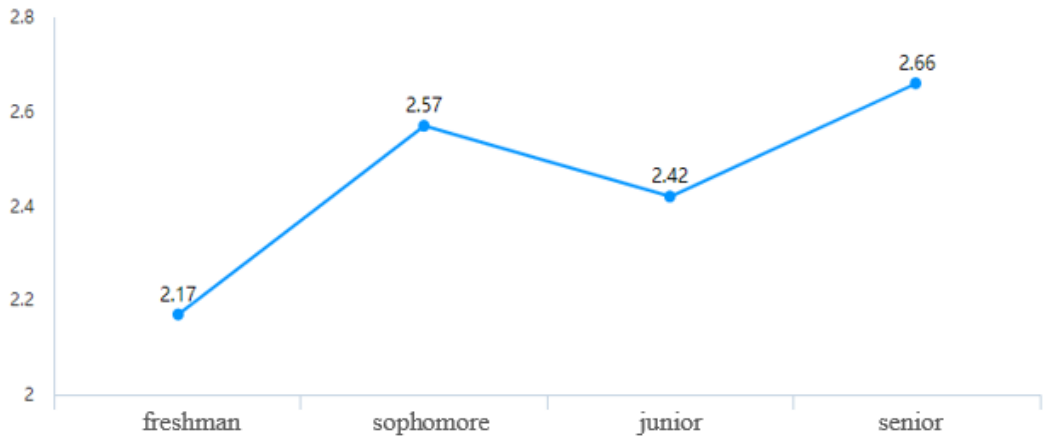
Table 3

Students' attitudes towards mobile learning method

Options	Frequency	Percentage(%)	Mean
1	18	11.76%	
2	65	42.48%	
3	57	37.25%	2.46
4	7	4.58%	
5	6	3.92%	

Figure 4.

Students' degrees of favorite for mobile learning (Four Grades)



1.6 Disturbances of mobile phone during learning

In order to understand the specific disturbances of students in mobile phone-based English mobile learning, two scale questions and a closed single-choice question were designed to understand whether the smartphone disturb the students' learning and to what extent that the disturb effects is. The assignment method for the gauge is: fully agree that the assignment is 1, completely disagree with the assignment of 5. The first theme is "I am very dependent on mobile phones when I am learning English." The average score is 2.59, which is lower than the median value of 3 (Table 4). The second theme is "I often use mobile phones to perform operations which is not related to the theme in the class." The average score is 3.24, which is higher than the median 3 (Table 5).

Table 4.

Students' dependence on smart phones

Options	Frequency	Percentage(%)	Mean
1	21	13.73%	
2	49	32.03%	
3	59	38.56%	2.59
4	20	13.07%	
5	4	2.61%	

Table 5

Students' distracted degree because of smart phones

Options	Frequency	Percentage(%)	Mean
1	12	7.84%	
2	15	9.80%	
3	71	46.41%	3.24
4	35	22.88	
5	20	13.07%	

2 The mobile learning strategies based on smartphones

2.1 Expand the supply of high-quality resources

Encourage social forces to set up online educational institutions, develop online educational resources, and provide high-quality educational services. Cultivate high-quality online education resources, and solve the problem of resource for mobile learning development from the national promotion level.

2.2 Actively introduce learning platforms

Universities should actively introduce learning platforms and rely on platforms to help students develop mobile learning. The survey shows that students have used learning platforms such as 91 SuKe and ChaoXingErYa in the course of learning. Students can ask teachers and peers about the knowledge points that have doubts on the platform, and can efficiently obtain solutions.

2.3 Increase ideological and political education

Teachers in colleges and universities have the responsibility to carry out ideological education to students, so that students can establish a correct outlook on life, world outlook, and values. Research results show that students spend too much time on mobile phones for entertainment activities, which is

not conducive to professional development. Teachers should carry out relevant activities to help students correct their learning attitudes, let students clarify their learning goals, and focus on learning.

2.4 Enhancing self-monitoring awareness

To overcome the interference caused by mobile learning, learners need to strengthen their self-monitoring awareness. The results of the research show that students are prone to distraction in mobile learning of English. Therefore, when students use fragmented time, they should make a reasonable plan and make full and reasonable use of time to carry out English mobile learning.

2.5 Use ICT to enrich classroom teaching

Educational information is developing rapidly, and information technology has been developed in practice for many years. Nowadays, college students have good conditions for English mobile learning. Teachers can make full use of the network resource platform, improve the use of WeChat mini-programs and related APPs, play the auxiliary role of information technology in education and teaching, and create an English mobile learning environment for students.

CONCLUSION

The research results show that students spend less time on mobile learning; students tend to use mobile apps for learning and mainly use video and audio resources for learning; the purpose of students' English mobile learning is to complete course tasks and improve basic language skills; While conducting mobile learning, high costs of mobile Internet data have become the most important limiting factor; students have a positive attitude towards English mobile learning, believing that it can promote the use of fragmented time. At the same time, the research also puts forward some strategies to promote students' English mobile learning at the level of teachers, students, and college administrators. Teacher level: provide the guidance of using mobile devices correctly; Student level: enhance self-monitoring awareness; College administrator level: actively introduce learning platforms.

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The Utilization of Online Mediation in Japan: From the perspective of affordance

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Abstract: The purpose of this study is to discuss the utilization of online mediation in Japan after eliciting the features of online mediation by focusing on affordance. The concept of affordance was used to capture the mutual dependency between web system zoom and the users. To obtain data, mediation role plays were conducted twice with two sets of three participants. After the role plays, focus group discussions and individual interviews were conducted. All of the mediation role plays and interviews were recorded with Zoom and used for analysis. The different affordance of devices and zoom functions for each participant were found. In addition, it was found that all of the participants in the mediation role plays relied heavily on audio sensory and the flow of the mediation converged at the end of the time. Thus, it was concluded e-mediation with Zoom afforded audio sensory rather than visual sensory of each participant and it was discussed that this feature is useful for educational purpose.

Key words: Affordance, Mediation, Education, Role play, Zoom

INTRODUCTION

The purpose of this study is to elicit the features of online mediation by focusing on affordance and discuss the utilization of online mediation for educational purpose. Mediation is used in educational settings (Burrell, Zirbel & Allen, 2003; Malizial & Jameson, 2018). In Japan, mediation is promoted as a means for eliminating bullying at schools (Takeda, 2020). However, it is still not prevalent in the Japanese education system, despite the fact that the number of bullying at schools has increased during the last five years. According to the Ministry of Education, Culture, Sports, Science, and Technology bullying was reported at 80 % of the total number of the schools in Japan. Ikejima (1997) stated that the important factors of solving bullying is compassion, justice, and trust among students, teachers and parents, and the practice of listening to others and creating empathy are the key elements of educational practice of eliminating bullying at schools. Thus, introducing mediation systems in education will be one of the solutions to prevent bullying at schools, because successful mediation also needs trust and rapport (Suzuki, 2017).

In facilitative mediation, a mediator, who does not have specific authority in the decision-making power, assists in solving problems related to a specific conflict. Instead of focusing on differences of superficial opinions between parties, the focus is on what both parties really care about or are interested in. Through discussion, their relationship may transform from negative and destructive to positive and constructive. Thus, the goal of facilitative mediation is to reach win-win solutions. In facilitative mediation, a mediator is responsible for managing the process of interaction, by being neutral, respecting each party's self-determination, providing a safe environment for negotiation, and ensuring confidentiality to enable open and honest communication. Thus, it is said that "the mediator is in charge of the process, while the parties are in charge of the outcome (Zumeta, 2020). Therefore, the facilitative

mediation will be a good practice for the students to listen to the others carefully in order to find the solution among parties.

According to Thompson (2015), the skills required for an effective mediator are developing rapport, building trust and displaying professionalism and the nonverbal communication plays a critical role in addition to verbal communication in mediation. Suzuki (2017) also points out the importance of creating trust and rapport beside several verbal techniques such as reframing, repeating, and summarizing in the Japanese context.

However, usage of the nonverbal cues in relathion to verbal cues might differ depending on online or off line as well as an individual's culture. In particular, Japanese culture is a high-context culture and not a low-context culture like western cultures (Hall, 1976). Thus, Japanese rely on nonverbal cues quite differently from Americans. For example, Japanese use backchanneling twice as many as Americans, and the functions of backchanneling is slightly different (Kubota, 1994). Japanese use physical touching less than Americans (Barnlund, 1975), and are comfortable with silence (Yashima & Kubota, 2001). The usage of eye contact differ among cultures (Vuver, 2018). Therefore, it is crucial to examine facilitative mediation in a Japanese context,

Because of the spread of COVID-19 in 2020, online video conferencing such as Zoom has become familiar not only with business people but also young children and students. Therefore, in this study, we decided to conduct role play of facilitative mediation in order to capture the nonverbal and verbal features of online mediation by using Zoom. The technology that assists online mediation is known as the "fourth party". The forth party plays three roles: administrative tasks such as correcting mistakes, communication support such as providing communication channels, and substantive functions such as assessing parties' preferences and priorities (Ebner & Thompson, 2014). However, utilizing some devices such as a personal computer, or a tablet with the Zoom application depends on the skills and knowledge of the users (Kubota, Suzuki, 2021, in press). These devices do not guarantee to provide the same quality of benefits to all users. Therefore, the concept of affordance is used to research the relationship between devices and users in this research.

The word affordance means "something that refers to both the environment and the animal. The affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or ill" (Gibson, 1979, p.127, cited from Harwood & Hafezieh, 2017, p.4), It can be both positive (e.g. beneficial) and negative (e.g. injurious). "Whereas the meaning of an object may change with the observer's changing needs, the affordances offered do not change, are invariant, being always present. However, an affordance is not a property or quality residing in either the object or subject, but relates to how objects are perceived with regard to their possibilities for use" (Harwood & Hafezieh, 2017, p.4). Thus, the meaning of affordance varies among the perceivers. In other words, the type of act that is afforded depends on not only the attribute of an object but also the attribute of the perceiver and/or the skills of the perceiver (Honda, 2005, p.57).

Therefore, in this study, in order to elicit the features of online mediation, the perspective of affordance will be used to capture the mutual dependency between Zoom (including a device) and the users. Secondly, the utilization of online facilitative mediation in Japanese education is discussed based on the findings.

RESEARCH METHODS

Zoom is one of the cloud-based video conferencing services which anyone can use once the application is downloaded. Thus, in this study, Zoom is used for the mediation role plays with two groups of three players and for two focus group discussions. Although Zoom was used, the chat and sharing functions were not used during the mediation.

In each group, one participant became the mediator and the other two became business persons in the same company. Two sets of the mediation role play were recorded for analysis. Immediately after the two role plays, two focus group interviews of three participants were conducted by watching the recorded role play. In addition, six individual interviews were also conducted after the focus group interviews. Table 1 shows the descriptions of the six participants and Table 2 shows the schedule and the length of time of each interview.

The data of the two focus group interviews and six individual interviews as well as the two transcriptions of the role play with participants' comments were analyzed in terms of verbal and nonverbal communication.

The scenario of the role play was written by the second author, Suzuki, who specializes in teaching collaborative mediation. In the scenario, one member became the mediator and the other two became the business persons (Mr. Tanaka and Ms. Yamada) in the same company, but they are in the different departments, with one in the head office and the other in the human resource department. Because of the recent increases in the number of foreign workers such as technical interns, the director of the company created a diversity promotion committee to create concrete measures as soon as possible. In order to pursue this project, committee members represented each department. However, the conflict between Mr. Tanaka and Ms. Yamada becomes fierce. Mr. Tanaka emphasized the need for a face-to-face meeting in order to create an idea while Ms. Yamada preferred to use Dropbox as much as possible without frequent meetings. Thus, Mr. Tanaka decided to ask for help from a mediator who belongs to a mediation group. The detail of the scenario was given to three role players one day before the role plays.

Table 1

Description of the Parties

Name	Gender	Role	Career
Team 1			
MA	F	mediator	Consultant
Mr.B	M	Mr.Tanaka	Shiho-shoshi lawyer*
Ms.C	F	Ms.Yamada	Professor
Team 2			
MD	M	mediator	Shiho-shoshi lawyer
Mr.E	M	Mr.Tanaka	Shiho-shoshi lawyer
Ms.F	F	Ms.Yamada	Consultant

*Shiho-shoshi lawyer is the unique profession in Japan. It is not quite the same as lawyer or solicitor.

Table 2

Schedule of Data Collection

Schedule	Data collection	Time (minutes)
May 26th	mediation role play Team 1	55
	focus group discussion	60
June 7th	mediation role play Team 2	57
	focus group discussion	100
June 11th	individual interview MsC	120
June 15th	individual interview Mr.B	115
June 20th	individual interview Ms.F	125
June 22th	individual interview Mr.E	130
June 23rd	individual interview MD	140
June 25th	individual interview MA	140

RESULTS

1.1 The flow of the mediation

In this study, two team played the mediation role plays on the different days as shown in Table 2 and it took about 54 minutes for team 1 and 59 minutes for team 2. Since it was announced at the beginning to finish the role play in about 60 minutes, the flow of the mediation became similar as shown in Table 3 and 4. The number of turn constructional unit are MA:218, Mr.B:173, and Ms.C:183 for team 1 and MD:173, Mr.E:163, and Ms.C :193 for team 2. The number of turns are MA:84, Mr.B:44, and Ms.C:96 for team 1 and MD:100, Mr.E:124, and Ms.C:103 for team 2. Thus, there were more interactions in team 2. The flow of the mediation was described in Table 3 for team 1 and Table 4 for team 2.

In the introduction, the mediators explained several confirmation conditions in regards to online mediation besides the usual statement of confidentiality and turning off mobile phones during the sessions. A mediator checked whether there was anyone around the parties or in the same room by asking. The parties were told not to interrupt while other is talking. Regarding recording, it was not mentioned by both mediators, however, Ms.C asked about recording to MA, and she showed her insecurity of recording and discussed for a while in team 1. Four overlappings to MA shows her eagerness about recording (Table 3). Thus, for the introduction of mediation, it took 8:33 (8 min 33 sec) for team 1 and 7:41 for team 2. In the real court, the introduction of mediation lasts about 3 to 5 minutes (Thomson, 2015), the introduction of online mediation is a bit longer than it. It was because the cannels of nonverbal cues are limited for online mediation, the mediator needed to rely on more verbal messages. The mediator MD mentioned that

it was difficult to affirm that the parties really understood what the others said with nonverbal cues, thus, he intentionally summarized more frequently and more precisely compared to face-o-face conversations. This, on the other hand, helped the parties to concentrate the contents of the discussions.

After the introduction, the explanation of the situation followed and the development of opinions occurred at 36:20 for tam 1 and at 37:30 for team 2. About ten minutes before the end of role plays, the content of discussion converged, then a smile and simultaneous laughing occurred in both role plays.

Table 3

The flow of the mediation by team 1

May 26th				
Time	**Steps**	**Main Speakers**	**Flow**	**Verbal/nonverbal cues**
0	Opening	MA	Greetings, explanation of the rules,	
8;33	Explanation about the situation	MA→Mr.B, MA→Ms.C	Ask for explanations about the situation	3 overlaping
17:03	Collecting information	MA→Mr.B, MA→Ms.C	Explanation by Mr.B and Ms.C, Question by Ms.C	1 overlaping
27:26	Comonalities and differences	MA	Summary of Comonalities and differences by MA	
28:07	Correction etc	MA→Mr.B,	Confirmation/addition/correction by Mr.B and Ms.C	1 overlaping
36:20	Development of opinions	Mr.B ⇔Ms.C	Mr.B and Ms.C talk diectly	direct talk between Mr.B and Ms.C
41:56	Comonalities and differences	MA	Clarification of Comonalities and differences	
43:037	Constructive proposal		Ms. C agreed with Mr.E's proposal	**Smile on Mr.B's face because Ms.C agreed**
48:10				**1 overlaping , loud laugh among three members, good rhythm**
48:48	Ask for any concers, closing	MA→Mr.B, MA→Ms.C	MA ask for any concers to Mr.B and Ms. C. M, MA shows empathy.	1 overlaping
53:11		MA	**Summary by MA, creat one sentence with three members**	1 overlaping,
54:29	End		end	

Table 4

The flow of the mediation by team 2

June 7th				
Time	**Steps**	**Main Speakers**	**Flow**	**Verbal/nonverbal cues**
0	Opening	MD	Greetings, explanation of the rules、confirmation of the purpose, check the surroundings.	
7:41	Explanation about the situation	MD→Mr.E, MD→Ms. F	Explanation by Mr.E and Ms.F, Dialogue to solve the missundestanding.	
20:16	Collecting information reconfiguaring the problem	MD→Mr.E, MD→Ms. F	While MD is sumarrizing, Mr.E raised his hand. Mr.E wanted to talk to clarify the missundestanding.	Mr.E raised his hand to get his turn to talk.
21:42	Summary	MD⇔Mr.E, MD →Ms. C	Mr.E agreed strongly what MD summarized by saying "so so so so." (No.192) (empathy.)	1 overlaping 、Ms.F coughed and drank coffee while listening.
35:48	Comonalities and differences	MD	MD sumarised comonalities and differences	
37:11	Question by MD		MD asked a question (no.308).	
37:30	Dialoge to creat a solution	Mr.F⇔ Mr.E	Ms.F gave positive feedback to Mr.E.	**1 overlaping, laugh, direct talk**
37:58	Development of opinions	Ms.F→MD	Mr.F asked MD to get a permision to ask a question, and started talking directly to Mr.E.	1 overlaping, Positive attitude
39:22		Mr.E ⇔ Mr.F		MD moved back.
49:03	Ways of solution, agreement		Mr.E recognised the good features of online (no.406).	
54:34			**Make a sentence with Mr.F and Ms. C.**	MD moved forward, **good rhythm.**
56:00	Ask for any concers, closing	MD→Mr.E, MD→Ms. F	MD asks for any concers to Mr.E and Ms.F. MD sumarised.	
59:36	End		End	

Thus, although the mediator and two parties were at distance, they felt the same rhythm while talking and listening at the end of the mediation. The interactions became smooth and rhythmical. There

were several affirmative sentences and praises. It means that all of the parties listened carefully what they were talking at least.

1.2 The features of Zoom functions

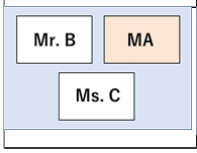
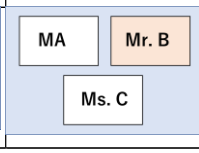
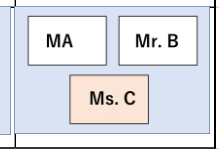
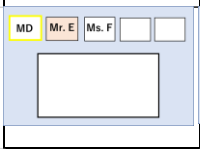
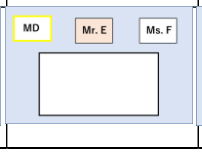
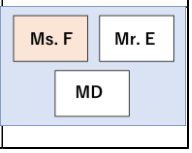
The process of mediation relied heavily on the features of Zoom functions in the case of online mediation. First,

the parties can use virtual backgrounds if they don't want to show their background. Especially the mediators were attentive to their backgrounds. They kept it simple by sitting in front of a white wall (MD) or using a simple virtual background (MA) in order to avoid any destruction. However four parties did not use any virtual backgrounds. Although the background of each party will make some impressions to the others. It didn't hinder any communication in this study.

Secondly, the layout of each party on the screen was important. When one party was too closely positioned to the mediator, the other party felt uneasy. Although the participants could choose gallery view or speaker view, they did not change the layout. As a result, some used gallery view and the others used speaker view shown in Table 5. At the time of this study, the version of Zoom didn't allow to change the layout of the mediators and two parties on the screen by themselves.

Table 5

Layout of the mediator and two parties in each screen

Team 1			**Team 2**		
MA	**Mr.B**	**Ms.C**	**MD**	**Mr.E**	**Ms.F**
					

Thirdly, the face of the mediator and the participants are shown on the same screen. Most of the parties were talking toward the face of the counter party. While talking, the parties could check their own facial expression if they want, thus, one party mentioned that he couldn't say anything rude. To that extent, the party concentrated more on the contents. The parties felt comfortable to talk without seeing the counter party's eyes directly.

Although eye contact is important, most of the participants didn't look at the camera but looked at the face of the person whom they were talking to. Most of the time, they looked down to see some papers or sometimes looked up to think or occasionally look at the face when they emphasize some words. To make a direct eye contact, a person needs to see the camera without seeing the face. it is not natural and didn't happen so frequently.

1.3 Device

1.3.1 Screen

Only the face and the shoulders were shown on the screen, so the mediators could not see the whole body to check the parties' reaction. In addition, the mediator could not show their listening posture to the parties such as intentionally showing that they were taking notes. Thus, sometimes, they had to verbalize more in online mediation compared to that in face-to-face sessions. At face-to-face sessions, the mediator (MD) needed to turn his body toward the others to listen, but with Zoom, he didn't need to move his body. Thus, he described himself as being like a jizo (stone statue). Instead, the mediator could see the faces of both parties at once in the screen. Since the mediator has to pay attention to maintain an equal balance of power and control the emotions of two parties, this feature is beneficial for the mediator. One party also felt that he was forced to listen until the end of the session, because he sat in front of the computer. Therefore, it can be said that the screen with the camera limited their body postures.

When the meeting was very smooth among the parties, the mediator MD slowly closed his eyes or moved backward to let the two parties talk freely. Thus, for the moderator, closing his eyes or opening his eyes, or moving backward and forward slowly controlled the conversation flows. On the other hand, the

parties only leaned against the chair or turned the chair slightly. The mediator could monitor their facial expressions and any body movement of both parties at a glance.

1.3.2 Location of camera and microphone

After watching the recording, Ms.C noticed that her voice became muffled because she looked down while talking. In addition, the parties noticed that it is undesirable if the voice is not clear. They noticed that the volume of their voice differed depending on the setting of the camera and microphone of each party. In case of MC, she mainly talked to MA and showed the right side of her face to the camera, that she realized created other parties the weak impressions.

1.3.3 Familiarity

For the parties, presenting a positive self-image is affected by the skill of using Zoom. If the party is accustomed to using Zoom, then he can relax while talking. However, if not accustomed to Zoom, she moved her eyes to see the camera or a screen randomly. This does not make a good impression on others. In addition, if the position of the camera and the microphone is not placed properly, then the voice of the speaker could not be heard or understand clearly, and this could give an impression of low self-image.

One mediator (MD) used a smartphone as a camera and noticed the time lag between his utterances and the responses from the parties. Thus, he decided to refrain from verbal backchanneling so often and verbalize slightly earlier than in face-to-face conversations. In case of his face-to-face conversations, he tended to take a breath before speaking. However, for online mediation, he could adjust his backchanneling as stated above. This was successful because the other parties did not resize the time lag. If the mediator is keen to the backchanneling, he could adjust his timing of backchanneling adequately. In other words, he was very skillful in terms of adjusting his behaviors to the devices.

1.3.4 Environment

In the scenario of a role play mediation, Ms.C had to play the role of t Ms.Yamada from Singapore. However, in the conversation, Ms. C said “New Zealand” instead of “Singapore”, because she had a conversation about New Zealand with her husband at her home just before starting the mediation role play with Zoom. Thus, the physical environment affected her selection of what she needed to say in the conversation.

1.4 Creating rapport

When the meditator met the parties for the first time, he tried to show neutrality more than usual in order to avoid projecting any prejudice or stereotypic views. To show his neutrality, the mediator nodded and spoke with a soft voice. The mediators nodded moderately while listening and avoided nodding intensely or saying “I see” since these behaviors might show their agreement with the opinions raised by one of the parties. Because nodding was the only way to present their supportive attitude without overlapping, the mediators regulated their use of nodding intentionally and changed the voice volume of the backchannels. They knew that they could not use eye contact, backchannels and hand gestures for online meetings as much as they could for face-to-face sessions.

The tone of the voice was controlled intentionally by one party because she believed that important things should be said softly with a small voice. In addition, the parties mentioned that the mediator spoke slowly and her tempo matched the party’s tempo. One party said “If the mediator changed her tempo then I may feel unpleasant.”

The mediators mentioned that it was difficult to observe breathing, any change of emotion, and the climate created by the parties’ entire body during Zoom sessions. On the other hand, the mediators could concentrate on the content of the meeting. “Although I look at the parties occasionally, I felt that I cannot get any feedback from them.” “In the case of face-to-face, I could get the information from top to bottom, as well as information from breathing, however, I couldn’t get such unintentional messages on Zoom.”

Since the counter party was not near, one party didn’t feel oppressed. He could not sense the other party’s breathing or determine the other person’s emotional ups and downs.

To take a turn, one party twisted his torso a little bit and raised his right hand and moved three fingers while he kept looking down. It took seven seconds for the moderator to notice this raised hand.,

because the moderator was busy summarizing what they have discussed. Because it is online, this kind of hand movement was not easy to notice. Other party raised her voice to take a turn.

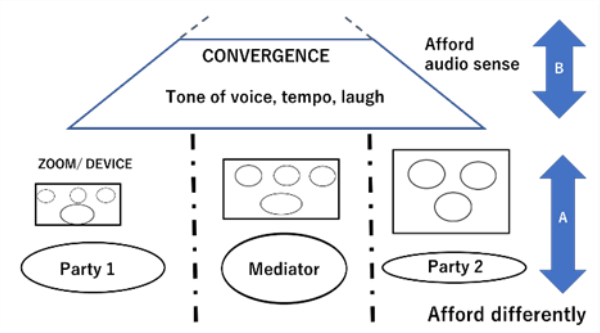
The parties could choose whether to look at others or not, and whether they listened to others carefully or not depending on the conflict or their emotions. Party A said, “I decided not to listen to her because she repeated the same things.” “When someone is searching for a position, then, it is fine that I don’t need to listen carefully. However, online, I need to listen at least in order not to overlap with what they said.” ‘If the conflict is severe, then I will look at the mediator’s face. Online, I can choose whether to look at the mediator’s face or not.”

DISCUSSION

To conduct the online facilitative mediation means two parties agreed to sit in front of a personal computer to talk with each other without leaving or refusing to communicate. Although the mediator could not grasp the climate of both parties, feeling safe and relaxed among the parties was a beneficial point of online-mediation. In addition, all of the parties sat in front of the camera with their upper bodies (mainly face and shoulder) facing forward. each moderator and the party joined the meditation through their own devices. Thus, these devices afforded different eye movements among the participants. Each participant sat on the different types of chairs, and the chair afforded the different body movements. Figure 1 A shows the different affordance of devices depending on the size of screen, the location of camera and microphone as well as the features of Zoom functions such as speaker view/gallery view and virtual background for each participant. In addition, the familiarity with Zoom meeting also gave different impression to others.

Figure 1

Affordance of Zoom and devices for the mediator and two parties



However, analysis of the flow of mediation showed that the contents converged at the end of mediation, and created rapport and good rhythm. In other words, online-mediation encouraged the behavior of listening to others until they had completed what they had to say, One of the participants mentioned that Zoom makes the participants “ladies and gentlemen.” It means that through Zoom, the participants cannot feel emotional changes as much as in a face-to-face meeting. Based on these instances, it can be said that the participants seemed to be keen on listening rather than looking at the movement in the screen. In the case of facilitative mediation, the participants needed to solve the problem of the conflict, thus they tended to concentrate on the flow of the discussions. Thus, Zoom afforded emphasis on the audio sensory of each participant rather than visual sensory of each participant in this study. (Figure1 B).

In Japan, each student has one tablet at school under the policy of GIGA school. Thus, the problem of different affordance due to the different devices will be solved (Figure A). Therefore, we need to take advantages of online mediation with Zoom that affords audio sensory rather than visual sensory. Through online mediation, the students can practice to listen to the others carefully to solve the problem. The students in the conflict could feel safe and secure because they are physically apart and concentrate for mediation. For the moderator, it will be a good practice to figure out the discussion points by listening to the different situations of two parties. The function of recording with Zoom can be used for educational

purposes. Recording should be prohibited for real e-mediation, however, for educational purposes, it is very useful. Students can record any mediation or mediation role play, and watch not only the flow of the mediation but also their own behaviors and facial expressions. Online mediation will be a good training to understand the process of mediation as well as body and facial expressions. It will be easy to practice under the policy of GIGA school. However, effectiveness of online mediation will be a future study.

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Classification of Characteristics of In-class Discussions in Online Universities and a Visualization Method of Learning Status by Modeling using Graph Mining

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Abstract: In Business Breakthrough University (BBT University) and adult education, lectures are delivered by video-on-demand and in-class discussions are asynchronous and text-based. We extract and classify the features of the flow of discussion in the courses that evaluate the content of class discussions. The classified features are modeled and visualized using graph mining. By visualizing the learning situation of the class, we will aim to improve the quality of online education through in-class.

Key words: learning, educational media, group learning, university education, graph mining

INTRODUCTION

Since the declaration of the state of emergency in April 2020 to prevent the spread of the new coronavirus infection, the digitization of educational institutions in Japan has progressed rapidly. It is now possible to have the same functionality as a face-to-face class in a classroom at home by using a web conference system, etc., as long as you have a PC and an Internet environment. Although formally equivalent to face-to-face classes, it is no exaggeration to say that the quality of education relies on the good nature of the students. This is still fine in the case of knowledge acquisition and skill acquisition, but for subjects that require interactive dialogue and discussion, education and evaluation methods that are appropriate for online are needed. It is necessary to think on the premise that pandemics and large-scale natural disasters will occur in the future. In addition, it is urgent to enhance online education so that learning does not stop in such emergency situations. Therefore, we propose a learning support system that enhances the learning effectiveness of online education in subjects that require interactive discussions.

ONLINE EDUCATION AT BBT UNIVERSITY

Business Breakthrough University (BBT University) is an online university established in 2005 by Business Breakthrough, Inc. (BBT), which was founded in 1998. BBT and BBT University have been providing education through online education since their establishment in 1998. BBT and BBT University have accumulated more than 10,000 hours of online content and course data from over 20 syears of online education experience.

BBT University is an online university that utilizes AirCampus (AC), a proprietary distance education system, to manage course enrollment and course management for all students. Courses are recorded in advance and are viewed on-demand according to a set schedule during the course period. After viewing, the students have discussions in the cyber-classroom on AC to deepen their understanding and come up with new views. It is important to improve the understanding of the whole class or the whole group.

As shown in [Table 1], there are various types of education methods, such as input type and output type, skill acquisition type and creative type, and self-study type and group learning type, depending on the educational purpose. In this study, we decided to examine learning support methods to improve the learning effect of subjects that require output, creative, and group learning methods. In this study, we focused on the characteristics of the flow of discussion in the class that achieved the learning objectives, which led to the study of learning support methods.

The data for subjects that emphasize discussion will be selected from the subjects of Business Breakthrough University and Attacker's Business School operated by ABS, Inc.

Table 1

Education method & Course group

Educational method	Course group
Group Discussion	**Management Strategy, Organization, Marketing, Entrepreneurship, International Affairs, etc.**
1-on-1	**Free research, Graduation research, etc.**
Knowledge acquisition	**Economics, Finance, Accounting, etc.**
Skills acquisition	**English, Problem solving, etc.**

CHARACTERISTICS OF DISCUSSION FLOW

A discussion consists of parent statements that raise issues about a certain point and child statements that reply to other people's statements. There are three basic relationships between statements in the flow of discussion: isolation, continuation, and branch.

① Isolation: Parenthetical (parenthetical only)

② Continuation: parent statement - child statement; child statement - child statement

③ Branch: parent statement +- child statement; child statement +- child statement +- child statement; +- child statement

The discussion consists of a combination of these three basic patterns.

Logic-based discussion: (2) Deeper hierarchy of continuity.

Exhaustive discussion: (3) More branches (same level).

Refutation-type discussion: (3) Branching occurs at multiple levels.

Providing information: shared once: (1) Isolation

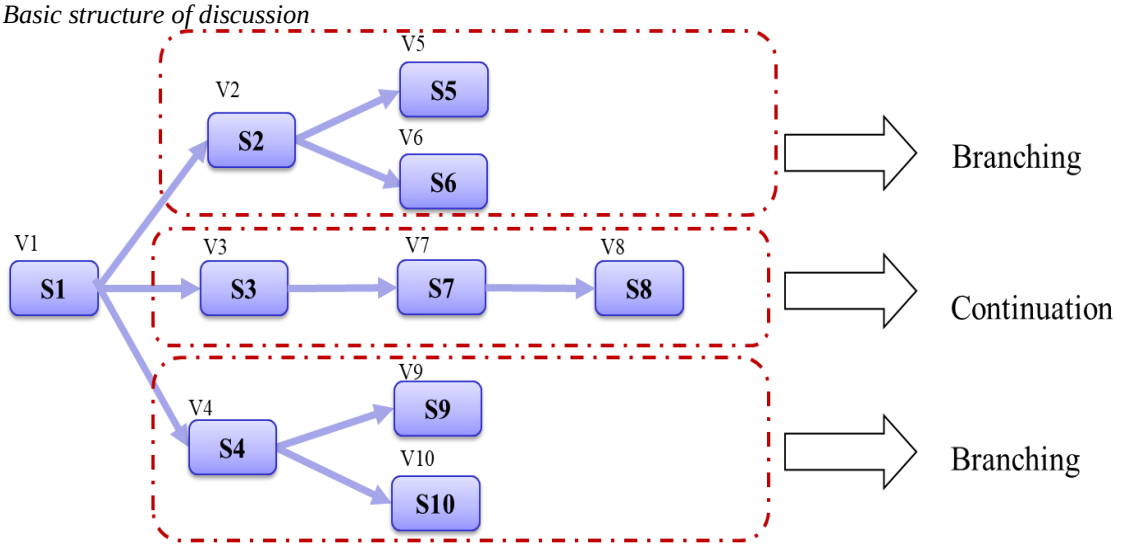
Providing information: shared at multiple times: (3) Branching (second level)

Missing the point: (1) Isolation

A text-based discussion consists of a combination of basic structures.

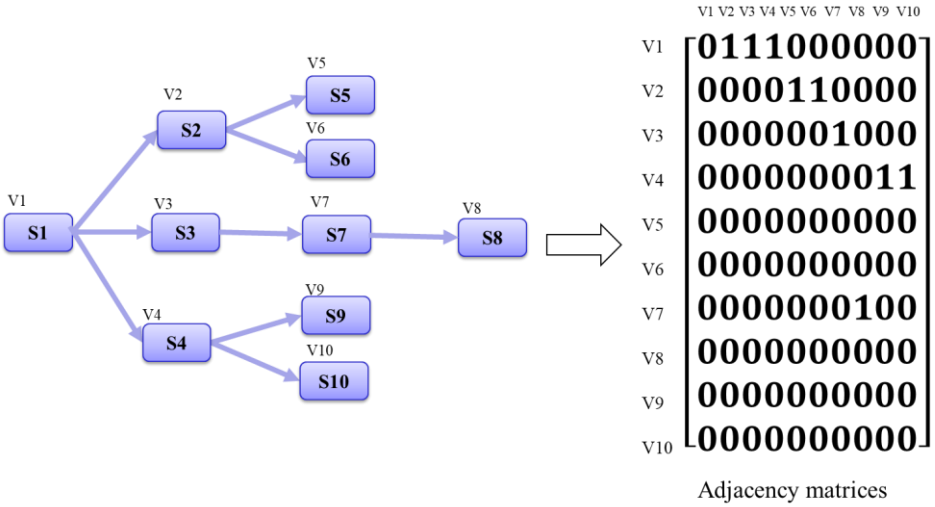
Figure 3.

Basic structure of discussion



The discussion of each issue or theme forms a collection of statements. In modeling the relationship between parent and child statements, we generate a matrix for each statement based on this set. The parent statement is assumed to be the root. Here, the matrix A = [a ij] is defined as follows The matrix A = [a ij] is set to [a ij] = 1 if statement j exists for statement i, and to [a ij] = 0 if it does not exist. For example, the combination of basic structures shown in Figure 1 can also be represented by an adjacency matrix aligned to a square matrix.

Figure 4.
In-class discussions represent combinations of basic structures in adjacency matrices



MODELING THE CHARACTERISTICS OF DISCUSSION FLOW AND LEARNING SUPPORT

Here, let us note that each statement which has been discussed in a classroom has the attributes of time axis and discussion flow pattern. Then, the matrix that models the relationship between parent and child statements can be fitted to the adjacency matrix. Furthermore, we can create a graph from the adjacency matrix. By numbering each statement with an ID, it becomes a vertex on the graph. The statement is clear from whom to whom, the graph becomes a directed graph. From this graph, we will discuss the possibility of considering this modeling and learning support method.

The adjacency matrix created for each parent statement is aligned on the time axis. Although it is possible to classify the characteristics of each parent statement to see if it achieves the learning goal, this would be too detailed and would result in a learning effect at the individual level. Therefore, the adjacency matrix created for each parent statement lined up along the time axis can be aligned to a square matrix with the same number of elements in the rows and columns, so it can be considered as a multiplex of edges graphed from the adjacency matrix in one set, removing the concept of time axis. This can also be seen as a learning effect for the whole class. Furthermore, if we assume that the weight of the edge is the number of characters in the statement where 1 is in the original adjacency matrix, i.e., the number of characters in the statement, then we have a weighted directed graph. If we view this as a working network of weighted directed graphs, it becomes possible to calculate the optimal weighting, which is expected to be effective when applied to learning support methods. The discussion in the class can be incorporated into the adjacency matrix and graphed.

In Figure 2, a node is a statement; let S = {s1,s2,...,sn} be the set of statements. Also, it always exists a person who utters a statement. So, let P = {p1, p2, ..., pm} be the set of person. It always exists at least one person for every statement. It is necessary to determine the corresponding color for the person so that it is not the same color as the other person. On the other hand, the adjacency matrix is equivalent to the row and column swapping. Therefore, we classify the matrix order of the adjacency matrix by person

based on the order of time of occurrence of the statement. Formally, the node is from the statement to the person. The above is shown in Figure 3.

Figure 5.
Adjacency matrices are equivalent to row and column swapping Node as a dependency of individuals from statements.

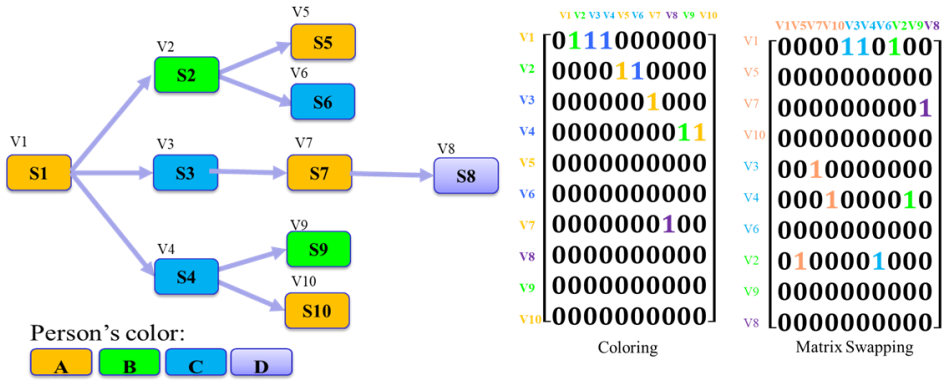
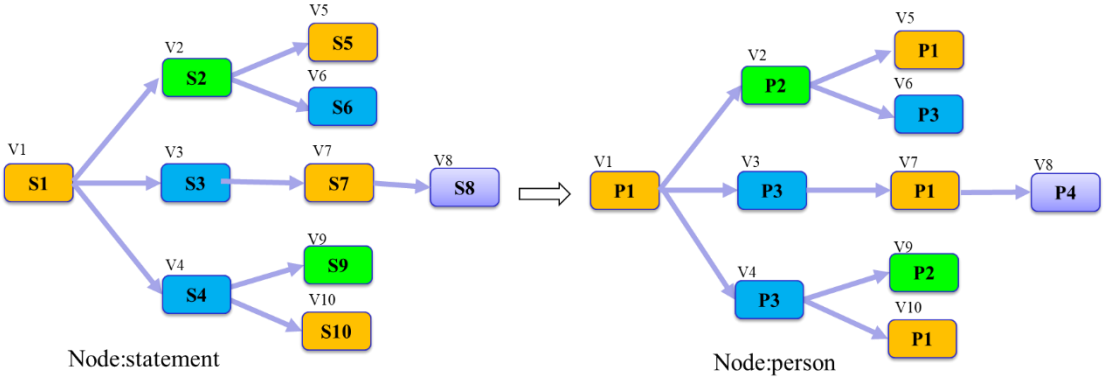


Figure 6
Node changes from statement to person
Graphical representation dependencies of statements and dependencies of individuals Definition:



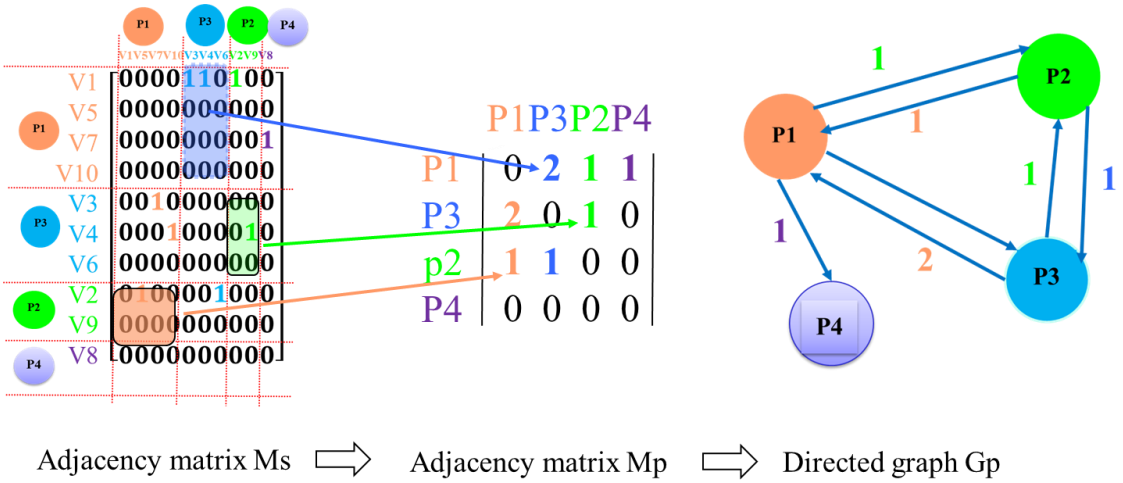
Dependency of statements: If statement b is a reply to statement a, we say that b is dependent on a. We denote this as a → b.
Independent statement: A statement b that does not have a dependency a → b is called an independent statement.
Isolated statement: If a is an independent statement and there is no a → b, then a is called an isolated statement.

Let P={p1, p2, ..., pm} be the set of person.
Let f: a→p (f(a)=p) be a mapping from statement a to person.

Dependency of person: When f(a1)=p1, f(a2)p2 and a1→a2 exist for statements a1, a2, and person p1 and p2, person p2 is called dependent on person p1 and is represented by p1⇒p2.

Figure 7

Transition from statement node via person node to Directed graph Gp Representation:



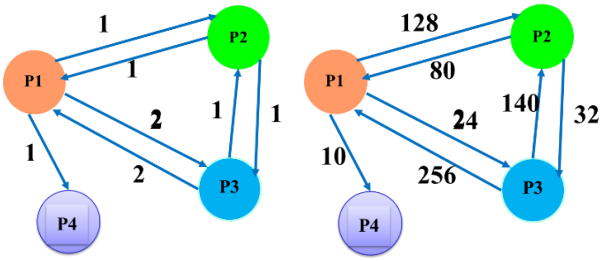
In a directed graph Gs(S, D), where S={s1, s2, ..., sn} is the set of statement nodes and D is the dependency between statements, Gs can be represented by a nth-order adjacency matrix Ms.
In the directed graph Gp(P, Dl), if P={p1, p2, ...pm} is the set of person nodes and elements dli,j of Dl are the number of person dependencies between person i and j, then Gp can be represented by a mth-order adjacency matrix Mpdl with dli,j as elements.
In the directed graph Gp(P, Dw), if P={p1, p2, ..., pm} is the set of person nodes and the element dwi,j of dependency between person i and j, then Gp can be represented by a mth-order adjacency matrix Mpdw with dwi,j as elements.

The number of statement of the inter-speaker dependency Gpdl is represented in the figure as a directed graph as shown below. The edges are labeled with the number of statement of the statement dependency. It is shown in Figure 6. The number of characters in the inter-speaker dependency relationship, Gsdw, is shown in the following directed graph as shown below. The edges are labeled with the number of characters in the statement dependency relationship. It is shown in Figure 7.

Figure 8

Label of Edges

Label: # of statements label: # of characters



Perspectives on making group learning effective

In order to enhance the learning effect of group learning, (1) evaluation of each individual's participation in the class and (2) evaluation of the class as a whole are necessary.

(1) Individual evaluation

There are three types of individual evaluation: a) the number of speaking partners, b) the amount of speaking, and c) the frequency of speaking.

a) Number of speaking partners

How many people you discussed with in the class, and the ratio of the number of people in the class

b) Quantity of statements

The amount of statements is measured by the number of characters in the statements.

c) Frequency of remarks

To measure the concentration and passion for the topic. It is shown below Table 2.

(2) Class evaluation

Based on the knowledge that BBT University has cultivated over 15 years as an online university, there are three points that are necessary for group learning to be effective: A. Diversity, B. Depth of discussion, and C. Enthusiasm of students. It is shown below Figure 7.

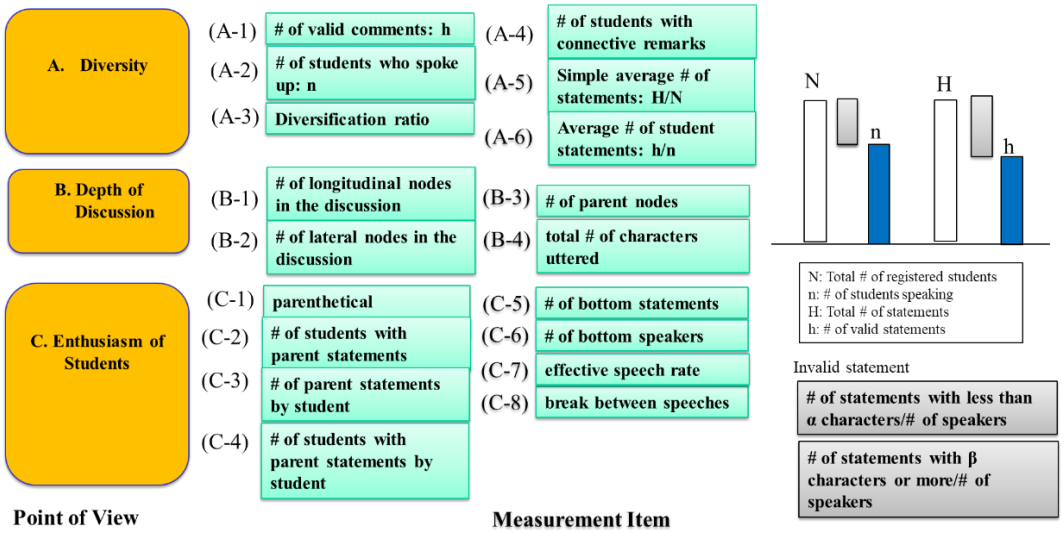
Table 2

Aims and perspectives of Group Learning

	A. Diversity	B. Depth of Discussion	C. Enthusiasm of students
Think for yourself and find a solution	Number of speakers	Number of nodes in the vertical and horizontal directions	break between speeches
2. Discussion that respects diverse values	Number of parent statements Diversification rate	Number of parent nodes	effective speech rate
3. Consensus building for collective knowledge	Number of Connected Speakers Diversification rate	Lateral node	Number of bottom speakers

Figure 9

Indicator system to measure the quality of in-class discussions



This is what we are doing, but on the other hand, there is this concern about the comments. If there are only a few students who are highly interested in the learning topic, the rest of the students can only do limited things such as sharing and comparing information, and their activities will decrease over time, eventually becoming heavily dependent on them (Andrew A. Tawfik, et al 2017).

It is also an instructional consideration to look at the demographics of the students and take into account that having diverse students speak as evenly as possible may not always be the most effective way to learn.

Future development

The same idea applies to the educational benefits that can be derived from online learning,

particularly the use of discussion boards and text-based discussions, which provide the following educational benefits that are not available in face-to-face learning environments

Opportunities for reflection and knowledge clarification (Brooks and Jeong 2006; Kim and Hannafin 2011)

Deeper involvement in the subject matter (Barron 2000),

Facilitative interaction (Johnson and Johnson 2008)

Knowledge convergence (Draper 2015; Weinberger et al. 2007)

In order to take advantage of this benefit, we would like to actively promote online education.

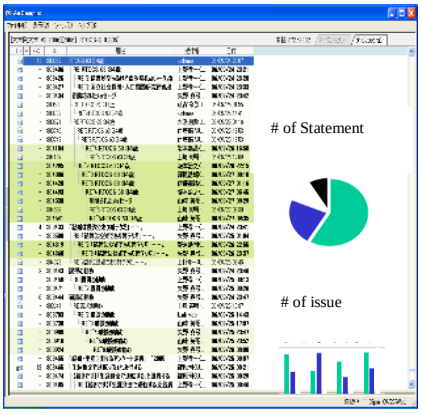


Figure 10. Learning Support Methods

In 2012, the U.S. announced the launch of Massive Open Online Course (MOOC), which provides university-level higher education online courses accessible to anyone with an Internet connection. In the U.S., three companies, Coursera, edx, and Udacity, launched MOOC (Massive Open Online Course) in 2012. MOOC education methods have been devised by many educational institutions as online education for higher education at the university level provided by MOOC. When MOOC are used in education, it is necessary to change each of them according to the educational methods in "Table 1" mentioned above.

In the case of MOOC in education, it is necessary to change them according to the educational methods listed in Table 1. Higher education cannot ignore the importance of communication skills and timely feedback of the frequency required to structure it (White, 2013). This is why the concept of blended education has emerged, which is a flexible combination of multiple teaching methods to allow students to share their knowledge and experiences in a variety of educational environments (Wilson & Gruzd, 2015). From the perspective of educational effectiveness, blended education combines the advantages of online education and real face-to-face education, which has many advantages over a single educational method (Metcalfe & Sastrowardoyo, 2016). Against this background, the MOOC mixed teaching method was designed to meet the following three basic requirements. (1) a combination of network teaching and local teaching, (2) a combination of teacher-led and student-led, and (3) a combination of autonomous learning and collaborative learning. (Xie Jian, Xu Binbin, Zych Izabela. 2018).These are discussed in this paper.

With these understandings, we proceed with what follows.We will review the logs of in-class remarks as a way to evaluate the learning effectiveness of courses that focus on in-class discussions, and assess the degree of questions and answers and contributions to the class. In addition, there is a movement to use AI to support learning effectiveness and course evaluation by having AI learn from the logs of class discussions accumulated in the system. In this context, online class discussions and group discussions develop by theme, with each statement regarded as a node, and the discussions connected along the way to form a tree structure. Furthermore, since the discussion is conducted online in an asynchronous manner, each node has a time-series attribute called a timestamp. Because of this attribute, each node can be numbered in a time series. This makes it possible to represent each theme in an adjacency matrix. Adjacency matrices are equivalent to row and column swapping. Therefore, it is possible to summarize the results for each speaker, which leads to individual and class evaluations. Through these methods, it is also possible to represent the data in a graph.

We will make an application to learning support methods which visualize measurement index and attract Current status in Cyber Classroom.Encourage students to understand and act autonomously.

CONCLUSION

In this paper, we examine learning support methods to improve the learning effectiveness of online universities and other courses that require output-based, creative, and group learning educational methods. In this study, we focused on the fact that, because of the asynchronous online teaching method, in-class discussions are text-based. By incorporating the text into the adjacency matrix and modeling it using

graph mining, we were able to identify the characteristics of the speech groups. We found that we could evaluate the diversity of Ei, the depth of the discussion, and the enthusiasm of the students, which is necessary for this learning method. In the future, we would like to evaluate the indicators of learning effectiveness in real time and incorporate them into learning support tools to enhance the learning effectiveness of students.

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Online Learning Support for Neurodiversity: UDL toward SDL for Diverse College Students

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Abstract Self-Directed Learning (SDL), which has become a requirement in the era of lifelong learning, is becoming increasingly important in the current pandemic situation. In an environment where learning online is no longer an option but a necessity, more and more learners are in need of SDL. Because of the diversity of learners, a special ladder is needed to reach each of them. Learners who have been forced into online education due to the pandemic, as well as those who have been taking distance learning classes via the Internet for a long time before that, need the ability to continue to learn while orienting themselves and adapting to their own characteristics in a separate and discrete situation, as well as the online learning support to do so.

In this paper, using the Universal Design for Learning (UDL) guidelines as a theoretical framework, we examine online learning support that can accommodate a variety of learners, especially a variety of neurons, and propose a matrix of effective support for SDL based on the UDL guides. Based on the results, we propose effective support for SDL in the form of a matrix based on the UDL guide. Based on the matrix, this paper proposes that future online learning support should include five things such as a) Information display customization (UDL1.1), b) Illustration via multiple media (UDL2.5), c) Highlight of important information (UDL3.2), d) Enhancement for monitoring process (UDL6.3), and e) Mastery-oriented feedback (UDL8.4) are considered essential in terms of feasibility and practicality.

Above all, the basic idea of UDL to provide multiple means, can expand SDL by increasing learners' own choices. Even if we cannot implement all the guidelines, we can provide more options to meet the diverse needs of learners, so that we can build a ladder from "education for all" to "SDL for all". This research will lead to evaluations by teachers and learners with diverse backgrounds, and will be a step toward recommendations for the implementation of features that should be realized in the future.

Key words: Online Education, Higher Education, Universal Design for Learning, Self-Directed Learning

INTRODUCTION & BACKGROUNDS

There are two things that are becoming increasingly necessary for learners in the current pandemic situation. One is online learning support, and the other is Self-Directed Learning (SDL). According to MEXT (2020), 90% of higher education institutions offered their courses entirely online as of May 2020. According to MEXT (2020), as of May 2020, 90% of higher education institutions offered courses fully online, and when combined with face-to-face courses, 96.8% of higher education institutions offered distance education via the Internet. This is a figure that was not possible before COVID-19. Subsequently, even in the midst of the declared state of emergency, primary and secondary schools often offered face-to-face classes, but a high percentage of higher education institutions still offered online classes, and despite the strong promotion of the revival of face-to-face classes by MEXT, only 16.2% of schools offered only face-to-face classes as of July. This may be evidence that, unlike primary and secondary education, more students (and faculty) are considered capable of tolerating distance learning.

However, it must be said that the idea that online teaching is easy for college students, even if it is difficult for developmental elementary and middle school students due to the large influence of environmental differences, is a mistaken idea, as many teachers have realized by this year. High SDL skills are essential for learning to occur in discrete locations where teachers do not share physical space, and without online learning support that encourages SDL, it will be difficult to guarantee adequate education. In addition, consideration for learners who are likely to be left behind when large gaps are created by differences in individual SDL abilities cannot be ignored. There have been cases where students who were distracted in face-to-face classes were able to concentrate when using online classes,

or where students who were able to speak as they wished through written communication were confused by e-learning with vague instructions.

Here, the importance of online SDL learning support, especially for learners with various difficulties, can be found. In this paper, the focus will be on neurodiversity, such as developmental disorders, which is considered to be a growing problem for students in Japan, and the methods of online learning support that will be needed in the future.

ONLINE LEARNING AND SDL

There is a deep connection between online education and SDL and SDL learning support. In the pandemic situation of COVID-19, online teaching has become the mainstream. This was an inevitable choice. However, it was also an opportunity to make people aware of the many advantages of online classes. According to a survey of students across Japan, many of them cited flexible location (79.3%) and time (66.1%) as the best aspects of online learning (MEXT, 2021). The "anytime, anywhere" advantage, which is difficult to achieve in face-to-face classes, was strongly felt by the learners, and some expressed the hope that the opportunity to learn online will remain after the pandemic is over.

However, learning opportunities at any time and place are meaningless unless the learners themselves decide to implement them. 42.7% of the students cited difficulty in understanding as a bad aspect of online learning, which is not a small number. Aside from the urgent quality of the lessons, online learning requires students to stay away and fight alone until they feel they understand. SDL is an essential part of online solitary learning, as it guides the student's own learning.

Deci's theory that people like to be able to make their own decisions is well known, but just because they like it doesn't mean they will succeed. However, just because we like something doesn't mean we will succeed in it, and it is not hard to imagine how autonomy would be crucial for each individual learner to continue learning if they were suddenly placed in such a situation. In regard to these issues, Blooming (2021) states that appropriate support for learners to learn on their own is necessary, especially in blended learning. She also emphasizes the various difficulties of different learners. This is where the second concept dealt with in this paper, UDL, appears.

UDL FLAMEWORK AND SDL

Universal Design for Learning is a learning-specific diversity response proposed by Hall and colleagues that is rooted in classroom practice. It has been practiced and researched continuously since the 2000s. Hall and his colleagues emphasize having options for three things in particular. Hall and colleagues emphasize having options for three things in particular, namely

- Provide multiple means of Representation
- Provide multiple means of Action and Expression
- Provide multiple means of Engagement

are the key principles (Hall, Mayer. & Rose, 2013, chapter10 section3). They argue that multiple means should be provided to keep hold of students with different characteristics as they acquire information and knowledge, as they demonstrate what they have learned through action and expression, and as they attempt to engage in learning with interest and motivation. They never proceeded to apply all of their guidelines to all classes. Rather, they recommend adapting them to situations where they are needed to reduce barriers found in the classroom. The guidelines are continually updated by the Center for Applied Special Technology (CAST), which they are involved with, and anyone can check the webpage for the latest framework (CAST, 2018). Therefore, the CAET guidelines should be considered as giving learners more options in such a number of aspects, rather than explaining a list of the nine required categories which responds the three principles with three to five items in each category.

Within the UDL framework, SDL and proximity domains are strongly considered. The ninth item is to increase Self Regulation options, but it should be advocated that not only this direct category, but also the overall design of providing more choices for learners is the foundation for the realization of SDL. In particular, when many students, not just the elite, are separated from each other and have to continue their studies individually, the idea of "supporting SDL with a ladder based on UDL and encouraging independence" will be particularly helpful in supporting learning.

ONLINE SDL SUPPORT WITH UDL FLAMEWORK

In this section, a trial consideration of online SDL support, using the UDL guidelines as a framework, will be presented. Each of the three UDL principles has three stages (Access, Build, and Internalize), making a total of nine categories as a framework. These three stages are also in line with Takabayashi's (2020) three stages of SDL: "Reach out, get, continue. Although there is a difference in the order of the three stages, it is important to consider learning as a continuous process, so it would be desirable to implement learning without being biased toward any of the three stages. Table 1 below considers the nine categories in terms of their feasibility and practicality in supporting online learning (especially in supporting the overall continuation of classes for students in higher education institutions, which is currently in need). A simple example is attached to the table.

Table 1

Proposal matrix for UDL guideline and SDL support ideas

UDL Guideline "Provide Options for…" (CAST, 2018)		Online SDL Support **Feasibility**	Online SDL Support **Practicality**	Example Ideas of Functions
Representation (What to learn)	1. Perception	Middle	High	Alt. audio/visuals
	2. Language & Symbols	High	High	Popup hints
	3. Comprehension	High	High	Word highlighter
Action and Expression (How to learn)	4. Physical Action	Law	Middle	Reduced clicks
	5. Expression & Communication	High	Law	Multimedia submission
	6. Executive Functions	Middle to High	High	Progress monitor
Engagement (Why learn)	7. Recruiting Interest	Middle	High	Multi tab ban
	8. Sustaining Effort & Persistence	High	High	Multiple levels
	9. Self Regulation	Law	High	Reflection boad

As shown in the table, it would not be feasible and practical to implement all categories of UDL support measures. However, by organizing them in this matrix, we may be able to see what support measures are effective in bringing more options to the learners who need them. What makes the UDL effective as a framework is that it suggests specific options at a more detailed level. 3 to 5 items are provided for each of the 9 categories. In each of the nine categories, three to five items are provided, and among the categories that are highly rated for both feasibility and practicality, the following five items are considered to be more practical.

The first is information display customization in UDL item 1.1. This item points to the variety of options and customization of the way learning content is delivered, which was not possible when the only materials available were paper textbooks. From a neurodiversity perspective, this could help learners with text recognition difficulties by allowing them to customize the font and other information display of the materials. This is more likely to be provided as an option if the materials exist as digital data on the LMS, and there is a need for learners of various diversities who may be distracted and have a hard time organizing and relating the information they receive.

The second is UDL item 2.5, Illustration via multiple media. Multimedia is useful for learners who are in different situations and have different communication skills. Not only that, but providing engaging multimedia that attracts learners with brain characteristics that make it difficult for them to stay focused will facilitate the SDL process and get more learners on board. Displaying the content of the material in

multimedia, rather than explaining it in one medium such as text only, is a good way to support what is currently being achieved in digital textbooks, making it easier and more accessible.

The third is a proposal for a feature called Highlight of important information, which is shown in UDL item 3.2. This function would not only help learners who have difficulty organizing information, but would also allow each person who continues to learn a difficult subject alone to organize and learn important concepts. In current online education, information highlighting may not be sufficient, either in the content of the class or in the explanations used to guide the class. An option to highlight not only technically easy words, but also concepts that occur repeatedly or are headings of items, is suggested.

Fourth is UDL item 6.3 Enhancement for the monitoring process, in which the importance of the learner's metacognitive perspective on learning is often mentioned. However, when learning alone and at a free pace, everyone would like to have support for self-monitoring. The online support for SDL in universities is the ability to view the progress of a learner's current classes in one place. Although the size of working memory varies from person to person, the suggestion of being able to see in one place online what needs to be done and what has been completed so far would be an important feature to remember. This assumes that all classes, including hybrid classes, send their progress to a common database, which might be a reason to lower the feasibility evaluation.

Fifth, another focus is on UDL item 8.4 Mastery-oriented feedback. When dealing with a variety of brain characteristics, the time it takes for each person to become proficient is naturally different. As an option, for example, by giving quizzes that can be worked on as many times as needed, or small assignments that can be shared by the teaching staff, students can continue to learn in order to advance their own learning while taking the time they need. It would also be possible to support learners to give each other feedback, with assistance on communication issues. It is suggested that online learning support should add features that allow learners with various difficulties to take their own time to improve their proficiency.

CONCLUSION

By combining the knowledge of UDL, which prevents disabilities and other factors from interfering with learning, with the knowledge of SDL, which provides the autonomy essential for online learning, we were able to identify the necessary functions of learning support. Naturally, it is important to design a variety of other human supports and processes as a whole. However, the fact that the functional aspects of the proposal have been compiled in this way is significant for future implementation. In the future, the implementation will become even more robust with the evaluation of practicality by various learners and their instructors, and the evaluation of feasibility by the technical experts. In this time when many students are trying to self-regulate to continue learning remotely, it is hoped that this research can be used to effectively offer more options to learners.

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Academic Support Community Design in Online Learning: Interviews with English Second Language Learner Families in the United States during the Coronavirus Pandemic

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Abstract: Online lessons have been introduced for many students worldwide, including elementary school students, due to the COVID-19 pandemic. This study conducted interviews with English second language learner (ESLL) families in the United States to determine the elements necessary to design a framework for an academic support community that includes support for ESLL families and schools. The interviews showed that online learning is not a substitute for in-person classes. Mothers reported being tired of supporting their children in academic work and found it difficult to continue children's online learning, because of the language and culture differences. Furthermore, the children's mental health was gradually being affected. Therefore, several changes are needed in online learning; one of these changes is creating an academic support community that includes an on-site facilitator and offers mental health care and parental support.

Key words: Online learning, English learner Families, Academic support

INTRODUCTION

Most Elementary schools in the United States introduced online classes in April 2020, due to the COVID-19 pandemic and the related "stay home order" measures to curb the spread of the virus. A previous study found that students' personal communities influence their success in online learning (Oviatt 2018; Roksa and Kinsley 2018). Despite strong evidence for the powerful influence of students' personal community on their learning, researchers have focused mostly on Moore's (1989) three withincourse interactions: student-content, student–teacher, and student–student. (Borup 2020). Moreover, few studies have focused on English second language learner (ESLL) families' support. This study focuses on academically weaker ESLL families in the United States and conducts interviews that reveal the possible elements to design a framework for an academic support community. The author investigated online classes administered between April and June, 2020, and from September 2020 to February 2021.

Case 1 – April to June, 2020

Method

The author conducted semi-structured interviews with four Japanese mothers living in the United States who have elementary school-aged children. The author asked open-ended questions regarding the contents of the classes, homework, and teacher and parental support. The children were aged from 5 to 10 years and the average length of stay in the United States at the time of the interviews was one year and two months.

RESULTS

The author extracted statements from the interviews based on their semantic coherence (Table 1). After categorization based on the similarity of the utterances, two elements were identified: online learning issues and parental support. The first element, online learning issues, includes the issue of providing time for socializing for children. Most mothers mentioned that the time their children spent interacting with their friends was the best part of the online class. For instance, one school provided 30 minutes of chat time once a week. The mothers felt that the online chat sessions were beneficial for their children's mental health.

Second, there is a perception among parents that it is advisable to conduct classes in shorter sessions. It is difficult for children to maintain concentration for an hour; therefore, conducting 30-minute sessions multiple times a day would be more effective.

The third suggestion was to limit the classes to only the major subjects, such as math and writing.

The fourth point addresses homework. Some schools gave printed homework, while others disseminated it via an online application (app). Apps can include daily lesson content and the teacher can provide feedback on the submissions speedily. Print-based homework, however, requires parents to review the work, with no teacher feedback. The app feedback function is useful, as it motivates the student.

The fifth point addressed improving computer operation and Internet literacy. As the children were not used to operating a desktop or laptop computer, mothers stated that they would prefer for their children to learn IT and Internet skills from kindergarten.

The last category addressed support from teachers to parents. The ability to communicate with homeroom teachers individually helped to reduce parental anxiety. Mothers felt that it was important for them to keep in touch with the homeroom teacher to continue to support online learning. Online chats and communication via the app facilitated immediate consultation with the teachers, easing parents' anxiety and encouraging them. Some schools sent questionnaires requesting feedback to improve the classes; one of the interviewees stated that, following the feedback, it became easier to participate in the online class. This highlights the need for teachers to communicate with parents when seeking improvements regarding the amount of homework or the type of classes that the parents want. Moreover, the teachers themselves also need to communicate with parents about the type of classes that parents want or other issues, such as their desire to reduce homework volume.

Table 1
Categories of online class issues

	Category
1	Provide opportunities for children to talk to each other
2	Introduce shorter hours and smaller classes
3	Only major subjects to be offered
4	App distribution with homework
5	Improving computer operation and internet literacy
6	Support from teachers to parents

The second element is parental support. In this regard, there are three categories: class and homework management, deterioration of the parent–child relationship, and support for siblings. The interviewees described feeling tremendous pressure because of online learning, as online learning requires extensive involvement of the parents (Table 2). As the classes commenced, parents had to manage homework and computer/Internet operation and monitor their classes. There were instances when the parents warned their children while helping them with their homework, which created disagreements in their relationship. Parental support is essential for online learning; however, parents themselves felt tremendous stress and anxiety in this situation. Additionally, homes with multiple children faced a greater burden, especially when the children's online classes occurred simultaneously. It is therefore necessary to add a video record function or deliver the class on video, so that it can be played back at a convenient time. Moreover, for ESLLs especially, the parents' ability and language skills may greatly influence children's learning and affect their ability to produce homework. It is therefore hoped that an online information exchange community can be established, or that the homeroom teacher will provide detailed instructions to parents on how to support their children in homework and study.

Table 2
Categories of parental support

	Category
1	Class and homework management
2	Deterioration of parent—child relationship
3	Support for siblings

Case 2 – September to January, 2020

Method

A new school year started in September, 2020 and some schools were still presenting online lessons. The author interviewed three mothers who have elementary school-aged children to investigate the online learning efforts in the new school year in the United States.

RESULTS

The school provided one Chromebook computer for each child. A Chromebook has both a mouse and a touchpad and are easy to handle. Further, Google Classroom was introduced in some schools. Communication, homework submission, and assignment presentations are now performed using Google classroom. This reduced the difficulties of using various applications and has made the process easier for parents. The second change was the increase in the number of teachers providing support for the lessons. One class has one main teacher and three co-teachers, and it is now possible to use the "breakout room" function to separate those children who cannot keep up with the lessons from the other children. The assistance of multiple teachers in online classes was stated to be indispensable. As class time was extended in the new semester, it was expected that parents could spend more time helping their children. However, parents decreased the support to their children, because they had switched to letting their children take online classes by themselves. The reasons for the change in parents' support include both physical aspects (such as the children's growth and class improvements) and emotional aspects, such as shifts in the parents' mindset (Table 3). From September, the class system had improved and their children had become accustomed to operating the laptop. This led to some mothers concluding that they did not need to provide continuous hands-on support. Moreover, in June, parents expected schools to reopen in September and were trying their best to support their children's academic performance, only until then. However, they later realized the difficulty of maintaining academic performance through online classes and concluded that there was no need to work so hard; this seemed to have led them to

giving up on online learning support. However, when they looked at their child's Chromebook history, they found that their child was only watching YouTube during class. As a result of the lack of parental support, some children stopped learning independently.

Table 3
Physical aspects

Reason	Answers
The system is now easier to use.	2
Chilldren got used to using laptop.	3
Children's English skills have improved.	2

Grades and a lack of understanding of children's learning status have emerged as new class issues since September. Until June, no grades were given, while since September, grades were given again. In the online learning setting, children who speak up are especially noticeable. Even if a shy child participates diligently, the process cannot be checked by the teacher in an online setting. As a result, some students felt that it was unfair that their grades were lowered because they were deemed to be participating less. Therefore, it is necessary to consider a grading system that is compatible with online learning, rather than the conventional grading system used for in-person classes. In addition, the tests that were given during in-person classes are no longer administered and mothers worried that the prolonged online schooling situation have made it impossible to ascertain how well the children were learning. Some mothers mentioned that they would like to know what level of academic ability should be aimed for if tests are not available in online learning. Lastly, all mothers pointed out the impact on their children's mental health. All of them were more concerned about their children's psycho-emotional development than their academic performance: believing they were unable to communicate with their friends and receive stimulation, and that the online classes were cutting out the social experiences associated with learning.

DISCUSSION

According to the interviews, most children were bored with the online classes and did not seem to be able to maintain their focus. Existing studies state that online learning self-efficacy positively influences online learning acceptance (Lee and Mendlinger, 2011). Appropriate training to increase levels of self-efficacy can be achieved through enactive mastery experiences that serve as indicators of capability. However, the children of the families interviewed did not get the vicarious experiences because they get little feedback from their teacher. They also did not experience comparison with the attainments of others, because there was no proxy experience to learn from, from other children in the class. As for verbal persuasion, this was a difficult aspect, because parents were disengaged from support; as for physiological and affective states, it was difficult for some children to speak up in class and to participate. Therefore, the interviews revealed that the content of the classes makes it difficult for children to develop self-efficacy.

As the previous study, parents involved in their children's education can help them to become more successful online learners by helping them learn appropriate study habits, motivational skills, and on-task behaviors. This, in turn, will improve their achievement in online classes (Liu et al. 2010). As stated in previous research, students were assigned to an online facilitation, which helped to increase their affective engagement. However, according to the interviews, mothers who experienced online learning were very stressed about the situation, saying it would have been impossible to manage if they were working, or that continued online learning was pointless. These findings indicate that although parental engagement is an essential requirement in this learning method, the most serious problem is the absence of parental engagement frameworks in online learning. Established frameworks tend to focus only on activities or interactions within the course and ignore the influence of actors outside the course on student learning. Furthermore, most frameworks were developed in higher education environments, ignoring the unique characteristics of K-12 students and their individual contexts (Borup et al. 2020). Furthermore, ESLL families had difficulty with online learning, due to a lack of compatibility with this method. Existing

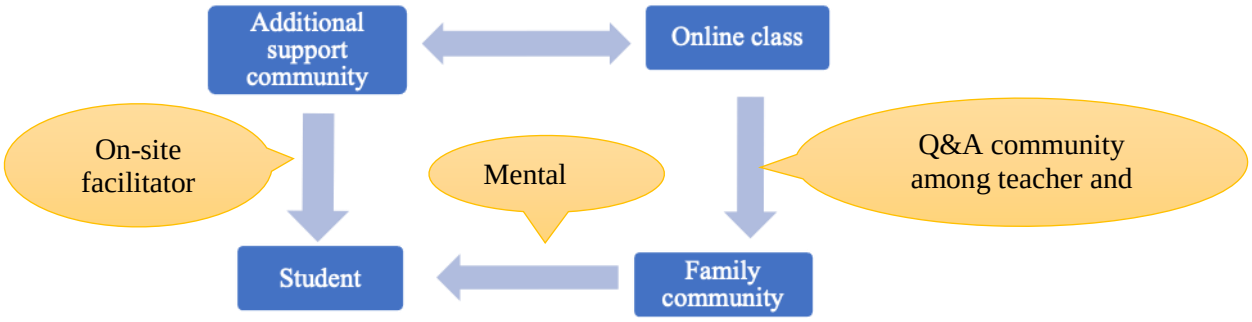
research has shown that culture and language differences have a negative impact on students' online course engagement and lead to poor academic acculturation (Al-Harthi 2005). For elementary school children, online learning required more homework, including essays on American society and history that were difficult for ESLL families to complete. Moreover, other research has shown that individualistic cultures generally have students with high self-efficacy, while cultures that are more collective in nature have a wider range of self-efficacy levels (Lee and Mendlinger,2011). Thus, to foster self-efficacy and to shape attitudes toward voluntarily participating in online classes, it is important to design an academic support community that includes (1) online class improvement, (2) family support, and (3) additional support.

CONCLUSION AND FUTURE PROSPECTS

First, our results show that several changes are needed for online learning methods. These include: (1) allocating socializing time for children, (2) providing lectures and class handbooks, (3) app distribution and feedback on homework, (4) establishing communication between homeroom teachers and parents, (5) introducing shorter classes and smaller groups, (6) adding a video record function, and (7) assistance through the participation of multiple teachers. Second, it is necessary to provide a space for online communication between teachers and parents. Then, parents should be primarily responsible for praising and motivating their children and providing mental health care. Third, it is hoped that a support community will be established that takes guidance from specialists in the field in providing language and culture support or an on-site facilitator system. These are essential requirements in creating a comprehensive design of online learning content for schools, parents, and a support community working together.

Figure1

Academic Support Community



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Designing an online learning reflection checklist for the development of cultural intelligence (CQ) in undergraduates at a Japanese university

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Abstract: As part of a larger project that aims to develop cultural intelligence (CQ) in undergraduates at a Japanese university, an online learning reflection checklist was designed and implemented for three consecutive years. The investigation aimed to explore the self-evaluated attrition of CQ competencies, and gauge participant opinion regarding elements of course instruction. The checklist is presented alongside a limited analysis of its CQ dimensions to understand the self-assessed participant CQ growth. Results indicate a high rate of self-assessed learning retention on the checklist, which points to the potential value of online checklists in self-directed learning. This study adds to the larger project's pedagogical focus by expanding the means for evaluating and understanding CQ development and -learning.

INTRODUCTION

Globalization has increased the cultural diversity in educational environments worldwide. This multicultural reality in academic contexts has seen further increases due to the COVID-19 pandemic, which has forced millions of educators and learners into online learning environments. While the effects of this pandemic may have been unforeseen, developments in the internationalization of education have for years prior suggested that a global workforce is increasingly moving across borders of time and space and utilizing virtual environments to do so. Consequently, higher education sectors in most countries have been occupied with supporting students to develop a set of soft skills alongside the required academic and professional qualifications that they are likely to need, in addition to providing the academic support for their chosen career path (Sit, Mak & Neill, 2017; Suharti, Handoko & Huruta, 2019). In fact, having work-ready graduates are now seen as a competitive advantage for universities and great effort is being made to provide students with interpersonal and intercultural opportunities (Paull, Whitsed & Girardi, 2016).

In this regard, studies in human resource development have long recognized that people with a 'global mindset' often adapt to and engage more successfully with work environments characterized by high levels of diversity (Kedia & Mukherji, 1999; Roux, 2018). Likewise, intercultural competence development research has suggested the kind of personal abilities or soft skills that are necessary to work in culturally diverse situations (Ang, Van Dyne & Tan, 2011; Leung, Ang & Tan, 2014). Developments in this field have recently forwarded the notion of cultural intelligence (CQ) to understand the set of intercultural competencies that characterize a person who can adapt and work in diverse environments with ease and efficiency (Livermore, 2011; Ang, Van Dyne & Rockstuhl, 2012).

The current study forms part of a larger project that is concerned with the development of an overarching pedagogy for the cultivation of CQ in Japanese higher education (Roux & Suzuki, 2017; Roux, Suzuki, Matsuba & Goda, 2018; 2019a; 2019b; 2020; Roux, 2021). The project connects the fields of instructional design and educational technology (ID&T) with developments in the areas of human resource training and CQ learning (Roux & Suzuki, 2017). Building on a unique framework that sought to synthesize well-known methods and models from these mentioned disciplines (Roux & Suzuki, 2017), the project expanded to a full-fledged blended (BL) university course to cultivate CQ in Japanese undergraduates (Roux et al., 2018; 2019a; 2019b). Earlier publications focused on the creation of a learning framework (Roux & Suzuki, 2017) and the design of instruction for a 15-week course to for CQ development (Roux et al., 2018, 2019a, 2019b), while later efforts adopted an evaluative focus of the

learning models employed (Roux et al., 2020, 2021). The current study continues in this vein by placing emphasis on assessing CQ development, taking an individualized learning approach.

CQ is conceived of as a 4-factor model and has its roots in intelligence theory (Ang, Van Dyne & Tan, 2011). Despite conceptual likeness and overlap with cognitive and emotional intelligence, it is seen as a distinct set of capacities that extends beyond mere cognitive and emotional domains (Ang et al., 2011). The four underlying dimensions refer to: (a) cognition, which includes knowledge about how cultures are similar/different; (b) metacognition, which refers to the mental strategies required to make sense of the nuances inherent to diverse cultural experiences; (c) motivation, or the interest and associated confidence in culturally diverse situations, and (d) behaviour, which signifies an ability to adjust and adapt to diverse socio-cultural (verbal and/or non-verbal) encounters (Leung et al., 2014). Given the parsimony of the idea and its focus on the personal development of intercultural competence, CQ has become a popular model for scholars, practitioners, and trainees in the fields of management and human resources (Leung et al., 2014: Fang et al., 2018).

In line with the purpose of the larger project's pedagogical goals for CQ learning (Roux & Suzuki, 2017; Roux et al., 2018, 2019), the current study focuses on the content of an online learning reflection checklist. This checklist was designed to assist in the evaluation of participant CQ development and aimed to (1) gain insights into the attrition of CQ knowledge and strategies, and to (2) gauge participant opinion in relation to elements of learning design inherent to the course. The focus here is limited to (1), which involves an analysis of learning statements contained in the learning reflection checklist. These are related to the two underlying dimensions of the CQ construct, which includes CQ knowledge (awareness and thought) and CQ strategy (a metacognitive dimension). In particular, the results from analyzing the CQ dimensions of this checklist are presented here to better understand the self-assessed participant CQ growth. Results from the current study is aligned with the value of utilizing online checklists to further goals of self-directed CQ learning and adds to the larger project's pedagogical focus by delineating and expanding the tools for CQ assessment.

RESEARCH DESIGN & METHODS

As a form of self-evaluation, a learning reflection checklist can be used when it is not possible to give in-person feedback (Dirksen, 2014). This format is further recommended in the field of learning design to create efficient and satisfactory learning that sets out to meet course requirements (Hosie, Schibeci & Backhaus, 2005). For online learning purposes, it has advantages in terms of personalizing the individual learning experience and is therefore also quite useful in situations involving remote settings. For the current project, it was simultaneously employed as a learning review, and the results for the first learning checklist (2018) were triangulated with summative scores participants received on short tests that covered the textbook contents. The findings were reported in Roux et al. (2019a and 2019b) and showed a favorable correlation between participant self-evaluations on the learning checklist (taken at the end of the course) and the scores achieved on the tests (taken at four intervals during the course). A summary of the 15-week course plan (Roux et al., 2018) with weekly lesson contents is shown below (figure 1) with the concomitant learning elements and research dimensions. The learning reflection checklist was conducted in week 15 as a review and conclusion to the course.

Figure 1.
Outline of a 15-week intercultural learning course aimed at developing CQ (Roux et al., 2018)

	Lesson contents	Learning elements	Research elements
1	▪ Introduction ▪ CQ Scale	▪ Content orientation & overview	▪ CQ Scale: Time 1
2	▪ Chapter 1: Thinking about Culture	▪ Mini-lecture & activities to address CQ development ▪ Learning reflection 1 (online)	▪ Formative feedback 1 (online)
3	▪ Explanation and enrolment: IVE Project – Unit 1: Introduction	▪ Asynchronous online discussion for linguistic & CQ development	▪ Qualitative analysis of online discussions
4	▪ Chapter 2: Hidden Culture & Differences	▪ Mini-lecture & activities to address CQ development ▪ Learning reflection 2 (online)	▪ Formative feedback 2 (online)
5	▪ Review 1: Chapters 1&2 ▪ IVE Project – Unit 2: My Place	▪ Online Quiz 1: Summative evaluation ▪ Learning reflection 3 (online)	▪ Formative feedback 3 (online)
6	▪ Chapter 3: Conflict	▪ Mini-lecture & activities to address CQ development ▪ Learning reflection 4 (online)	▪ Formative feedback 4 (online)
7	▪ Chapter 4: Identifying Conflicts	▪ Mini-lecture & activities to address CQ development ▪ Learning reflection 5 (online)	▪ Formative feedback 5 (online)
8	▪ Review 2: Chapters 3&4 ▪ IVE Project – Unit 3: Events in our lives	▪ Online Quiz 2: Summative evaluation ▪ Learning reflection 6 (online)	▪ Formative feedback 6 (online)
9	▪ Chapter 5: Values and Belief Systems	▪ Mini-lecture & activities to address CQ development ▪ Learning reflection 7 (online)	▪ Formative feedback 7 (online)
	▪ Workshop: 'Does race matter?'	▪ Multi-cultural workshop ▪ Learning reflection	▪ Analysis of audience feedback
10	▪ Chapter 6: The role of Values in Intercultural Conflict	▪ Mini-lecture & activities to address CQ development ▪ Learning reflection 8 (online)	▪ Formative feedback 8 (online)
11	▪ Review 3: Chapters 5&6 ▪ IVE Project – Unit 4 (final): Plans for the future	▪ Online Quiz 3: Summative evaluation ▪ Learning reflection 9 (online)	▪ Formative feedback 9 (online)
12	▪ Chapter 7: Perceptions	▪ Mini-lecture & activities to address CQ development ▪ Learning reflection 10 (online)	▪ Formative feedback 10 (online)
13	▪ Chapter 8: Stereotypes	▪ Mini-lecture & activities to address CQ development ▪ Learning reflection 11 (online)	▪ Formative feedback 11 (online)
14	▪ Review 4: Chapters 7&8	▪ Online Quiz 4: Summative evaluation ▪ Learning reflection 12 (online)	▪ Formative feedback 12 (online)
15	▪ Consolidation & reflection ▪ Conduct CQ Scale	▪ Learning reflection 13 (online)	▪ Formative feedback 13 (online) ▪ CQ Scale: Time 2

The learning reflection checklist was designed to cover learning content from a prescribed textbook, entitled *Culture & Conflict* (Lee & Rogers, 2014). Following a careful reading and analysis of the relevant textbook chapters, an online learning reflection checklist (utilizing Google forms) was devised to incorporate the essential learning content thematically. This process culminated in the 24 learning statements which are presented in table 1. The 25th statement on the checklist was phrased as an open-ended question that required an opinion from participants (results from this latter statement were previously published in Roux et al., 2019). Responses to the learning statements were measured on a 6-point Likert-type scale, with 1 termed *"not at all",* and 6, termed *"yes, exactly".*

Table 1.
An online learning reflection checklist for CQ competencies (Section 1) (25 questions)

	I can explain and/or define what is meant by the 'culture' of a group of people.
	I understand that there are different parts of culture and can give some examples.
	I understand that there are different parts of culture and can give some examples.
	I understand the difference between 'visible' and 'hidden' culture and can give examples.
	I understand that some parts of culture are easier to change than other parts and can give examples of them.
	I understand why the hidden parts of culture might be difficult to change.
	I understand that I can belong to many different cultural identity groups and can give examples of them.
	I understand that sometimes when people belong to, or identify strongly with one cultural group, they might be biased towards, or neglectful of other groups.
	I understand the meaning of cultural conflict.
	I understand that conflict can be positive or negative.
0	
	I understand that conflict can be functional OR dysfunctional, depending on how the people
1	*involved in it respond to one other.*
	I understand that conflicts often involve a disagreement about resources, a difference in
2	*needs, or strong differences in values, norms, and belief systems.*
	I understand that conflict can escalate or de-escalate, depending on how people interact with
3	*one another.*
	I understand that the emotions of people involved in a conflict can make a big difference in
4	*how a conflict is managed.*
	I understand that cultural beliefs are learnt during childhood and can help explain why
5	*people behave the way they do in certain conflict situations.*
	I understand that it is important to be aware of my own cultural values and beliefs, because it
6	*will help me to be tolerant of the differences that I meet in other cultures.*
	I understand that even though people might share the same values, we can still have conflict
7	*because we differ in how we rank or prioritize the values.*
	I understand that in some cultures, the importance of groups is valued higher than those of an
8	*individual. These are called 'collectivist' societies.*
	I understand that my perception of a situation or a person can strongly influence my emotions,
9	*my thinking and/or my actions.*
	I understand that perceptions can sometimes increase conflict, but that if we take out the
0	*emotional responses, it can help to de-escalate the tension.*
	I understand that to prevent a conflict from continuing, it might help to describe it without
1	*using emotional words and suspend all action.*
	I understand what stereotypes are and that they are caused by having rigid or inflexible ideas
2	*about people or groups of people.*
	I understand that stereotypes are also formed by limited knowledge and experiences.
3	
	I understand that the formation of stereotypes can be decreased through education, getting
4	*more life experiences, and training my mind to accept more variety.*
	One thing from these studies that I would like to understand better is… (Your opinion)
5	

RESULTS

The course checklist was given to three classes of undergraduate participants at the end of a course aimed at intercultural communication (as described in Roux et al., 2019a, 2019b). A summary of these results (obtained for the academic years 2018, 2019 and 2020) are given in table 2. Results show that a combined total of 112 participants provided feedback on the learning checklist across three courses (conducted in 2018, 2019 and 2020, respectively). If combined averages are compared for these three years, virtually no differences are observed in terms of participant self-assessed performance for each of the learning statements. In fact, participants gave consistent feedback ratings that ranged from a low

rating of 4.6 points to a high rating of 5.48 points (out of a possible 6 points) across all three checklists. Of note is that there is virtually no difference between average feedback ratings when blended and fully online instruction are compared. Overall, the ratings are very high and may indicate that participants rated their learning experience positively and are cautiously taken as one indication of effective learning transfer.

Table 2
Contrasting averages on a learning reflection checklist for self-assessed CQ competencies 2018-2020

Learning statement	*Averages for 2018 (n = 43) (blended instruction)*	*Averages for 2019 (n = 33) (blended instruction)*	*Averages for 2020 (n = 36) (fully online)*	*Overall average (n = 112)*
1	4.60	4.70	4.89	*4.73*
2	4.99	5.24	5.08	*5.10*
3	5.15	5.12	5.11	*5.13*
4	5.27	5.42	5.39	*5.36*
5	4.95	4.76	5.00	*4.90*
6	4.78	5.33	5.47	*5.19*
7	5.07	4.94	5.03	*5.01*
8	4.64	4.97	4.89	*4.83*
9	4.94	5.42	4.78	*5.05*
10	5.22	5.42	5.28	*5.31*
11	4.71	4.97	4.97	*4.88*
12	4.89	5.00	5.22	*5.04*
13	5.26	5.48	5.19	*5.31*
14	4.98	5.33	5.28	*5.20*
15	4.62	4.97	5.14	*4.91*
16	4.95	5.21	5.08	*5.08*
17	5.15	5.21	5.14	*5.17*
18	5.01	4.94	5.08	*5.01*
19	5.14	4.85	4.92	*4.97*
20	4.88	5.00	4.94	*4.94*
21	4.79	4.88	4.92	*4.86*
22	4.91	5.09	5.22	*5.07*
23	5.18	5.36	5.42	*5.32*
24	4.96	5.15	5.11	*5.07*
Combined average scores	*4.96*	*5.12*	*5.11*	*5.06*

DISCUSSION

Although these results point towards a positive effect for participant learning, it is worth considering several caveats. Firstly, on the one hand, self-assessed evaluations remain a "black box" and are often criticized for being prone to the effects of 'over-evaluation'. On the other hand, Andrade (2019) observes that from a pedagogical perspective, the benefits of self-assessment may come from engaging actively with the learning process, rather than achieving so-called "verifiable" achievements on performance testing. Secondly, although efforts were made to triangulate summative performance in the 2018 course with the present findings, the same procedures still need to be conducted for the 2019-2020 courses to enhance the current findings in view of the larger project's goal for evaluating CQ growth. Thirdly, the reflection checklist contents may need to be independently reviewed or statistically validated to assess whether the learning statements are appropriate and successful in achieving the desired learning. Finally, although the original project framework (Roux & Suzuki, 2017) incorporated several basic and

well-known instructional models, it may be necessary to reconsider its structure by incorporating more recent research in this area. As such, a study by Whitsed et al. (2016) applies aspects of the Kirkpatrick Model and the *New World Kirkpatrick Model* (Kirkpatrick & Kirkpatrick, 2015) to investigate the *Interaction for Learning Framework (ILF)* (Arkoudis, Watty, Baik, Yu, Borland, Chang, Lang, Lang & Pearce, 2013). These, and other similar studies need to be explored to enhance current understandings of the present study and its meaning against the larger backdrop of investigating the growth of CQ in Japanese undergraduate education.

CONCLUSION

As part of a larger project that aims to develop cultural intelligence (CQ) in undergraduates, an online learning reflection checklist was designed and implemented at a Japanese university. The checklist was administered 3 times upon completion of a course aimed at building intercultural competence. It was implemented in a blended format (for 2018 and 2019) and, given the constraints of the COVID-19 pandemic, fully online for 2020. The checklist aimed to explore the attrition of CQ knowledge and strategies, and gauge participant opinion regarding elements of course instruction. The focus of the present study was to present the checklist and provide a limited analysis of participant feedback in terms of its cultural learning content to understand the self-assessed participant CQ growth. Findings indicate a high average rate of self-assessed learning retention on the checklist across all three years, with virtually no difference between the blended/fully online format of the courses. The results point to a positive engagement among participants and link well to the potential value of online checklists in self-directed learning. Recommendations are to expand understandings regarding the use, application, and validation of self-assessed learning in CQ development and to incorporate ideas/models from similar studies in the field of intercultural learning in higher education. This study adds to the larger project's pedagogical focus by expanding the means for evaluating and understanding CQ development and -learning.

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Factors affecting the perception of presence in elementary school students by the type of distance learning

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Abstract: The purpose of this study is to examine factors affecting elementary school students' perception of presence in the three types of distance learning. To achieve the purpose, 19 elementary school students participated in distance learning classes at J Elementary School from April 2020 to February 2021. To analyze factors affecting the perception of the presence of distance learning, participants wrote their opinion on the distance learning class. Data were analyzed using the content analysis methods with two Ph.Ds in educational technology. Feedback is the most common factor affecting students' perception of presence in the three different types of distance learning. In addition, there are different factors for each type of distance learning class.

Keywords: Presence, Distance learning

INTRODUCTION

Due to COVID-19, from the beginning of April 2020, all the elementary, middle, and high schools in Korea began to start distance learning. It was applied to classes in the regular curriculum, not just for supplementary learning. This was the first distance learning class for all public school students at the national level (Namgoong, 2020).

In distance learning, learners may perceive a low presence in the process of experiencing learning, unlike in off-line class instruction(Garrison, Cleveland-Innes, & Fung, 2010). The presence is a concept that means 'a feeling or perception of being somewhere', and since it is relative and subjective, the level of reality perceived by an individual may be different even if they are in the same place(Kim & Kang, 2010).

The presence perceived by learners in distance learning is a factor that can reduce the psychological distance that comes from online learning situations, and acts as an important factor in determining the success of learning(Lim, 2013). However, online distance learning does not have a direct interaction between instructor and learner as well as between learner and learner, unlike learning in a general face-to-face situation, so the sense of reality can be perceived lower than in traditional offline situations(Garrison et al., 2010). Therefore, it is important to design lessons that allow learners to perceive a presence for successful learning in distance learning (Lim, 2013; Park & Lee, 2018).

For elementary school students, it is difficult to feel a constant presence in a classroom situation unless the teacher is actually within the learner's gaze(Lee, 2020). Learners with a low presence are not active in the learning process and are more likely to give up learning or not have a successful learning experience even after completing learning(Garrison & Arbaugh, 2007; Picciano, 2002). However, learners with a high presence show activeness in the learning process and are highly likely to show positive learning effects by immersing themselves in learning. For this reason, it is necessary to design classes in consideration of the learner's sense of reality in remote classes for elementary school students(Lee, 2019).

The presence is influenced by various factors(Al-Fadhli, 2011; Kim, Kwon, & Cho, 2011; Vonderwell & Zachariah, 2005; Wu, 2016). Therefore, an in-depth study is needed to know in detail what factors affected the presence in distance learning. Qualitative research makes it possible to discover in-depth and detailed factors and to understand and analyze objects from an insightful perspective that goes beyond explanations of phenomena(Hwang, 2015; Jo, 1999). Therefore, by analyzing the presence of elementary school students who have experienced distance learning through qualitative research, the presence experienced by elementary school learners is examined in-depth and insight, and the degree of perception of reality and detailed factors affecting the perception of reality are searched for distance learning. It will be possible to provide clues to increase the learner's sense of reality in the situation.

Based on this necessity, this study was to examine factors affecting elementary school students' perception of presence in the three types of distance learning presented as 'task performance-oriented classes', 'content utilization-oriented classes', and 'real-time interactive-focused classes'. In addition, it intends to provide clues to derive a lesson design that takes advantage of the characteristics of the presence according to the type of distance learning.

RESEARCH DESIGN & METHODS

The purpose of this study is to examine factors affecting elementary school students' perception of presence in the three types of distance learning. The research questions were set as follows.

Research Question 1. What are the factors that affect the perception of presence perceived by elementary school students in task performance-based distance learning?

Research Question 2. What are the factors that affect the perception of presence perceived by elementary school students in content utilization-based distance learning?

Research Question 3. What are the factors that affect the perception of presence perceived by elementary school students in real-time interactive-based distance learning?

For this research, 19 elementary school students participated in distance learning classes conducted by a researcher at J Elementary School from April 2020 to February 2021. Each student experienced a distance learning class consisting of task performance-based distance learning, content utilization-based distance learning, and real-time interactive-based distance learning. [Table 1] ~ [Table 3] show activities and tools for each type of distance learning.

Table 1

Task performance-based distance learning

Stage	Activity	Tools
Preparation	- Attendance check and evaluation method. guidance - Task performance method guidance - Upload task to the online learning site	Google classroom Site for online learning (www.edulabtv.com)_
Task performance and interaction	- Task performance-based online learning - Task performing and uploading - Interaction via comment	Google Classroom Google office tools Padlet Site for online learning (www.edulabtv.com)
Evaluation and feedback	- Evaluation of task - Personal feedback - Interaction via comment	
Revision and submission	- Revise the task - Final submission - Final evaluation and feedback	Google classroom Site for online learning (www.edulabtv.com)_

Table 2

Content utilization-based distance learning

Stage	Activity	Tools
Preparation	- Attendance check and evaluation method. guidance - Content utilization method guidance - Upload content to the online learning site	Google classroom Site for online learning (www.edulabtv.com)_
Content utilization and interaction	- Content-based learning - Task performing and uploading - Interaction via comment	Google Classroom Google office tools Padlet Site for online learning
Evaluation and feedback	- Checking the content learning log - Evaluation and feedback - Interaction via comment	
Revision and submission	- Revise the task - Final submission - Final evaluation and feedback	Google classroom Site for online learning (www.edulabtv.com)_

Table 3

Real-time interactive-based distance learning

Stage	Activity	Tools
Preparation	- Preparing live online class - Attendance check and evaluation method. guidance - Activity preparation	Zoom / Google Meet Google classroom
Real-time interaction (Teacher – Students)	- Live online class with video conferencing tool - Real-time interaction between teacher and. students - Learning activity with online tools	Google Classroom Google office tools Padlet, Mentimeter, etc.
Real-time interaction (Students – Students)	- Live online class with video conferencing tool - Real-time interaction between students - Learning activity with online tools - Group activity	
Evaluation and closing	- Evaluation and feedback - Class summary	Zoom / Google Meet Google classroom

To analyze factors affecting the perception of the presence of distance learning, testimonials were received from the students at the end of the semester, and after the first review, additional interviews were conducted face-to-face according to the learner's answers, which were then documented through the company-wide process. The data collected as above were jointly analyzed with two PhDs in educational engineering using the content analysis method.

Table 4

Research Procedure

Data analysis method by the content analysis	**Data analysis method in this study**
Research question or hypothesis setting	Research question setting
Sampling for analysis	Collect learner testimonials and additional interview materials
Determination of analytic nomads and units of analysis	Analysis of teaching, cognitive, social, and emotional presence Determination of analytic nomads and units of analysis
Content Analysis Coding	1. Content analysis and coding facilitator composition (Researcher and two Ph.D. in Educational Engineering) 2. Word meaning, category definitions, the coding rules set 3. Content analysis and Coding (Individual) 4. Reconciliation of differences of opinion through joint consultation and adjustment of the meaning of words and definitions of categories 5. Content analysis and coding based on the contents discussed (Individual) 6. Content analysis and coding result arrangement through a final consultation
Statistical processing of analysis results	Statistical processing of analysis results
Interpretation of research results	Interpretation of research results
Write research results	Write research results

RESULTS

First, in task performance-based distance learning, Factors affecting the perception of presence include clarity and difficulty of task activity, teacher's feedback, motivation for learning, and presentation of supplementary materials. In addition, there is mutual feedback between students, task performance type, interest in other students' activities, and group discussion activities, convenient learning system, the difficulty and quantity of tasks, tasks in which one can express one's thoughts and arguments, situation of learning alone, the form of tasks to relieve pressure.

Second, in content utilization-based distance learning, Factors affecting the perception of presence include learning to perform tasks based on videos and contents, learning design considering concentration, and feedback and interaction from instructors. In addition, there are re-learning processes, personalized learning and length and quality of content, and content provision for new fields and interactive tasks. Also, There are an absence of communication channels, alone-learning style, communication restrictions, temporary delays, and problems with video and sound quality.

Third, in the real-time interactive-based distance learning, factors that affect the perception of presence include a class that is the same as a school class, learning activities using online learning tools, a class composition that reflects interactive elements, temporary delays, and problems with sound and video quality, free-riding problems, teacher's authority to guide the use of the camera, the class composition taking into account length and concentration. In addition, there is the stability of learning coexistence, face-to-face situations, teamwork, group composition and conflict of opinions, and learning at home.

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Effects of Live Online Training of Civil Servants

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Abstract: This study analyzes the live online training effectiveness and acceptance perception of civil servants as face-to-face classroom training is cancelled or reduced due to the spread of Covid-19 and converted to live online training. The survey results of 2,310 participants were analyzed by using a survey tool for the effects of live online training at a major government training institute.
The survey consisted of a total of 11 areas and 33 items to investigate learner characteristics (efficacy), education methods (interaction), course characteristics (effects), and educational environment (environment) by applying Technology Acceptance Model (TAM) to investigate perceived ease of use, perceived usefulness, and learning engagement. Finally, we investigate live online training attitudes, subjective norms, perceived control, and intention by applying the Theory of Planned Behavior (TPB). Chi-squared test and clustering analysis was used to analyze the data. There was no statistical difference in gender. However, people in their 40s expressed higher live online training effects than those in their 20s. In terms of ranks, lower position officers had positive perception toward the effects than the higher rank officers (Grades 8, 9 > 6 and 7 > 4 and 5 > 1, 2 and 3).

Key words: Live online learning, Technology Acceptance Model, Theory of Planned Behavior, Public servants

INTRODUCTION

The unprecedented spread of coronavirus infections has led the world to experience a period of transformation such as unprecedented full-scale online school opening, teleworking routine, live online education, and online video conference conversion and operation. The human resources development (HRD) of public institutions is also at the crossroads of significant change. With the cancellation and reduction of existing collective face-to-face education, public HRD institutions are introducing live online education based on video-based education platforms and rapidly applying online education (Park & Oh, 2021). Amid the rapid changes in the era of the fourth industrial revolution, digital transformation has already become a global phenomenon changing the overall form of life, including politics, economy, society and culture.

However, since the advent of e-learning, there have been concerns in the HRD field that it has not maximized effectiveness and efficiency, which are advantages of digital transformation, only by assisting and improving face-to-face education. In this situation, the direction and role of HRD is being re-examined as the crisis caused by covid-19 triggers 'non-face-to-face' education. Initially, e-learning classes using previously developed content were selected as an alternative learning operating system for collective education as part of the non-face-to-face education method. Thus, HRD focused on live online training methods and attempted various changes in order to leverage digital transformation. Live online education is universally expanded not only in domestic and foreign companies, but also in K-12, higher education institutions, and its efficiency and effectiveness are sought as an alternative to e-learning (Choi, 2020; Zhai et al., 2021). Live online education is one of the alternative ways to replace traditional face-to-face learning. Live online education has recently been actively operated by HRD public institutions,

including universities. This is a form of education in which professors and learners gather at a certain time using Internet-connected remote education platforms and video conferencing systems such as Zoom, Meet, and etc. Various studies have been actively conducted since the spread of Covid-19 (Han, 2020; Hong & Yoo, 2020).

Another issue in workplaces and HRD is diversity in global workforces and generational differences and addressing this is critical (Shepherd, 2020). Especially, in a HRD public institution where large number of trainees whose ages span from their 20s to 50s, differences in personal characteristics as well as learning styles should be of high importance when design training program.

While Technology Acceptance Model (TAM) was useful to explain the user's intention to use new technologies, it has been also adopted in education setting (Shan, 2019). To determine the factors that influence the use of new technology, causal relationships between beliefs, attitudes, intentions, and behavior are studied (Davis, 1989). The two main variables have a significant impact on attitude toward using. Furthermore, the attitude of use leads to the connection of the behavioral intention to use, which leads to the result of the actual system use. As such, TAM has the advantage of high explainability and modifiability, so many researchers are applying the model in studies (Kim, et al., 2019; Jamil, 2017). Recently, it has been applied to identify variables that significantly affect the use of new information technologies in the field such as studies exploring variables that affect the educational use of technologies (Chintalapati, 2017) and comparing models for remote classes in the Covid-19 era (Jeong, 2020).

Looking at the Theory of Planned Behavior (TPB), it has been widely applied in the social sciences as a model that helps to specifically predict the behavior of users on a particular target (Hong & Cho, 2013). In this work, TPB model was applied to illustrate continuous usage based on Attitude, Subjective Norm, and Perceived Behavior Control to complement the limitations of rational behavior theory (Ajzen, 1991).

Based on this context, this study analyzes the effects of live online training conducted by educational training institutions for national civil servants, and explores differences in perception of live online training based on learner characteristics. In addition, to propose implications and directions for effective education design and management for a live online education.

RESEARCH DESIGN & METHODS

Phase 1 investigates literature related to the nature and effectiveness of live online education, collects and analyzes related research and development models (Table 1). The survey tool in phase 2 applies the live online education effectiveness measurement tool. The tool identifies the effectiveness of learners' live online training and their intentions for future retaking, and to understand their intentions for action based on learners' choice of training. In Phase 3, a survey was conducted on the effectiveness and awareness of live online education. Based on the survey results data, a correlation analysis and two-stage cluster analysis were conducted in Step 4 to derive implications for live online education effectiveness, and to propose implications considering learner characteristics.

The subjects of this study are public officials who participated at a national education and training institution program. The number of subjects who participated in the survey was 2,310.

Research Tools

The instruments for the study were developed to identify the perception and effectiveness of line online education and the intention of retaking classes in the future for national and public HRD institutions in order to smoothly move on to line online education system. The questionnaire was revised through three rounds of consultation, and the operational definitions of the derived variables were validated. The research instrument was developed based on literature review on live online education characteristics, information technology acceptance models, and planned behavior theory in three major areas, such as <Table 1>.

Table 1
Live online education effectiveness measurement tool for educational training institution.

Classification	Variables	Items	Definition
Characteristics	Learner characteristics	Efficacy	Confidence and belief that learning can be done well.
	Interaction	Collaboration	The degree of communication and collaboration between instructor and learners.
	Course characteristics	Effects	The degree to which the educational purpose and process are appropriate
	Education environment	Environment	The degree to which the operating environment such as network, system, and operation support was appropriate.
Technology Acceptance Model	Perceived ease of use	Convenience	The degree to which the system is perceived as not cumbersome and easy for learners to use.
	Perceived usefulness	Usefulness	The degree to which the education is perceived as beneficial for learning and/or performance.
	Learning engagement	Engagement	The degree of concentration on learning without using Internet or other programs.
Theory of Planned Behavior	Attitudes toward live online education	Acceptance	The degree of perceived need, affinity, and positive emotion for live online education.
	Subjective norm	Expectation	The perceived degree to which the organization recognizes the expectations, evaluations, opinions, and etc.
	Perceived control	Initiative	The degree of subjective evaluation whether the user can utilize and control live online education.
	Intention to choose live online education	Intention	Intention to use live online education for future classes.

RESULTS

The perception of trainees on live online education is shown in <Table 2> below. The appropriateness (4.15) was the highest, and were followed by efficacy (4.13), usefulness (4.11), initiative (3.88), environment (3.98), and intention (4.00).

There was no difference in gender. In other characteristics, there were differences in the perception of live online education effects depending on age groups, ranks, region, duration, course type, and course status.

Table 2
Perception on live online education

Classification		Items	Mean	SD	Cronbach α
Efficacy (4.13)	1	I can relate my knowledge and information to what I have learned in live online education.	4.18	0.73	0.9
	2	I am confident that I can learn well through live online	4.1	0.832	

		education.			
	3	I am confident that I can complete the tasks given.	4.1	0.82	
Collaboration (4.01)	4	I communicated with the instructors in various ways, including conversation, chatting, notes, and text messages.	4.12	0.85	0.83
	5	I and my colleagues shared the necessary data and information.	4.01	0.89	
	6	Tasks were shared fairly and solved together with colleagues.	4.11	0.81	
Effects (4.15)	7	I was able to achieve the educational purpose of the curriculum.	4.11	0.81	0.84
	8	The teaching methods (lecture, discussion, practice, role play, etc.) used by the instructor were suitable for live online education.	4.10	0.86	
	9	Various media such as pictures, music, and videos were used effectively.	4.23	0.79	
Environment (3.98)	10	The system was stable.	3.88	1.03	0.84
	11	The management of the online system was smooth.	4.03	0.882	
	12	When I had a problem, I was able to get help quickly.	4.04	0.84	
Convenience (4.22)	13	I was able to study through live online education without much effort.	4.09	0.84	0.83
	14	It didn't take long to get used to taking live online training.	4.27	0.78	
	15	I was able to save time by taking live online training.	4.3	0.76	
Useful (4.11)	16	Live online education classes were just as helpful as face-to-face education.	4.08	0.9	0.91
	17	Learning effectiveness was enhanced through live online training courses.	4.1	0.84	
	18	I was able to make use of what I learned.	4.15	0.84	
Engagement (4.02)	19	I was able to concentrate and learn during live online training.	4.04	0.93	0.84
	20	Tasks were accomplished by concentrating on live online education.	4.08	0.85	
	21	I did not do things that distract me during the live online training course.	3.93	0.94	
Acceptance (4.06)	22	I think non-face-to-face education such as live online education is necessary.	4.10	0.86	0.89
	23	I think live online education is a good idea.	4.07	0.89	
	24	It was good to take live online education.	4.01	0.9	
Expectation (4.08)	25	My company allows me to take live online education, and I also think it positively.	4.12	0.92	0.82
	26	The company expects that it will get similar results to face-to-face education, and I think so too.	3.88	1.05	
	27	The company expects me to study hard through live online education, and I'm trying to live up to that expectation.	4.23	0.76	
Initiative (3.88)	28	I took good notes of what I learned in class.	3.65	0.95	0.83
	29	I self-reviewed what I learned.	3.65	1.03	
	30	I tend to look up information needed for class.	4.07	0.84	
Intention (4.00)	31	I intend to take another live online course in the future.	4.07	0.96	0.89
	32	I would recommend live online education to those around me.	3.97	0.99	
	33	I hope other courses that I need to take will also be provided live online.	3.95	1.02	
		Total Mean	**4.06**		

Looking at the difference in live online education effects per age group, 42.0% of the upper group was in their 40s and 32.1% of the lower group was in their 20s. The perception of effects among age

groups were significantly meaningful (χ^2(6, N=2,310) =78.786, p<.001). Contrary to the general perception, trainees in their 40s and 50s generally perceive the effects of live online education higher than those in their 20s and 30s.

Table 3

Perception on live online education depending on learner characteristics

Classification		Group			Total
		Upper	**MIddle**	**Lower**	
Gender	M	571 (36.5)	710 (45.4)	282 (18.0)	1,563 (100.0)
	F	278 (37.2)	336 (45.0)	133 (17.8)	747 (100.0)
	X^2 (2, N=2,310)		0.102		
Age	20s	113 (28.8)	153 (39.0)	**126** **(32.1)**	392 (100.0)
	30s	104 (35.6)	130 (44.5)	58 (19.9)	292 (100.0)
	40s	**363** **(42.0)**	393 (45.4)	109 (12.6)	865 (100.0)
	50s+	269 (35.3)	370 (48.6)	122 (16.0)	761 (100.0)
	X^2 (6, N=2,310)		78.786***		
Rank	1,2,3	15 (19.7)	42 (55.3)	**19** **(25.0)**	76 (100.0)
	4,5	244 (31.0)	349 (44.3)	195 (24.7)	788 100.0)
	6,7	512 (40.1)	591 (46.3)	173 (13.6)	1,276 100.0)
	8,9	**78** **(45.9)**	64 (37.6)	28 (16.5)	170 100.0)
	X^2 (6, N=2,310)		61.578***		

***p<001

Among ranks, 45.9% consisted of upper group (1st, 2nd, and 3rd classes) and 25.0% was lower groups(8th, 9th classes), meaning that high ranking officers considered live online training less effective (χ^2(6, N=2,310) =61.578, p<.001). Higher ranking officers viewed effects of live online education less effective than the subordinate position (8, 9 > 6, 7 > 4, 5 > 1, 2 and 3).

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STEAM practice case analysis and countermeasure research based on content analysis method

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Abstract: In the 21st century, the requirements for innovative and comprehensive talents are getting higher and higher. With its advantages in interdisciplinary training of comprehensive talents, STEAM education has received extensive attention from scholars from all over the world. my country has also continuously promoted the application and development of STEAM education. However, related researches mostly focus on the exploration of STEAM education theoretical models, and few scholars have systematically analyzed the development of STEAM education practice. In order to better understand the development of STEAM education practice research in my country, this study uses content analysis to take the STEAM teaching practice cases developed in the past ten years from 2011 to 2021 as the research object, from the basic information of the literature, teaching information, technical support information, and curriculum The four dimensions of evaluation information have been coded and analyzed in depth, sorted out the status quo of my country's STEAM education practice, unearthed the existing problems, and put forward corresponding suggestions and measures in order to provide help for the better development of STEAM education practice in my country.

Key words: STEAM education, Instructional design, Content Analysis

INTRODUCTION

With the advent of the era of knowledge economy and the era of global network information technology, society has become increasingly changeable and complex, and the demand for high-quality talents is increasing, [1] especially emphasizing the innovation ability and problem solving ability of talents. In order to meet the needs of talent training in the 21 st century,

STEAM education came into being. In STEAM, A refers to Art [2], which emphasizes mathematics as the foundation, interprets science and technology through engineering and art, supports students to understand the world in the way of subject integration, transforms the world in the form of comprehensive innovation, and cultivates their innovative ability to solve problems.[3]

In recent years, many developed countries, such as the UK, South Korea and the United States, have taken STEAM education as a hot spot of education reform, ranking high in the national strategic position to build a global core competitiveness.[4] 《The 13th Five-Year Plan of Education Informatization》 issued by China ' s Ministry of Education also clearly put forward that we should actively explore the application of information technology in new educational models such as interdisciplinary learning (STEAM education) and maker education.[5] Up to now, STEAM education has been localized in China for a period of time, many scholars have made active exploration and research on how to carry out STEAM education with Chinese characteristics.

From the theoretical level of STEAM education, these articles provide suggestions for the development of STEAM education in China. However, few scholars pay attention to the practical application of STEAM education in China. Therefore, this study sorts out the practice cases of STEAM education in the past ten years in China, and uses the content analysis method to code and analyze the practice cases, so as to summarize the practice status of STEAM education and provide suggestions and support for the better development of STEAM education in practice. Please follow the requirement of Submission for the limits of manuscript length according to your presentation session (concurrent or round table session). Standard number of pages is among 4 to 8 for concurrent session and Standard number of pages is among 2 to 4 for round table session.

Please refer to the APA style when you list up references. List the names of the authors in alphabetical order at the end of the manuscript. Capitalize the author's last name whether it appears first (e.g. KUROKAMI, H.) or last (H. KUROKAMI). Citations within the text should follow the following format. (i.e.) Kurokami (2008) reports… or …was indicated. (Kurokami 2008b). When listing Japanese/Korean/Chinese/or others which is not English books or articles, write the romanized titles if they exist.

Research design

1. Research process and method

Abc This study mainly uses content analysis method to encode and analyze the relevant literature on STEAM education practice published in China from 2011 to 2021. Content analysis is a research method to analyze the information and its changes contained in the literature, which can objectively and systematically quantify the research content, so as to sort out the relevant hot spots and development status of the research object. [7] The purpose of its research is to realize the reappearance and effective inference of the research object based on the analysis of quantitative data.[8] This study will combine the general steps of content analysis as follows :

(1) Extract sample literature on the basis of identifying research questions and complete literature screening.

(2) The first dimension and the second dimension of the coding analysis unit are obtained by summarizing the relevant literature. In the process of literature coding analysis, the second dimension is further refined and the operational definition of the relevant categories is determined.

(3) Statistics and analysis of the coding results.

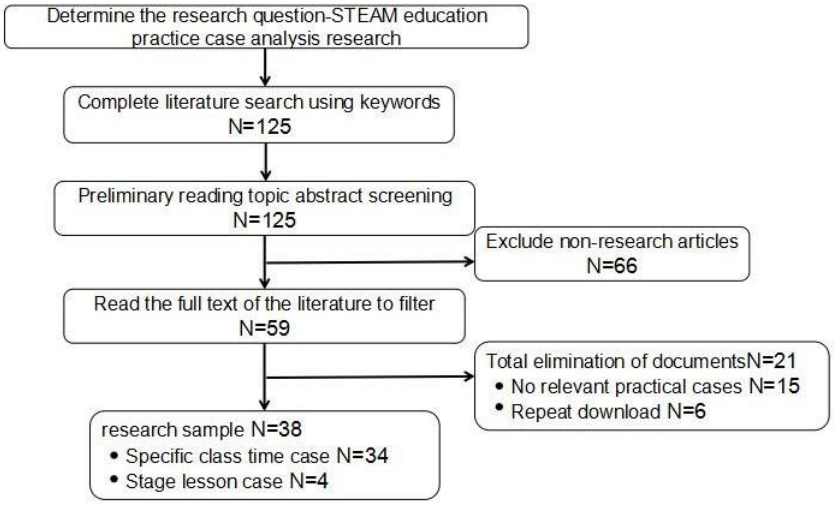
(4) According to the results of the analysis, some suggestions are put forward for the better development of STEAM education practice in China.

2. Research object

The research object of this study is mainly from the journal literature of CNKI. The keywords of ' STEAM education ' and ' lesson, case ' and ' teaching design ' are used to carry out literature retrieval in CNKI. The time span is 2011-2021, and 125 relevant literatures are retrieved.

According to the screening process shown in Figure 1, a total of 38 sample documents were retained.

Figure 1
Flow chart of literature screening



3. Analysis dimension

Based on the coding table shown in table 1, this study conducts a statistical analysis of STEAM educational practice cases from the first dimension to the second dimension. By default, each independent document is an independent analysis unit. If it contains multiple practical cases, it is encoded as multiple independent analysis units.

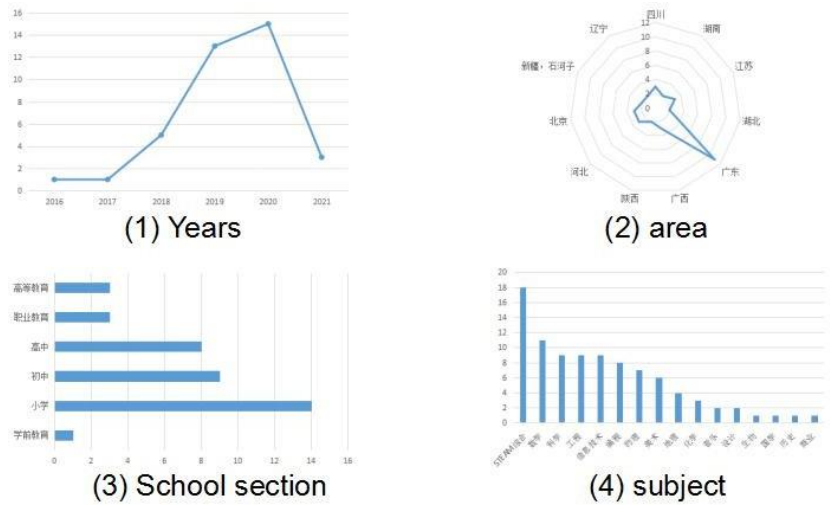
First-leve dimension	Secondary dimensionl				
Basic Information	Years of publication	Author	Institutional area	School section	subject
Teaching information	teaching objectives	Teaching content	Teaching mode	teaching method	Highlight characteristic innovations
Technical support information	Environmental support	Resource support			
Course evaluation information	Evaluation subject	Evaluation object	evaluation standard	Supervisory feedback	

Research results and discussion

1. Basic information analysis

The basic information of STEAM educational practice literature is quantitatively analyzed, andthe results are shown in Figure 2.

Figure 2
Statistical summary of basic information quantification



1.1 Analysis of publication years

It can be seen from Figure 2 that since the 13th Five-Year Plan issued by the Ministry of Education of China in 2016 emphasizes the application of interdisciplinary and maker in teaching,the literature on STEAM education practice in China has increased year by year. In the past three years, the STEAM education practice case articles have shown a sharp upward trend, and experts, scholars and teachers have continuously integrated the STEAM education concept into the localization classroom. China ' s STEAM education practice is in an active exploration period.

1.2 Publication of regional analyses

The statistics of STEAM education practice research areas can summarize the current situationof STEAM education practice in various regions of China, and further understand the localization development of STEAM education in China. From Figure 2, it can be seen that STEAM education practice research in China is more carried out in southern cities, and mostly concentrated in Guangdong Province. There are few areas to carry out STEAM education research in the north, mostly concentrated in Hebei, Beijing and other central cities. It can be seen that the development of STEAM education practice in China has great regional differences and unbalanced development.

1.3 Practice grade analysis

It can be seen from the above figure that China ’ s STEAM education practice mainly focuses on basic education, namely, primary and secondary education, followed by higher education and vocational education, while there are few practical studies on STEAM in preschool education.

As an important way to cultivate talents in the new era, there are still differences in the application and attention of STEAM education in China.

1.4 Analyze practical subjects

STEAM education is developed from STEM education. On the basis of emphasizing the comprehensive application of natural science knowledge such as science, technology, engineeringand mathematics, art is added to supplement the vacancy of humanistic art in the process of natural science application. By summarizing and analyzing the subjects of STEAM education practice, we can have a more intuitive and clear understanding of the integration of interdisciplinary knowledge points. It can be seen from Figure 2 that in the current STEAM education practice, there are more interdisciplinary knowledge integration based on science subjects such as mathematics, science, engineering, information technology and programming

(the summary and analysis of the integration of five or more subjects in the main subjects in the practice case is shown in Figure 3). Music, art, history and other humanities-based subjects arenumerous, so in the future STEAM education practice, we can not ignore the ' A ', we should payattention to the role

of humanities in supporting natural science learning.

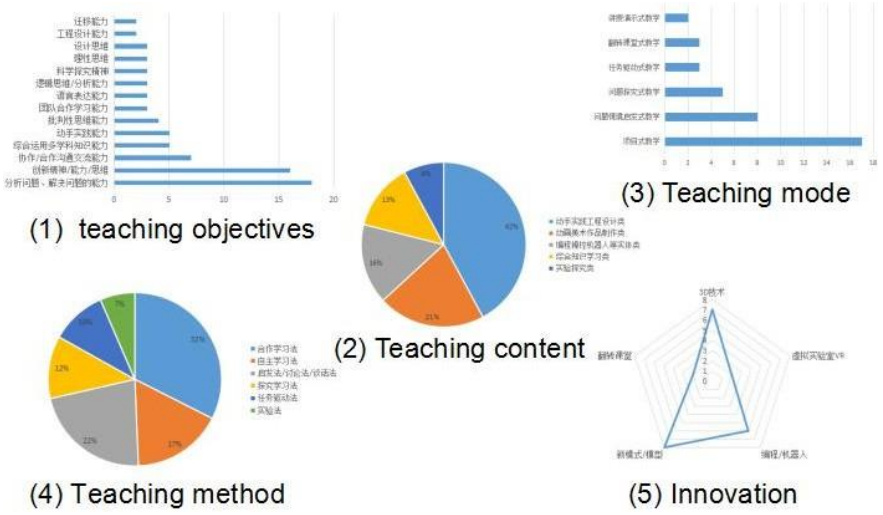
Figure 3
Summary of subject integration

Subject integration		The number of occurrences	Total times
Information Technology+STEAM	Animation (flash) +STEAM	2	9
	Information Technology + Art+STEAM	2	
	Information Technology + Mathematics + Engineering + Physics	3	
	Information Technology+STEAM	2	
Programming+STEAM	Robot programming+STEAM	2	8
	Scratch programming+STEAM	3	
	Programming + mathematics	1	
	Programming + design+STEAM	1	
	Programming + Nature and Science	1	
Physics+STEAM	Physics + Art+STEAM	2	7
	Physics + Humanities+STEAM	2	
	Physics + Chemistry+STEAM	2	
	physical+STEAM	2	
Art	Fine Arts + Information Technology+STEAM	2	6
	Fine Arts + Chinese (Chinese Studies)	2	
	Art + STEAM	2	

2. Teaching information analysis

The statistical analysis of STEAM education practice literature teaching information is shownin Figure 4.

Figure 4
Statistical summary of teaching information quantification



2.1 Teaching objective analysis

STEAM education requires students to comprehensively use multidisciplinary knowledge to solve problems in the process of project learning. It not only emphasizes students ' mastery of knowledge content, but also emphasizes the development of their thinking ability. Therefore, the thinking ability goals that appear twice or more in practice cases are summarized in order to have a clearer understanding of the thinking ability goals of STEAM education in China. The results are shown in Figure 4. In the process of STEAM education in China, it is most expected to develop students ' ability to analyze and solve problems and cultivate students ' innovative spirit. At the same time, it emphasizes the development

of students ' communication coordination and cooperation ability. It is hoped that students can comprehensively use multidisciplinary knowledge and improve their practical ability.

2.2 Teaching content analysis

STEAM education concept emphasizes students ' ability to master knowledge development in the process of learning by doing and practicing. According to the different results of practical cases, the selected teaching content can be divided into five categories : programming control robot and other entities, hands-on practical engineering design, animation art production, comprehensive knowledge learning, experimental inquiry. The proportion of each category is summarized as shown in Figure 4. It can be seen that STEAM education in China still focuses on the production of entity products and the creation of virtual works, and pays attention to the output of teaching content. But students often get knowledge and ability development in the process of practice, so teachers should pay attention to the results and process when choosing content.

2.3 Teaching model analysis

The diversified organization of teaching activities constitutes different teaching modes, but the boundaries between different teaching modes are relatively vague and often mixed. In this study, the teaching modes used are classified according to the development of practical literature

teaching activities, which are project teaching, problem situation heuristic teaching, problem inquiry teaching, task-driven teaching, flipped classroom teaching and lecture demonstration teaching. The summary analysis results are shown in Figure 4. STEAM emphasizes the integration of multidisciplinary knowledge and requires the integration of practical activities, spiritual connotation and values of different disciplines in teaching.[9] Therefore, teaching is mostly based on projects, problems and tasks. However, the existing teaching models are mostly the generalization and derivation of foreign teaching models. Chinese scholars should also explore the STEAM teaching mode with Chinese characteristics based on the existing mode and the characteristics of Chinese students.

2.4 Analysis of teaching methods

Teaching method is the general term of teaching behavior in teaching activities. This paper is classified according to the teaching methods in 《Teaching Theory》 edited by Professor Li Bingde.[10] STEAM education is an education involving multiple subjects, emphasizing the communication and cooperation of multiple subjects in the learning process. Therefore, cooperative learning method is particularly prominent in STEAM educational practice. In the process of cooperative learning, teachers pay attention to the guidance of students ' learning process, and use task-driven method, heuristic method, conversation method and discussion method to guide students to carry out inquiry learning. The results are shown in Figure 4. Before carrying out cooperative learning, students need to have a basic understanding of relevant knowledge. Based on the concept of STEAM, teachers often take the method of students ' autonomous learning, by providing micro-course resources or allowing students to use network resources to consult and complete. However, there is no fixed teaching method in the process of STEAM teaching practice. Cooperative learning method is not the only way to carry out STEAM teaching. Teachers should be good at selecting appropriate methods to guide students to carry out learning according to students ' characteristics, teaching content.

2.5 Analysis of practical innovation points

As can be seen from Figure 4, in the theoretical research of practical cases, many scholars have designed and developed new teaching models or models combined with current research hotspots, and verified them in practical cases, including the integration of results-oriented concept, the construction of cooperative learning model, the addition of metacognitive strategies, the guidance of core literacy and deep learning, etc., which provides a theoretical basis for the localization of STEAM education concept in China. In the application of new technologies and media, 3 D printing technology and programming robots are widely used. VR virtual laboratory and other new technologies have gradually joined the STEAM education practice. It can be seen that STEAM education in China pays more and more attention to localization development on the basis of new ideas and technical support.

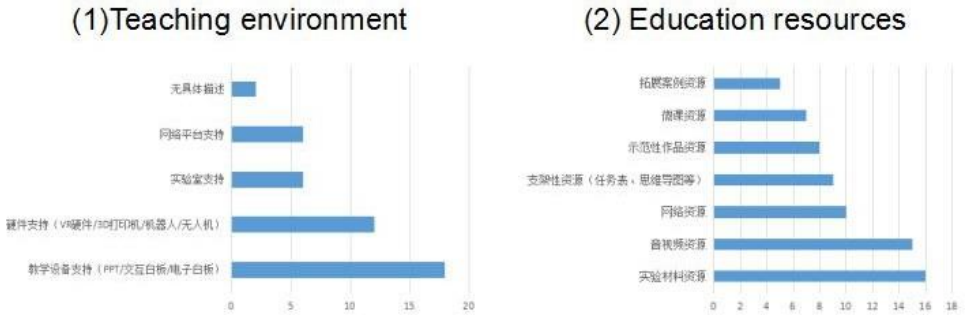
3. Technical support information analysis

STEAM education follows the concept of " learning by doing " and encourages students to use the support of technology and environment to carry out exploratory learning and acquire knowledge development ability from direct experience. Therefore, technical environment and resource support are the key links for teachers to carry out STEAM teaching. [11] Coding the

technical support information can sort out the current situation of the use of technical resources in STEAM education practice in China, and provide the basis for subsequent research. The results are shown in Figure 5.

Figure 5

Summary of technical support information



3.1 Environmental support analysis

Teaching environment is the main position for teachers to carry out STEAM education. Environmental support can help teachers to carry out classroom orderly and efficiently. It can be seen from Fig. 5 that most of the current STEAM practice classrooms are based on basic teaching equipment and carry out teaching with interactive whiteboards and PPTs. Only 31 % of teachers integrate VR, 3D printing, robots and other hardware technologies into classroom teaching. There are only 6 articles using standard laboratory environment to carry out STEAM teaching. The development of STEAM education is mostly based on specific projects or problems, emphasizing that knowledge of extension from practical activities requires certain media technology and environment. Teachers should complete teaching facilities and create corresponding situations on the basis of conditions permitted to help students learn interdisciplinary knowledge better.

3.2 Resource support analysis

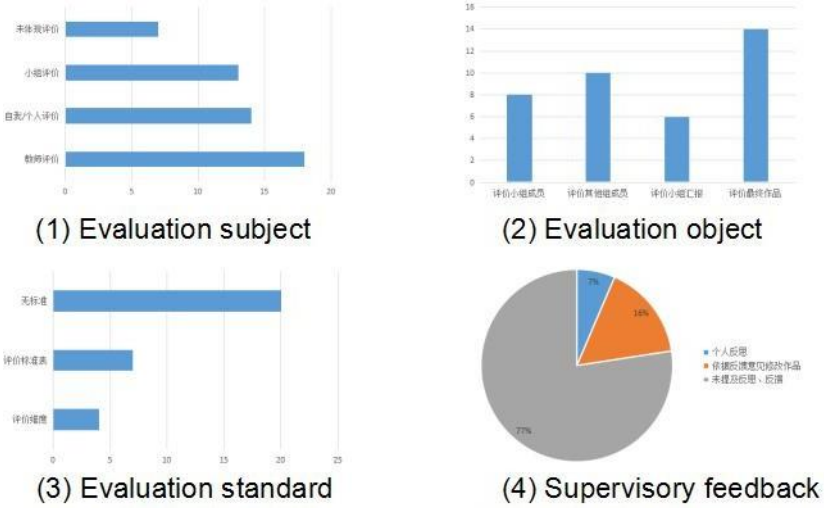
STEAM education is developed on the basis of constructivism theory, emphasizing that students construct knowledge in the process of learning. Therefore, in STEAM teaching, teachers should provide students with the support of various resource tools to help students complete knowledge construction in the learning process. It can be seen from Figure 5 that teachers use audio and video resources as classroom introductions to create appropriate learning situations for students, and on this basis provide students with experimental material resources for practice. However, the use of scaffolding resources and demonstration works resources to guide students to complete self-knowledge construction is less, and the application of micro-course resources to develop students ' autonomous learning ability and expand case resources is more ignored. Therefore, teachers should be good at using a variety of resources to enable students to complete knowledge construction and develop various abilities in the process of learning.

4. Curriculum evaluation information analysis

Teaching evaluation is a process based on teaching objectives, according to scientific standards, using all effective technical means to measure the teaching process and results, and give value judgment.[12] The coding summary results of teaching evaluation information are shown in Fig. 6.

Figure 6

Summary of course evaluation information



4.1 Evaluation subject analysis

The evaluation subject refers to the evaluators who directly or indirectly participate in the project evaluation to solve the problem of " who will evaluate ".[13] According to the coding analysis of relevant literature, the evaluation subjects are divided into three categories : teacher evaluation, group mutual evaluation and student personal evaluation. The statistical results are shown in Figure 6. However, in STEAM educational practice, it is generally not a single subject evaluation, but a multi-subject evaluation. Comprehensive multi-agent evaluation can ensure the true effectiveness of STEAM classroom evaluation.

4.2 Analysis of evaluation objects

Evaluation object to solve the problem of ' what to evaluate ' is to determine the evaluation data for the evaluation subject.[13] In the process of evaluation coding analysis of practical literature, the evaluation objects are divided into two categories, one is for human evaluation, which is to evaluate the individual performance of group members and students. Another category is the evaluation of objects, that is, the evaluation of the completed works and the results of the students ' presentations, as shown in Figure 6. The evaluation of STEAM teaching practice focuses on the evaluation of the final product, while paying attention to the performance of group members in the process of completing the work and the presentation of the final group evaluation report. Both emphasis on human evaluation and evaluation of results, showing a trend of diversification.

4.3 Analysis of evaluation criteria

Evaluation criteria include determining the focus of evaluation content and developing evaluation indicators to solve the problem of ' how to evaluate '.[13] On the basis of excluding the literature that did not reflect the evaluation literature, the evaluation criteria of 31 retained literatures were summarized, and the results were shown in Figure 6. There are as many as 20 articles without specific evaluation criteria and dimensions, accounting for 54 % of the total.

These articles are based on the subjective evaluation of teachers or students, without specific and practical evaluation criteria. It can be seen that there are still problems in the evaluation mechanism of STEAM educational practice in China, and it is urgent to strengthen the standardization of STEAM educational practice classroom evaluation criteria.

4.4 Monitor feedback analysis

Supervision feedback is to analyze how the evaluation results affect the evaluation object, namely students and their practical works, and solve the problem of ' how to use '.[13] From the statistical results in Figure 6, it can be seen that 24 or 63 % of the STEAM educational practice literature did not guide students to reflect and further improve their works. Most teachers carried out classroom summary after completing the evaluation of the works, and did not give students the opportunity to fully reflect and re-examine their works and improve them. While STEAM education emphasizes the development of

students ' comprehensive ability to use knowledge, it also emphasizes the cultivation of students ' critical thinking ability. Reflection is one of the most effective ways to develop students ' critical thinking ability. Therefore, teachers should pay attention to the feedback information in STEAM teaching practice, actively guide students to carry out reflective learning, and improve the supervision and feedback mechanism of STEAM education practice.

Thinking and Suggestions

According to the above analysis, in order to improve the practice of STEAM education in China, the following strategies can be adopted in the process of STEAM design and implementation.

1. Reducing the regional differences in STEAM education through smartreplication

At present, the STEAM education practice is mostly concentrated in the cities of the more developed provinces in the south, while the efforts of other provinces to carry out STEAM education practice are relatively small. However, the development of STEAM education is not driven by one side. In Guangdong Province, where the STEAM education practice is relatively mature, we can take the way of famous teachers ' classroom or dedicated classroom to cooperate with various provinces in the country, show and share the experience of STEAM education practice, and narrow the regional differences of STEAM education in China in the way of intelligent replication to achieve balanced development.

2. Calls for the involvement of multidisciplinary teachers in the development ofdiverse interdisciplinary integration

STEAM education is developed from STEM education, which emphasizes the integration of science, technology, engineering, mathematics and other scientific subjects from the source, but it is in order to make up for the vacancy of art that ' A ' is expanded. Therefore, in carrying out STEAM education practice class, we should actively call on multidisciplinary teachers to join, carry out diversified discipline integration, and help students achieve all-round development.

3. Select the direction of teaching innovation, explore new teaching mode.

Through the coding summary of practical literature, it can be seen that the current STEAM education in China follows the pace of project-based and problem-based, and explores different teaching modes and teaching models combined with the corresponding theories. It emphasizes the dominant position of students in STEAM education and learning, and adopts cooperative learning, autonomous learning, inquiry learning and other teaching methods. However, combined with China ' s education situation, students have been under the examination-oriented education system for a long time. Whether the extremely innovative and loose teaching mode and teaching method are really suitable for China ' s education background is conducive to the development of students. Therefore, while combining the new theory, researchers should also refer to the learning ability of Chinese students, actively carry out teaching practice, sum up experience and develop localized teaching mode and path suitable for the development of Chinese students, and gradually guide Chinese educatees to the road of innovation and development.

4. Use of media, technology and resources to support new models andapproaches

STEAM education emphasizes that students can learn by doing, but the realization of learning by doing needs the corresponding technology and resources to provide support. At present, new technologies such as 3D printing technology, VR technology and robot programming have been continuously applied to STEAM teaching, and there are also extensive resource support in the teaching process. With the support of new technologies and resources, teachers can boldly innovate the teaching mode, exploit new teaching paths with the support of technology, media and resources, so as to improve the development of STEAM teaching with Chinese characteristics and form a STEAM teaching practice system with Chinese characteristics.

5. National, school and teacher tripartite linkage to develop reasonable STEAMevaluation criteria

At present, the evaluation subjects and evaluation objects in STEAM education practice in China are diversified, but there is no unified and standardized evaluation standard in the process of carrying out evaluation. Even in some cases, it is not scientific to judge directly according to the evaluation items

summarized by teachers. So our country urgently needs to develop localization STEAM education evaluation index, big to the national government small to the subject teachers should actively join in the evaluation standard formulation. At the national level, a unified, universal and guiding evaluation standard should be issued to meet the implementation needs of most STEAM education. At the school level, it is necessary to design the evaluation index of STEAM education project with the characteristics of our school, in order to effectively promote the landing of STAEM education. At the teacher level, it is necessary to accept the constraints of the evaluation criteria in the classroom teaching process and act according to the evaluation criteria, so as to play the actual effect of the evaluation criteria.

Conclusion

Due to the limited space of this study, only the four dimensions of basic information, teaching information, technical support information and teaching evaluation information of STEAM educational practice cases in the past decade in China are summarized and analyzed, which

basically presents the current situation and practical characteristics of localized STEAM educational practice in China. From the perspective of research methods, the content analysis method adopted in this study has certain subjectivity. In future research, other research methods need to be integrated to further conduct a more detailed and comprehensive analysis of STEAM educational practice literature, so as to better grasp the situation of STEAM educational localization practice and contribute to the exploration of STEAM educational practice with Chinese characteristics.

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Representative Talks

Representative Talk, 16:20-17:00, August 20, 2021

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President of Japan Association for Educational Media Study(JAEMS)

Wooyong Eom

Professor, Keimyung University, SOUTH KOREA

President of Korean Association for Educational Information andMedia (KAEIM)

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Co-Chair of Teaching, Colleges and Community (TCC)