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Editors
Nancy LAW, Gary WONG, Esther WOO, George JIANG

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A Systematic Review of School Leaders' Challenges and Responses During COVID-19: What the International Evidence says

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The presentation will share the findings from a study on school leaders' challenges and responses during COVID-19. The study uses a systematic review of international evidence to identify the teaching and learning challenges and the school practices to address them. It is informed by the contingency opportunities theory, which considers the environmental constraints and opportunities for schools. Results identify four main challenges and five main responses. Implications for education authorities and schools are discussed.

Objectives

Contextualized in the prolonged school suspensions due to the COVID-19, the presentation will share findings from an ongoing study that examine the different teaching and learning challenges faced by school leaders during the pandemic and the responses that they undertake to address these challenges. The study is important in light of the onset of the pandemic (since late 2019) that has severely disrupted teaching and learning in many parts of the world. It is aligned to the sub-theme on learning and teaching with digital technologies.

'Challenges' as used in the study refers to problems that are 'built on the subjective interpretations of those who encounter them; thus, a problem emerges in the 'gap between desired and actual state', which leads to a challenging situation' (Tamadoni et al., 2021, p. 3). Most of these challenges can be solved or managed by school leaders and policymakers (Spillane & Lowenhaupt, 2019). In light of the myriad challenges confronting school leaders (comprising principals, vice-principals, and teacher leaders), it is perhaps unsurprising that they have experienced tremendous stress during the pandemic (Fotheringhama et al., 2022; Hayes et al., 2022; Hulme et al., 2023; Reid, 2022).

School leaders adopted different practices in response to the myriad challenges during the pandemic. For the purposes of the present study, school leaders' practices in response to these challenges is defined as encompassing their actions to manage contingencies that disrupt teaching and learning during the pandemic.

Methods (Including Theoretical Framework)

The present study employs a systematic review of the international to surface a comprehensive range of (a) challenges that school leaders are confronted with and (b) school leaders' practices in response to the challenges they encounter in different contexts during the pandemic. The systematic review was informed by the contingency opportunities theory (Wasserman et al., 2010). The theory provided a balanced consideration of the environmental challenges confronting schools (constraints) and what schools can do (opportunities) (Tan, 2018). The inclusion of constrains and opportunities corresponded to expected findings from the systematic review comprising

insights on teaching and learning challenges that school leaders faced during COVID-19 and the practices that they adopted in response to these challenges respectively.

The main search of relevant studies was performed using seven key education-related databases (*Academic Search Complete, APA PsycArticles, Australian Education Index, British Education Index, Education Full Text, ERIC, Families & Society Studies Worldwide*), two other broader databases (*Scopus, Web of Science*), and other complementary searches.

Studies were included if they

- addressed challenges in teaching and learning confronting school leaders and/or
  school practices in response to these challenges during and after the pandemic;
- involved G1-12 schools;
- were empirical primary studies;
- were written in English; and
- were dated 2019 to March 2023.

Studies were excluded if they

- involved challenges in teaching and learning confronting school leaders and/or school practices in response to these challenges before the pandemic
- involved kindergarten, college, or university students;
- were reviews or non-empirical studies;
- were news articles, magazines, or articles in professional (non-academic) journals;
- were non-English studies; or
- were duplicates.

The following information were coded from the studies:

- study title/authors/year
- study types
- research designs
- participants
- countries/continents
- challenges for teaching and learning during pandemic
- school practices in response to these challenges during and after pandemic

The six-phase thematic analysis (Braun & Clarke, 2020) was used to derive themes from the studies. The six phases were

- reading the studies and noting initial ideas
- generating initial codes
- identifying potential themes
- further developing and reviewing the themes
- refining, defining, and naming the themes
- reporting and discussing the themes

Results

224 studies were included in the systematic review. The teaching and learning challenges and responses to these challenges were linked to those affecting socioemotional well-being and safety. They involved different stakeholders beyond school leaders. They also pertained to the period of time corresponding to school closure during the pandemic and post-pandemic reopening.

Results on challenges confronting schools pertained to (a) schools' need to respond to the challenging external environment; (b) **i**mplementation and consequences of home-based, online teaching and learning during the pandemic; (c) need to do more with less; and (d) deteriorating socioemotional well-being of the school community during the pandemic.

Results on schools' responses to address these challenges pertained to (a) schools responding to the challenging external environment during the pandemic; (b) facilitating student learning during the pandemic; (c) resources and teacher capacity; (d) addressing the school community's well-being; and (e) recovery, innovation, future-proofing post-pandemic.

Significance

These results highlight the need for education authorities to strengthen the crisis management plan for schools, strengthen network of professional learning communities within and between schools, and provide resources and support for schools. Implications for schools include school leaders institutionalizing a crisis response framework and team comprising different members of the school community, developing a long-term schoolwide e-learning plan, and addressing the socioemotional well-being of the school community.

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The Impact of a Mobile Instant Messaging Application on Feedback Uptake of Performing Arts Students

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In an era marked by rapid technological evolution, the intersection of mobile instant messaging (MIM) applications and education presents a fertile ground for exploring innovative learning and teaching methodologies. This study delves into the utilization of MIM applications, particularly WeChat, to enhance feedback uptake among sophomore Performing Arts students in China, a domain where traditional feedback mechanisms are challenged by digital advancements and the changing landscape of learner engagement.

Background and Rationale

Feedback constitutes a cornerstone of educational development, offering a mirror through which learners can reflect on their progress and areas for improvement. The performing arts, characterized by their dynamic and interactive nature, demand a feedback process that is not only immediate but also rich in content and engagement. With the advent of mobile technologies, MIM applications have emerged as potent tools for facilitating communication and feedback. However, research exploring their efficacy in the context of Performing Arts education remains sparse, signaling a gap this study aims to fill. In summary, our research question is: 1. What functions does an instant messaging application deliver when performing arts students use it to accomplish feedback uptake? 2. What are the effects when students of performing arts use an instant messaging application to accomplish feedback uptake? To respond our research questions, we choose the USM model as our theoriotical framework. The model is demostrated as follows (Figure 1).

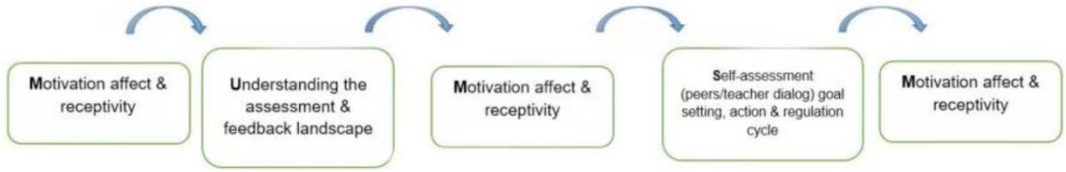

Figure 1 USM Model (Wood, 2021)

Methodology

Adopting a qualitative research approach, this investigation hinges on the Unified Self-assessment and Motivation (USM) model, designed to explore technology-mediated feedback processes. Through semi-structured interviews, online observations, and analysis of student reflections, the study examines the impact of WeChat on feedback uptake among Performing Arts students. The choice of WeChat as the focal MIM application stems from its widespread adoption and multifaceted functionalities, which align with the study's objectives to explore diverse feedback modalities.

Findings

The study's findings underscore the multifaceted role of WeChat in facilitating immediate, interactive, and vivid feedback. Immediate feedback, enabled by WeChat's real-time messaging and calling features, fosters a dynamic feedback loop between instructors and students, allowing for swift adjustments and clarifications. Interactive feedback, enhanced through features like 'Moments' and 'PaiPai,' introduces a social dimension to feedback, enriching the learning experience with peer and instructor interactions. Vivid feedback, facilitated by the multimedia capabilities of WeChat, enables the sharing of rich, contextualized feedback, encompassing videos, images, and text, thereby enhancing understanding and retention.

Significance

This study contributes to the burgeoning field of technology-enhanced learning (TEL) by demonstrating how MIM applications can transcend traditional educational boundaries, offering new pathways for engagement, understanding, and improvement in Performing Arts education. By leveraging the ubiquitous nature of mobile technologies, educators can foster a more inclusive, responsive, and enriched learning environment, aligning with contemporary learners' digital habits and expectations.

Moreover, the research highlights the potential of MIM applications to serve as a bridge between the traditional, mentorship-driven pedagogies of the Performing Arts and the digital-centric learning preferences of modern students. In doing so, it not only enhances the feedback process but also enriches the artistic and educational journey of performing arts students, preparing them for a digitally integrated professional landscape.

Future Directions

While the study sheds light on the promising integration of MIM applications in Performing Arts education, it also acknowledges the need for further research. Future studies could explore the longitudinal impact of such technologies on learning outcomes, expand to diverse educational contexts, and investigate the scalability of the USM model across different disciplines. Additionally, as digital technologies continue to evolve, ongoing research will be crucial in adapting educational practices to leverage new tools and platforms, ensuring that the benefits of technology-enhanced learning are fully realized.

Conclusion

In conclusion, this study affirms the transformative potential of mobile instant messaging applications in enhancing feedback uptake within Performing Arts education. By integrating technology with traditional educational practices, it paves the way for a more engaged, responsive, and enriched learning experience, underscoring the critical role of technology-enhanced learning in the future of education.

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To Resist It or To Embrace It? An Investigation of Generative AI Chatbot's Potential to Support EFL Writing

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EFL writing is widely recognised as a fundamental component of academic literacy, which involves constructing a clear and logically- sound claim supported by evidence and reasoning to convince others to accept one's stance. The development of generative artificial intelligence chatbot (e.g. ChatGPT), the newest pre-trained large language model, has recently attracted unprecedented worldwide attention. This exploratory study used a mixed method to collect data. Sixty writing papers and essays were collected from EFL students to analyse the feedback, and then ten students were interviewed. Results showed that generative artificial intelligence feedback can present a large amount of language issues (like grammar issues, logic issues and content-related issues). The student reported very positive attitudes towards the features of the Gen AI Chatbot - ChatGPT. The present study provides educators and researchers with a comprehensive perspective on the potential and limitations of chatbots in language education and encourages further research and innovation to overcome challenges and improve the effectiveness and sustainability of chatbots in language education.

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Empowering K–12 STEM Teachers to Be AI-Ready: The Insights from A Bibliometrics Study

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The increasing proliferation of artificial intelligence (AI) in educational settings has drawn significant attention recently, especially after deep learning (DL) techniques became ubiquitous from 2014 onwards, leading to a burgeoning body of academic literature intersecting the interdisciplinary fields of AI and education. It is crucial to comprehensively explore this academic discourse—to elucidate its prevailing trends and issues—to inform future research. Therefore, we conducted a bibliometric study to address this emergent research gap.

We extensively searched the Web of Science Core Collection (WOSCC) database using an advanced syntax comprising critical terms related to AI and education. 1001 articles published during 2014-2023* (until September) were retrieved from the database, and 239 articles were considered after two rounds of independent screening by two coders with interrater reliability greater than 93%. Keywords co-occurrence analysis was performed at a co-occurrence frequency of 4 with default clustering perimeters and the Lin-log modularity method. 71 co-occurring keywords were identified and clumped into 4 clusters encompassing the research trends: (i) *Cluster 1: Applying AI techniques in solving educational problems*; (ii) *Cluster 2: Broadening AI into K–12 educational systems*; (iii) *Cluster 3: Empowering STEM education with AI technologies*; (iv) *Cluster 4: Preparing teachers to teach AI and use AI in their classrooms*. Subsequently, eleven overarching research trends were highlighted within these clusters based on an inductive-interpretive analysis.

In this paper, we will predominantly discuss the research trends related to the proliferation of AI in the context of K–12 STEM education, particularly those that shed light on how to support K–12 STEM teachers to be AI-ready: 1) Broadening AI into K–12 educational systems (Keywords: *K–12 education, education, artificial intelligence, school, ethics, etc.*). 2) Demystifying AI to K–12 students with various educational technologies (Keywords: *educational technology, computational thinking, educational robotics, robotics, tools, augmented reality, virtual reality, etc.*). 3) Infusing AI into STEM education across educational levels (Keywords: *STEM education, science, mathematics, etc.*). 4) Designing STEM learning experiences with AI-based tools to engage students (Keywords: *students, engagement, learning, performance, impact, design*). 5) Utilizing AIED applications to support STEM teachers (Keywords: *teachers, teaching, technology, intelligent tutoring systems, support, etc.*). 6) The emergent need for teacher preparation to enable them to teach and use AI in their classrooms (Keywords: *teacher education, professional development, AI education, pedagogical content knowledge, framework, etc.*). 7) Facilitating adequate AI readiness for teachers to utilize various AI technologies (Keywords: *technology integration, acceptance, classroom teaching strategies, skills, etc.*).

The results accentuated that K–12 STEM teachers face several challenges in teaching AI and harnessing it to facilitate learning, as they are mainly daunted to teach AI due to their naïve understandings, as specific research studies indicate. Effective professional development (PD) and teacher education initiatives must address these challenges. While a few studies investigated experienced teachers' technological-pedagogical-content-knowledge (TPCK) by adopting the *integrative* TPCK framework, we identified several limitations: Unclear dimensions of their TPCK frameworks, limited alignment of theoretical constructs with classroom praxis, and lack of considerations of the contextual factors that impact AI education. Ergo, we urge future research to address these limitations pragmatically. For this purpose, we suggest leveraging the *transformative* ICT-TPCK framework—a design-based framework whose dimensions could inform both top-down and bottom-up approaches to TPCK construction. This could be indispensable to major stakeholders, from teachers to policymakers. Regardless, future research should also investigate the long-term effectiveness of their initiatives for supporting K–12 STEM teachers in being AI-ready.

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Exploring Hong Kong Pre-Service Teachers' Perspectives on AI Models and Computational Thinking: An Interpretive Inquiry

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Computational thinking (CT) has emerged as a pivotal component of K–12 education for fostering problem-solving skills among the next generation of learners. However, CT integration remains an arduous challenge for K–12 teachers due to their limited preparation, prior knowledge, and relevant expertise in CT. To respond to this challenge in Hong Kong, we designed and implemented an introductory CT course employing plugged (i.e., with computers, programming, or digital) and unplugged (i.e., without computers, programming, or non-digital) CT approaches alongside AI technology to prepare pre-service teachers.

The CT course was organized at the undergraduate level at a prominent university in Hong Kong. It was offered as a free elective to undergraduate students across the participating institution who aspired to become K–12 teachers. To inform the design of our future course iterations, we conducted an interpretive inquiry within the course to explore how these teacher trainees learn CT through different teaching and learning (T&L) activities. The course cohort comprised twenty-eight students, including twenty-five pre-service teachers and three part-time in-service teachers. The in-service teachers did not participate in the research inquiry. The pre-service teachers, who were undergraduate students, came from several faculties and departments within the institution. As a result, the cohort showcased a significant diversity in terms of educational backgrounds and disciplinary expertise.

The course entailed T&L activities purposefully designed to address the technical and applied aspects of CT, with content including CT concepts and constructs (e.g., initialization, functions, variables, conditionals, iteration, and arrays), learning of these concepts and constructs using unplugged platforms such as LEGO patterns, and applications of these concepts and constructs with plugged platforms using block-based programming languages (e.g., Blockly and Snap!). The trainees utilized Blockly to program Micro-Bits to develop peripheral devices and DIY (Do-It-Yourself) projects. More importantly, they designed and interacted with rudimentary chatbots leveraging AI models (e.g., ChatGPT, GPT-3, Cohere, DALLE-2, and Stable Diffusion) using the 'Snap!' programming language.

The interpretive inquiry explored the pre-service teacher trainees' learning experiences of CT during the course. The trainees were sampled purposively with the following criteria: (i) Undergraduate students who aspire to be K–12 teachers, (ii) have no formal teaching experience, (iii) participated in all the T&L activities, (iv) completed all their weekly reflections, and (v) consented to participate in the study. Fifteen trainees (n=15) met the criteria and were engaged in the data collection. We used multiple qualitative data sources for triangulation and generating a *thick* description: (a) Participant Observations (e.g., field notes, photographs, video records, and learning artifacts), (b)

Participant Reflections (e.g., reflections, personal insights, and comments), and (c) Participant Interviews (e.g., response to semi-structured interview questions).

Concurrently, we conducted inductive content analysis (ICA) following a two-phase iterative coding process. During this, two coders worked independently and reported an inter-coder agreement greater than 89% afterward. The ICA accentuated the emergence of three core themes, encompassing numerous subthemes within our data. The three core themes are delineated as themes of (1) CT Knowledge, (2) CT Perspectives, and (3) Potential Barriers. Nevertheless, this paper disseminates part of our findings on the trainees' CT Perspectives *only*: It delves into their post-course perspectives on AI models and CT, seeking to elucidate the pedagogical implications of integrating AI models and CT into K–12 education, respectively.

The ICA revealed that ten (of the fifteen) participating trainees extensively evidenced meaningful perspectives on AI models and CT. Four major themes emerged within their perspectives based on the axial coding: (i) Embrace AI Models to Enhance T&L; (ii) Perceive AI Models as Computational Thinkers; (iii) Employ CT for Effective Prompting of AI Models; (iv) Recognize the Challenges of Adopting AI Models. Most notably, the trainees perceived various challenges when asked about adopting AI models for their current and future T&L: (a) limited guidance and experience in integrating AI models within education settings, (b) conflicting reasons among students when it comes to utilizing AI models, (c) difficulties in designing assessment tasks that ensure transparent and honest use of AI models, and (d) adverse effects on learning transactions in classroom settings.

The rapid proliferation of AI models (e.g., large-scale pre-trained and large language models) is being extensively debated in higher education settings. However, these models' full potential and implications remain predominantly unexplored within K–12 education and teacher education. The study under consideration, therefore, has endeavored to contribute to bridging this burgeoning research gap. It provides new insights into T&L CT through prompt engineering—a potentially novel approach to democratizing CT education that could be the conduit to bridging the divide between CT and general education. The teacher trainees acknowledged the significance of CT in developing AI models and its necessity for effectively harnessing them. Notwithstanding, future studies should pragmatically investigate this interplay, particularly the extent and roles of different CT practices during prompting and their implications for learning different sprompt engineering techniques.

Keywords: AI models, computational thinking, K–12 education, pre-service teachers, perspectives

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Examining Pre-service Teachers' Social Justice Dispositions amidst the Educational Digital Divide

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Schools in India serve a highly diverse population, and social exclusion and discrimination based on gender, caste, class, and religion are pervasive in the classrooms. Based on the assumption that preparing teachers to teach for social justice can challenge the rising inequalities in schools, this study aims to increase understanding of what it means for pre-service teachers to be prepared in a teacher education programme with a stated commitment to social justice.

To understand how pre-service teachers navigate learning to teach for social justice, a framework of *social justice dispositions*: tendencies and inclinations that enable teachers to confront their beliefs and attitudes about diversity, thus guiding their practice, was used. The study explored the social justice dispositions of the pre-service teachers enrolled in their first year, final year and recent graduates of the Elementary Teacher Education (ETE) programme offered at women-only colleges at a large university in Delhi. The following research questions were addressed:

1. How do the social justice dispositions differ for pre-service elementary school teachers enrolled in the first year, final year and one year out of a teacher education programme?
2. In what ways are these social justice dispositions complicated for pre-service teachers as they navigate the programme?

An exploratory sequential mixed-methods research was carried out in two phases: a) an online survey consisting of background questions and a Social Justice Teachers' Disposition (SJDT) Likert scale with 214 pre-service teachers and graduates; b) followed by in-depth interviews with 21 participants selected purposively. In addition, I analysed the programme documents, such as the mission statements, course syllabi, assignment descriptions, and completed assignments of individual pre-service teachers.

Drawing on major traditions of social justice education and critical social theories, I propose a conceptual framework identifying five dispositions of a social justice educator: awareness of diversity, critical self-reflection, preparedness to teach for diversity, challenging inequalities, and advocating for social justice.

The present paper will share findings from the in-depth interviews conducted with 21 pre-service teachers and graduates. In particular, I will focus on the challenges encountered by the final-year pre-service teachers during their online teaching practicum and in-service teachers during the pandemic. The findings shed light on how social justice dispositions are developed as pre-service teachers navigate the digital divide in the context of India.

The theoretical backdrop of feminist standpoint theory and scholarship grounded in social justice education facilitated a critical exploration of the opportunities within the

ETE programme for pre-service teachers to learn about social justice. Findings also reveal moments within the programme that served as patriarchal and oppressive, thus complicating the discourse around teacher education for social justice.

This study illuminates how university-based teacher education for social justice can be realized in the diverse social context of India. Furthermore, this research offers insights for teacher educators and policymakers in India and other countries to think critically about ways teacher education programmes can prepare and support pre-service teachers to become willing social justice educators.

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Longitudinal Activity Theory for Technology Implementation (LATTI)

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The present paper presentation proposal for CITERS 2024 serves as part two of the previous year's (CITERS 2023) paper presentation titled:
Activity Theory to Analyse ePortfolios in an IB MYP Sciences Classroom: Longitudinal Multiple-Case.

This 2024 paper presentation continues to be associated with the following journal article:
Kwong C.-Y. C. & Churchill D. (2023). Applying the Activity Theory framework to analyse the use of ePortfolios in an International Baccalaureate Middle Years Programme Sciences classroom: A longitudinal multiple-case study. *Computers & Education, 200,* 104792.

It is important to note that instead of focusing on the theoretical framework and the results of the aforementioned published journal article as already underlined in 2023, the current paper presentation's objective is to emphasise on the **methods** synthesised through contemporary (2020–2023) educational technology literature review that takes up aspects of the PRISMA guidelines. The literature review's two main search areas, *longitudinal research design* and *novelty effect*, assisted by the Activity Theory System for analysis, help to propose the *longitudinal Activity Theory for technology implementation (LATTI)* **framework** that forms the methodological backbone of the published study. This CITERS 2024 paper presentation may be **practically significant** for **learning and teaching with digital technologies** (the selected sub-theme of CITERS 2024) because the longitudinal research design is admittedly 'not so common in our field' (email correspondence from a Q1 journal editor-in-chief, 3 August 2023) and may therefore be **academically significant** as a notable methods gap for future journal publications contributing to **digital transformation and innovation** research.

A longitudinal study is 'often used in educational research [as] this type of study involves tracking individuals or groups over a period of time in order to monitor and record developments in their learning, circumstances, or achievement' (A dictionary of education, 2015). Recent (2020–2023) technology or system design implementation-related reviews that outlined aspects of the longitudinal research design or the novelty effect are chosen from Q1 journals in order to warrant reasonable academic rigour. This first section, a review of reviews, is essential for researchers to **learn about recent research results and evidence-based practices** that may provide recommendations for theory.

The novelty effect is 'the increased effort and attention research subjects tend to give to media that are novel to them. The increased attention paid by students sometimes results in increased effort or persistence, which yields achievement gains. If they are due to a novelty effect, these gains tend to diminish as students become more familiar

with the new medium' (Clark, 1983, pp. 449-450). Recent (2020–2023) technology or system design integration-related articles that specifically expanded on aspects of longitudinal research design and the novelty effect as well as the practical ways the latter was seemingly mitigated are described. This second section, a review of articles, is vital for practitioners to **improve the use of design and technology in teaching and learning**, thereby an opportunity to present recommendations for practice.

To stimulate and facilitate productive discussions among academics and practitioners for CITERS 2024, and analytically assisted by the Activity System Elements, the most commonlyfeatured **recommendations** supported by the arguably **innovative** LATTI framework are highlighted: Tool (e.g., autonomy and control: personalisability), Subject (e.g., Perceived ease of use of Tool), Rules (e.g., Timeliness and flexibility: Subject has freedom to choose when and how to engage with Tool), Community (e.g., Audience: Positive effect from subjective norms), Division of labour (e.g., Guidance from facilitator: Introductory session and coherent tasks for Subject), and Outcome (e.g., Intrinsic focus: Not high stakes with extrinsic awards for Subject).

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Inquiry-Driven Innovation: A Case Study in Museum Design Course Through Guided Inquiry and Project-Based Learning Integration

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The increasing adoption of project-based learning (PBL) in many design faculties at Chinese universities remarks a notable shift from conventional theoretical methods to experiential and practical learning (WANG & Choi 2023). Nevertheless, this approach frequently leads to a narrow focus on specific projects, potentially limiting broader learning within the discipline (St.John et al. 2023). Although students may initially show a strong commitment to their learning, it is important to note that these projects may not cover the majority skills and knowledge required in their future professional development, necessary for life-long learning. To solve this problem, the combination of Guided Inquiry Design (GID) and PBL can be highly beneficial. GID promotes inquiry-based learning, where students develop their own projects instead of being assigned pre-determined tasks (Maniotes 2017). This paper examines the integration of the "Museum Experiential Spatial Design" course into a design programme at the undergraduate level. The course effectively combines GID with PBL. Over five years, this approach has not only resulted in students getting numerous international and national design awards, but also, increased student engagement, and fostered personal perspectives and analytical skills essential for future professional growth. The study aims to: 1) examine the impacts of integrating GID and PBL on student learning outcomes in a design course; 2) investigate how IT techniques can enhance the GID and PBL processes; 3) offer recommendations for educators seeking to incorporate these methodologies into their teaching, and future directions of the investigation. The study involves qualitative feedback from students and insights from their inquiry diaries that were documented during the process. Furthermore, it includes case studies of student projects that illustrate their practical implementation.

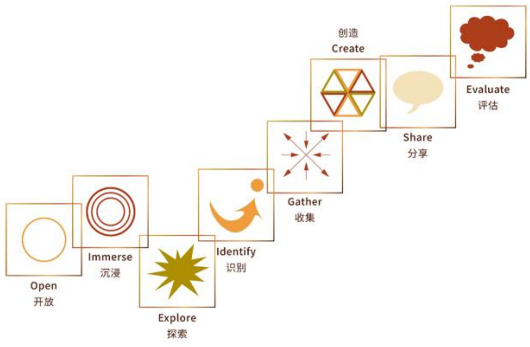

Figure 1 Guided Inquiry Design

Guided Inquiry Design Learning (GID) is a scientific learning process that involves students voluntarily exploring a topic. Students require inspiration and guidance to explore fresh territories, invest new ideas, explore new creativity, and produce new works. The course is divided into three phases: Conceive, Design, and Realisation. It utilises an eight-step guided inquiry approach that aims to challenge students' learning patterns (Figure 1) in Open, Immerse, Explore, Identify, Gather, Create, Share and

Evaluate (Maniotes et al. 2016). By deeply interacting with museums' themes, students are encouraged to question, explore, and invent as they move from curiosity to immersive research to the construction of meaningful, visitor-focused exhibitions.

Stages	Steps	Guided Inquiry Design Learning Method	Museum Design in Practice	Inquiry Tools: IT Innovation
Conceive	Open	Broaden Horizons and Perspectives Stimulate Curiosity	Getting into the subject Familiarise with the background	Virtual Reality (VR) tours of global museums Interactive Mind Maps Online Debate Forum
	Immerse	Build up Background Knowledge Discover Interest Points	Lectures and Workshops	Online Libraries and Databases
	Explore	In-depth Learning Explore the unknown	Field Trips Museum Exhibition Design Case Study	Social Annotation Tools for collaborative reading and discussion of case studies
Design	Identify	Identify Research Question Determine Research Direction	Project Brief Blue Print Design	AI-Powered Research Assistants
	Gather	Extract Valuable Data	Exhibit Organisation Design Concept Development and Integration Exhibition Outline	Collaborative Note-Taking Augmented Reality (AR) to check exhibits details
	Create	Reflect the Learning Outcomes	Space zoning and flow design Exhibition Scheme Design Representation	2D Visual and 3D Modeling Tools
Realise	Share	Learn from peers Present what has been learned	Project Report Review and Discussion	Online and Offline Forum connect with different stakeholders
	Evaluate	Evaluate the results of learning	Evaluation and Test	Online Feedback and Assessment

Table 1 Guided Inquiry Design in Museum Design Course Implementation

In the teaching and learning process, incorporating various IT innovations into inquiry-based learning tools modernizes traditional methods, enhancing immersive learning experiences in both PBL and GID. Students use these tools to achieve the three "Cs" of the learning strategy: Collaborate and Communicate, Compose and Create, Choose and Continue (Maniotes 2017). In PBL, virtual reality (VR) and augmented reality (AR) replicate real project situations within a virtual environment, allowing for the practical implementation of theoretical knowledge (Shaikh 2023). Additionally, collaborative virtual environments and tools foster teamwork and provide dynamic feedback, encouraging a process of iterative learning. In GID, immersive technologies enhance the process of "explore," "identify" and "gather" stage. This is particularly beneficial when students are collecting and synthesizing information, by facilitate personalised and supportive learning routes, adjusting to individual preferences and allow for greater freedom of exploration during the inquiry process, enhancing the collection and integration of knowledge.

Initial results indicate that students who took part in the course showed enhanced creative problem-solving capabilities, better teamwork abilities, extensive and well-founded knowledge base as well as a deeper grasp of museum design principles. The utilisation of IT technologies enhanced the learning experience by improving research, design, and presentation processes. Future research could prioritise the improvement of innovative techniques to enhance the GID process. Additionally, there is a need to develop assessment methods within a Gen-AI background to give more accurate evaluations of learning procedures and outcomes. Furthermore, it is essential to investigate the how PBL combined with GID and implementation techniques can be scaled up and implemented in larger classes across diverse, resource-limited settings.

Keywords: Guided inquiry design, project-based learning, immersive learning technologies, museum design, student innovation

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Enhancing Educational Equity in Rural EFL Contexts through AI-Enhanced Self-Guided After-School Initiatives

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Introduction

Disparities between urban and rural resources challenge equitable educational access, particularly in China where such gaps are pronounced due to a shortage of qualified educators and adequate after-class materials in rural areas. These conditions hinder effective English as a Foreign Language (EFL) education, limiting rural students' engagement in ample learning experiences and achieving educational outcomes. Prior research has focused on technological integrations in resource-rich and classroom settings, overlooking how to enhance self-directed learning (SDL) with artificial intelligence (AI) after-school programs. Given the complexity of linguistic acquisition and the need for tailored tools, this study employs the intelligent computer-assisted language learning (ICALL) framework. The research aims to systematically assess the efficacy of extracurricular AI tools in enhancing SDL and English language proficiency among primary school students in rural China as a basis for providing targeted solutions to bridge the identified education gaps.

Methods

The research used a longitudinal mixed-methods approach to assess the AI tools' influence in an academic year. There were five time points for data collection which were at the beginning of the study, middle and end of the first and second semester. The quantitative data incorporated students' duration and frequency of after-class learning activities and test scores. Baseline data included end-of-term grades from the previous year and a survey. Subsequent data collections were scheduled to monitor progression and capture any shifts following the AI intervention. The analysis utilized GLM with repeated measures and ANOVA to compare value changes. To further investigate and validate, semi-structured interviews were conducted at the end of the year. The questions delved into the qualitative data of students' perceptions of the learning environment and the impact of AI on their SDL practices and achievement. Thematic analysis provided more in-depth and comprehensive information support for quantitative results.

Findings

Quantitative data indicates distinct promotion in student SDL, engagement, and performance for the implementation of AI tools. All schools show a reduction in homework time and an increase in extracurricular AI-enhanced learning duration. From the initial to the final record, listening duration increases by 3.06 minutes, speaking 1.15 minutes, reading 5.91 minutes, and writing 4.00 minutes. The frequency of AI usage rises from 1.42 to 2.49. The score increases 10.506 ($p < .001$) overall. Furthermore, the data reveals differences in the amplitude of variations and outcomes among schools. Thematic analysis identifies key impacts of AI on SDL capabilities, motivation, efficiency, and language skills, resulting in more interaction, greater autonomy, and better scholastic attainment.

Discussion

The evidence obtained by the study shows that AI promotes educational equity by providing high-quality educational opportunities for rural students through intelligent tutoring systems and personalization, as well as making up for the lack of information and content categories. AI is to improve the learning environment, making educational resources more accessible and more tailored to individual needs and preferences, thereby improving students' SDL. It also reveals that the change extent across schools and students' willingness to engage in various language skills are influenced by socio-economic disparities, indicating that the impact of AI tools is modulated by contextual factors, preferences, and requirements. This insight calls for the customization of AI tools to effectively address the challenges and demands of different educational environments, ensuring that these technologies support, rather than undermine, efforts to close educational gaps.

Conclusion

This study substantiates that AI-enhanced after-school programs observably improve SDL and English language skills among rural EFL students by bridging gaps in extra resources availability. Through longitudinal experiments, the study obtained the magnitude of change among schools and periods. As no comparison with schools in urban areas, future research should explore the scalability of AI across diverse regions and assess its longer-term impact on students' academic and personal development to ensure these benefits are sustained. Furthermore, it implies to develop targeted training programs for teachers that focus on effectively integrating AI into teaching and learning activities, complementing traditional methods and assignments.

Keywords: AI, EFL, self-directed learning, rural education, equity

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Application of Head-Mounted Display-Based Augmented Reality and Mixed Reality in Nursing Education: A Scoping Review

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Objectives

As Generation Z with a penchant for information technology has become the main cohort of nursing learners, and influenced by the COVID-19 pandemic of the past years, the adoption of new technologies in nursing education has become an inevitable trend. Immersive technologies represent one such advancement. However, the currently most mature technology, virtual reality (VR), has issues such as lack of physical feedback, disconnection from reality, and motion sickness. The head-mounted display based-augmented reality and mixed reality (HMD-based AR and MR) offer hands-free operation and a blend of virtual and real-world elements, allowing for the improvement of some of the shortcomings of VR. The application of these techniques in nursing education has gradually become more numerous. Despite this, the current state of application of HMD-based AR and MR in nursing education still lacks a systematic description, and the existing studies on the concepts of AR and MR are somewhat vague. Therefore, this study aimed to conduct a scoping review of the current status of HMD-based AR and MR applications in nursing education, and to analyze the use of the concepts of AR and MR, ultimately clarifying the future development direction of HMD-based AR and MR application in nursing education.

Methods

According to the five-stage framework of the scoping review, a comprehensive collection and summarization of evidence on the application of HMD-based AR and MR in nursing education was conducted in November 2023. The database search included CNKI, WANFANG, VIP, Chinese BioMedical Literature Service System (CBM), PubMed, Cochrane Library, Embase, CINAHL, Web of Science, Scopus, ProQuest Dissertation & Thesis, IEEE, ACM Digital Library, and Engineering Village. Additionally, manual searches of reference lists were conducted. The literature was independently screened by two researchers based on relevance. Studies that did not engage participants with HMD-based AR and MR, as well as those not including nurses and nursing students, were excluded. Key information from the included literature was collected using a table. The table primarily encompasses information regarding the research objectives, study subjects, interventions, outcome measures, and key findings.

Results

A total of 40 studies containing 2224 participants were included in this review, spanning from 2016 to 2023. The study population included nurses, nursing students, other medical professionals, students from other healthcare disciplines, technical developers, volunteers, and school faculties. The studies included 17 from the United States, nine from South Korea, four from China (two each from mainland and Taiwan),

three from New Zealand, three from Australia, and two each from Germany and Japan, with reports written in English and Chinese. The type of research primarily involved mixed-methods research, while also encompassing qualitative and quantitative research. The main application areas were skill training (simulation) and knowledge learning. In the study, the HMDs primarily employed were classified into three categories: immersive HMDs, smart glasses, and smartphone-based HMDs. Some studies have incorporated artificial intelligence (AI), wearable devices, and tactile feedback mechanisms in conjunction with HMDs, augmenting the efficacy of these systems. The software could be primarily categorized into existing commercial software, self- developed software, and software that comes pre-installed with HMDs. The outcome measures included three types: feasibility, effectiveness, and personalized experience. However, the focus was on feasibility. Overall, the feasibility of applying HMD-based AR and MR in nursing education is promising, with learners experiencing satisfactory outcomes and better effects compared to traditional educational methods, though further validation is still needed. The using of research terms for AR and MR tended to be ambiguous, with instances of differing concepts but essentially the same interventions.

Conclusion

Despite various explorations in the application of HMD-based AR and MR in nursing education, current studies were still focused on feasibility research. It is essential for future nursing education to develop and implement more portable and cost- effective HMD-based AR and MR solutions to promote their various forms of application in nursing education. Such systems should be closely integrated with cutting-edge technologies such as large language models (LLMs) to enhance the overall utility of HMDs as teaching aids. Research should detail the intervention procedures instead of merely citing AR and MR concepts, examining the combined effect of various elements of reality and virtuality on outcome measures. It is also necessary to design specialized evaluation methods and tools to assess the practical application of these technologies in educational settings. Conducting further efficacy studies and randomized controlled trials will substantiate the effectiveness of HMD-based AR and MR in nursing education, thereby establishing a foundation for their broad-scale deployment.

Keywords: Nursing education, Head-mounted display, Augmented reality, Mixed reality, AR, MR, Simulation

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Introducing the STEM Education Performance Expectation Framework for Primary and Secondary Schools in Hong Kong

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This paper presents a performance expectation framework for STEM education among primary and secondary school students in Hong Kong, developed through a three-round Delphi study involving 32 experts from various stakeholder groups. The framework consists of seven Key Performance Indices (KPIs): Knowledge Integration in Real-World Application, Communication & Expression, Design Thinking & Problem-Solving, Personal Development & Mindsets, Literacies & Competencies, Cultural & Social Competency, and Making Use of Local Resources. Each KPI is defined and broken down into key components with justifications and ratings based on a 3-level system (Basic, Intermediate, and Advanced). The study also identifies good practices of STEM education at the school and education system levels, as well as policy options to support students in attaining the performance expectations. Policy recommendations focus on curriculum enhancement, teacher professional development, resource allocation, and community engagement to address key challenges and leverage best practices in K-12 STEM education in Hong Kong. The findings of this study provide evidence-based strategies to promote STEM education, inform curriculum development, and guide training programs for teachers. By establishing benchmarks and identifying priorities, this framework serves as a valuable resource for policymakers, educators, and other stakeholders working to enhance STEM education in Hong Kong.
Keywords: STEM Education, performance expectation, attitude, skills, knowledge

Layman summary on policy implications and recommendations

The findings of this Delphi study on establishing a performance expectation framework for STEM education in Hong Kong have several important policy implications and recommendations:

1. Enhance STEM curriculum: The Education Bureau should enhance the STEM curriculum across all grade levels to incorporate the identified key performance indices and their components. This will ensure students develop the knowledge, skills, and mindsets needed to thrive in a rapidly evolving, technology-driven world.
2. Provide teacher training: Invest in comprehensive professional development programs for teachers to equip them with the pedagogical strategies and content knowledge necessary to effectively implement the performance expectations in their classrooms. This includes training on integrating STEM disciplines.
3. Allocate resources: Adequate resources should be allocated to support the implementation of the performance expectation framework. This includes funding for STEM facilities, equipment, learning materials, and technology infrastructure in schools. Special attention should be given to underprivileged schools to ensure equitable access to quality STEM education.

4. Foster community partnerships: Encourage schools to collaborate with local industries, organizations, and experts to provide students with authentic, real-world STEM learning experiences. These partnerships can offer mentorship, internships, and resources that enhance the relevance and impact of STEM education.
5. Promote cultural integration: Incorporate elements of Hong Kong and Chinese culture into STEM projects and learning experiences to foster students' sense of identity, belonging, and cultural appreciation. This cultural integration can inspire unique innovations and solutions that address local needs and challenges.
6. Emphasize lifelong learning for both students and teachers: Cultivate a lifelong learning mindset among students by promoting self-directed learning, resilience, and adaptability. Encourage and support teachers to engage in continuous learning and professional growth to stay up-to-date with the latest developments in STEM education and their respective fields.

Overview

Science, Technology, Engineering, and Mathematics (STEM) Education has been a priority education initiative by the HKSAR since 2015. The government recently launched a series of measures to promote STEM education in primary and secondary school sectors. A dominating policy argument for STEM education in HK was to nurture a versatile pool of talents for enhancing the competitiveness of HK. The transition to a knowledge-based economy in HK did not only create demands for STEM talents, but also a STEM workforce. Hong Kong needed to raise the overall STEM literacy to diversify into a knowledge-based economy (The Academy of Sciences, 2016). STEM education was a means to developing STEM literacy, which entailed being able to integrate and apply knowledge and skills across different STEM disciplines. Given the vast investment of resources in STEM education, our knowledge about what to expect from STEM-literate students to be able to do remained very limited. Without these performance expectations, it would have been difficult for policy makers, curriculum developers, educators and teachers to tell for sure how reliable the existing STEM education was in meeting its goals.

Objectives

The proposed project aimed at establishing a performance expectation framework across key learning stages, which outlined the progressive and developmental for STEM literacy. Specifically, we conducted a Delphi study (target n = 32) to identify expert communities' collective views of:
1. Components constituting STEM literacy and its associated performance expectations at each key learning stage;
2. Good practices of STEM education conducive to attaining these performance expectations; and
3. Priorities of policy options for promoting STEM education.

Our study actively involved representatives from key stakeholders throughout the process, including school principals, curriculum leaders, panel heads teachers university professors, scholars, and external bodies sharing an interest in STEM education. More importantly, these stakeholders were the ones who ultimately acted upon the results of the Delphi study, making the implementation of STEM policies a more effective process. The practical implications of the project were three-fold:

1. A performance expectation framework for STEM education was established to serve as benchmarks, informing the government of evidence-based strategies to promote STEM education;
2. Findings on good practices of STEM education informed the government the strategies that needed to be maintained and reinforced; and
3. Findings of this project provided evidence for Education Bureau that informed curriculum development and training programmes on STEM education.

Delphi Study

The study unpacked components constituting STEM literacy in the HK context and the associated performance expectations at each key learning stage. It also identified priorities of STEM education policies and developed an initial set of policy options. We used a three-round Delphi study to identify expert communities' view about promoting STEM literacy (see Figure 1). Expert opinions, rather than general ones, were often sought in developing education policies. Delphi study was characterized as a structured process of group communication among experts. It had the advantage of using group decision making techniques, thereby having greater legitimacy than those made by an individual (Brooks, 1979). It assumed that a group's most representative opinion on a complex problem was more significant than any one individual's opinion. Their opinions were collected via intensive questionnaires interspersed with feedback reports. Communication between individuals was coordinated by the investigators through structured information flow and controlled feedback. Anonymity avoided social-emotional behaviours such as influence of dominant individuals on group opinion and distraction by group pressure to conform. This enabled individuals to focus on the task per se. This process of communications from an informed group presented all the options and supporting evidence to policy makers' consideration (Clayton, 1997).

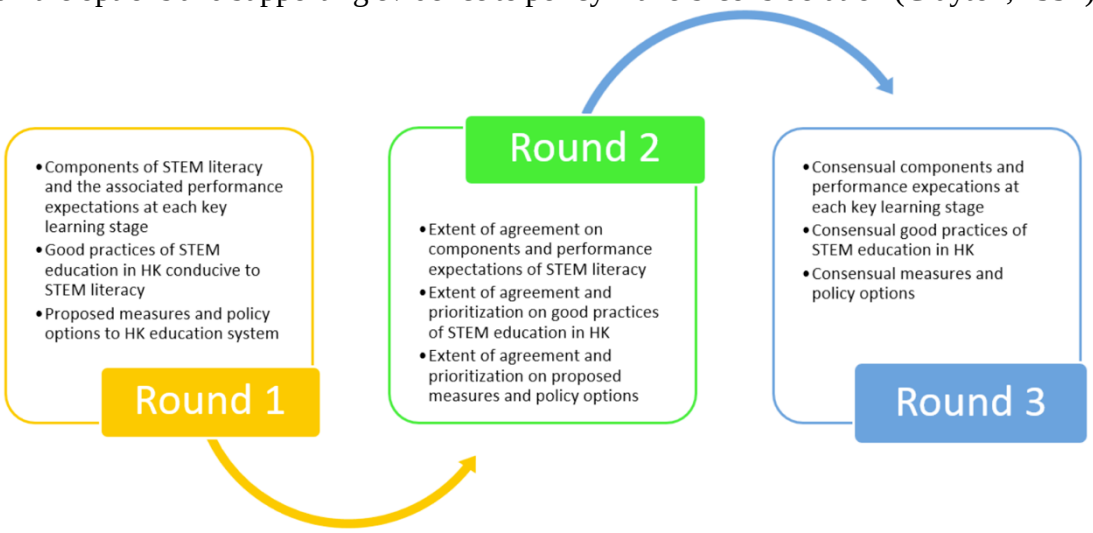

Figure 1 Foci in each round of data collection in this Delphi study

Participants

The quality and size of the expert panel was key to the success of the Delphi method (Powell, 2003). The minimum number for a Delphi panel was considered to be 10 (Cochran, 1983) with reduction in error and improved reliability with a larger group size. As a general rule-of-thumb, the panel size for a heterogeneous group was 5 to 10 participants (Clayton, 1997). Experts on a particular topic, i.e., STEM education in this

case, coming from different professional stratifications such as primary school teachers, secondary school teachers, school principals and university academics, comprised the panel. To obtain a broad range of potential priorities for education policies, this study sought input from four professional areas (Target n = 32), namely:

1. Practitioners engaged in STEM education at primary schools, including school principals and General Studies / Mathematics / Technology curriculum leaders, panel heads and teachers (n = 8);
2. Practitioners engaged in STEM education at secondary schools, including school principals and Science / Information and Communications Technology / Mathematics / Design and Technology curriculum leaders, panel heads and teachers (n = 8);
3. University academics engaged in STEM-related teaching activities for primary or secondary school students, e.g., those involved in conducting outreach programmes, or university academics engaged in research or teaching activities in STEM education (n = 8); and
4. Those involved in external bodies with an interest in STEM education, e.g., curriculum developers and service providers of STEM education (n = 8).

All experts had more than 10 years of experience in their field of expertise. A nomination process for potential participants was initiated to identify well-known and respected individuals from members within each target group, e.g., from the Hong Kong Association for Science and Mathematics Education, the Hong Kong Association of the Heads of Secondary Schools, and Hong Kong Teaching Excellence Alliance. Then these nominees were selected through a ranking process and an invitation letter was sent by e-mail to selected nominees.

Data Analysis

In this Delphi study, participant responses were analyzed through thematic coding analysis (Robson, 2011, p. 474) after each round. Two members of the research team got familiarized with the written responses to generate initial codes, which were grouped into themes. All the responses were coded reflexively and iteratively using a computer-based qualitative data analysis software (NVivo) until a reliability of >80% was achieved. Any discrepancies between the two coders were resolved with the help of a third objective rater. A list of components constituting STEM literacy and the associated performance expectations emerged from the responses. A summary of performance expectations for each learning stage was generated for each emergent theme of components, capturing the essence of participants' statements. The research team discussed the emergent themes until consensus on the categorization and wording of theme was obtained.

Components constituting STEM literacy and the associated performance expectations (Research Objectives 1 & 2) were identified in Round 1 Delphi study. Extent of agreement on these was sought in Round 2 and re-rated in Round 3. Median and the Interquartile range (IQR) for each statement, using the rating given in the 5-point Likert scale, were calculated. A consensus regarding the extent of agreement on each statement was obtained when the participants rated a theme with a median ≥4.0 on the 5-point Likert scale and the IQR was ≤1.33 (Heiko, 2012). Ideas with a mean rating less than 4.0 were eliminated. This ensured that it was panel members who made the

decisions and not the researchers, thus reducing researcher bias (Uhl, 1983). These findings informed policy-making and curriculum development for STEM education.

Good practices of STEM education at school level and education system level and measures that were conducive to the performance expectations were identified in Round 1 Delphi study. Extent of agreement on these aspects was sought in Round 2 and re-rated in Round 3 (Research Objective 3). Similar was performed for proposed policy options that supported students to attain performance expectations (Research Objective 4). These findings generated an initial set of policy options and suggested measures that informed governmental policies for promoting STEM education in Hong Kong.

While a Delphi study design yielded a valuable source of information, it was important to acknowledge its limitations. First, despite the substantive and thought-provoking ideas generated from the panel members, they might not have been exhaustive nor all-inclusive. Second, panel members were often limited in their time in dedicating to the study. This might have lowered the response rate and reduced their capacity for an in-depth consideration of all dimensions under investigation. It was important to maintain close contact with panelists in a Delphi study. Throughout the study, numerous phone calls, email and text messages were received and sent. This also helped achieve high response rates. For each round of the Delphi study, one week after sending out the questionnaire, each member was contacted to ensure that they had received our email and to prompt their return of completed questionnaire. This was followed up on a bi-weekly basis until all responses were received.

Results

Table 1 presents the performance expectation framework for STEM education among primary and secondary school students in Hong Kong. In this table, we list 7 major Key Performance Indices (KPIs). Each KPIs has a definition and a list of Key Components. Each Key Component has a justification or rationale based on the participants responses. We also rated the advance level of each Key Components based on a 3-level system (Basic = STEM for All, Intermediate= STEM for Some, and Advanced = STEM for the Gifted). One X indicate that this Key Component is somewhat expected for the respective level, XX indicate it was much expected, XXX indicate it was strongly expected, and no-X means not expected. We also attached a table including very detailed rubric for each Key Components under each KPI in the appendix excel file.

KPI	Definition	Key Components	Justification/Rationale	Basic	intermediate	advanced
Knowledge Integration in Real-World Application	The ability to apply theoretical knowledge to practical situations in various real-world contexts.	- Activate and integrate disciplinary concepts in real-world contexts and phenomena.	Fosters a deeper understanding of STEAM principles by applying them to tangible problems, thus demonstrating relevance and enhancing retention.	X	XX	XX
		- Synthesize knowledge across STEAM disciplines to develop solutions for community and sustainability challenges.	Encourages interdisciplinary thinking, which is crucial for solving complex issues that require a holistic view and diverse approaches.		X	XX
		- Engage in project-based learning that addresses authentic, open-ended problems.	Offers hands-on opportunities for students to apply their knowledge and skills to real-world challenges, fostering a deeper understanding of the problem-solving process and the impact of their solutions.		X	xx
		- Apply systems thinking, considering multiple factors and stakeholders when analyzing real-world issues.	Develops the ability to evaluate the interconnectedness of systems, which is essential for understanding the impact of solutions in a broader context.	X	X	XX
		- Cultivate an awareness of STEAM ideas, principles, and opportunities in daily life.	Builds a bridge between academic learning and everyday experiences, making STEAM more accessible and relevant to students' lives.	X	XX	XX
Communication & Expression	The capacity to convey ideas and information effectively through various forms of expression across different media.	- Clearly communicate complex STEAM ideas through interdisciplinary approaches and multimedia.	Enhances students' ability to convey technical information effectively, which is key to collaboration and innovation in professional and public domains.		X	XX
		- Engage in simple discussions about STEAM topics with peers and teachers.	Encourages students to articulate their understanding of STEAM concepts, promoting active learning and fostering a sense of community in the classroom.	xxx	xxx	xxx
		- Employ artistic and cultural expression and storytelling (narrative) techniques to convey STEAM-related concepts and innovations.	Leverages creativity to make STEAM subjects more engaging and relatable, boosting interest and comprehension.	X	XX	XX

		- Participate in cross-disciplinary discussions and debates on STEAM-related issues.	Encourages critical thinking and the articulation of well-reasoned arguments, while also promoting active listening and respect for diverse perspectives.	x	xx	xxx
		- Integrate arts into STEAM projects to enhance creativity and problem-solving in scientific and technological processes.	Encourages innovative thinking by blending analytical and creative skills, which can lead to more holistic and innovative outcomes.	X	XX	XX
		- Utilize visual thinking and design aesthetics to effectively present and discuss STEAM information.	Improves students' ability to visualize and design solutions, which is essential in fields where the presentation of data and concepts needs to be both informative and appealing.		X	XX
Design Thinking & Problem-Solving	A methodology that provides a project-based approach to solving problems with a focus on understanding multiple factors and perspectives.	- Apply design thinking methods to address challenges from ideation to evaluation.	Promotes a structured approach to innovation that is iterative and user-centric, mirroring the processes used in professional STEAM fields.	X	XX	XX
		- Engage in brainstorming sessions to generate ideas for solving STEAM-related problems.	Encourages creative thinking and collaboration, helping students develop essential skills for problem-solving in various contexts.	xxx	xxx	xxx
		- Identify and articulate problems before attempting to solve them.	Ensures focus on the right issues by clearly defining problems, which is a foundational step in developing effective solutions.	X	XX	XX
		- Engage in hands-on exploration and minds-on reflection in problem-solving (engineering).	Supports experiential learning, which can lead to deeper understanding and retention of concepts through active engagement.	X	XX	XX
		- Innovate and employ critical thinking by synthesizing and debating various perspectives.	Encourages the consideration of multiple viewpoints, fostering a comprehensive understanding of issues and promoting creativity in problem-solving.		X	XX
		- Empathize with people's and societal needs when designing STEAM solutions.	Instills a sense of social responsibility and the importance of user experience in the design process, reflecting the human-centered nature of many STEAM applications.	X	XX	XX

		- Encourage entrepreneurial thinking to create solutions and ventures that bridge STEAM with societal needs.	Prepares students for the modern workforce, where the ability to innovate and turn ideas into viable products or services is highly valued.		X	XX
Personal Development & Mindsets	The growth of personal attributes and mindsets necessary for continuous learning and adapting in a multidisciplinary field.	- Promote self-directed learning to acquire new knowledge and skills necessary for multidisciplinary integration.	Empowers students to take charge of their learning journey, which is crucial for lifelong learning and adaptability in a rapidly changing STEAM landscape.	X	XX	XX
		- Embrace a lifelong learning mindset, actively seeking out new knowledge and skills to stay at the forefront of rapidly evolving STEAM fields.	Encourages students to view their education as an ongoing process, continuously updating their knowledge and adapting to new developments in their fields.			xxx
		- Foster a growth mindset, learning from challenges and failures to improve understanding.	Develops resilience and a positive attitude towards learning, which can lead to greater academic perseverance and success.	X	XX	XX
		- Strengthen collaboration and conflict resolution skills within STEAM team projects and discussions.	Builds teamwork and communication skills, essential for successful collaboration in diverse and interdisciplinary STEAM environments.	X	XX	XX
		- Build resilience and encourage risk-taking in the pursuit of STEAM discoveries and technological advancements.	Prepares students to navigate the uncertainties of research and innovation, fostering a culture of exploration and discovery.		X	XX
		- Develop a strong STEAM identity and explore diverse STEAM career paths and opportunities.	Enhances student engagement and retention in STEAM fields by helping them envision a future for themselves in these areas and understand the range of career possibilities.		X	XX
Literacies & Competencies	The mastery of essential skills and abilities required to engage with and adapt to various STEAM fields.	- Enhance information, digital, and media literacy within the context of STEAM fields.	Prepares students for the digital age, where information literacy is key to navigating and making sense of the vast amounts of data encountered in STEAM fields.	X	XX	XX
		- Develop basic computer skills to collect and disseminate information.	Equips students with foundational digital skills necessary for engaging with STEAM content and resources in the modern world.	xxx	xxx	xxx
		- Acquire and apply mathematical reasoning skills to solve STEAM-related problems.	Strengthens quantitative literacy, enabling students to interpret and manipulate data, recognize patterns, and make data-driven decisions in various STEAM contexts.	X	XX	XXX
		- proficiency in using relevant technologies and tools to support STEAM learning and project development.	Equips students with the necessary technical skills to effectively engage with and contribute to STEAM fields, enhancing their ability to apply knowledge in practical settings.		XX	XXX
		- Master computational thinking skills to analyze problems and identify algorithmic abstractions in STEAM projects or everyday life (technology).	Builds a foundation for problem-solving in the digital world, facilitating the understanding of complex systems through the lens of computational methods and algorithmic thinking.		X	XX

		- Develop future literacy to understand how STEAM can influence and drive advancements in society and various professions.	Ensures students are prepared for future technological shifts and can anticipate changes in their fields, allowing them to remain relevant and proactive in their careers.		X	XX
		- Engage in scientific inquiry to explore and understand phenomena in the natural, social, and engineered worlds.	Promotes critical thinking and a methodical approach to understanding the world, which is fundamental to scientific literacy and informed decision-making.	X	XX	XX
Cultural & Social Competency	The ability to understand, appreciate, and engage with diverse cultural and social contexts, particularly in Hong Kong and China, within the context of STEAM education and projects.	- Integrate local Hong Kong culture and broader Chinese cultural elements into STEAM projects and learning experiences.	Enhances students' understanding and appreciation of their cultural heritage, fostering a sense of identity and belonging while engaging in STEAM education.	X	XX	XX
		- Develop STEAM projects that promote cultural appreciation, preservation, and integration.	Encourages students to view STEAM through a cultural lens, recognizing the potential for STEAM to contribute to cultural understanding and social cohesion.		X	XX
		- Explore the cultural and social implications of STEAM innovations and their impact on local and global communities.	Promotes a holistic understanding of the role of STEAM in society, encouraging students to consider the cultural and social dimensions of their work.	X	XX	XX
		- Explore the unique cultural and historical resources of Hong Kong and China to inspire STEAM projects and innovations.	Encourages students to draw inspiration from their rich cultural heritage, promoting the integration of traditional knowledge and practices with modern STEAM approaches.		xx	xx
		- Engage in culturally responsive and ethical practices when conducting STEAM research and developing solutions.	Ensures that students are sensitive to cultural differences and ethical considerations, promoting responsible and inclusive approaches to STEAM education and practice.		x	xx
		- Foster cross-cultural collaboration and understanding through STEAM projects and partnerships.	Prepares students for an increasingly globalized world, where the ability to work effectively across cultural boundaries is a key skill in STEAM fields.		X	XX
Making Use of Local Resources	The effective utilization of available geographical, natural, and social resources in the local context to enhance STEAM learning and project outcomes.	- Identify and explore the natural and built environments in the local community.	Encourages students to observe and engage with their surroundings, fostering a sense of place and connection to the local environment as a foundation for STEAM learning.	xxx	xxx	xxx
		- Incorporate local geographical features (e.g., ocean, weather, topography) into STEAM projects and learning experiences.	Contextualizes STEAM learning within the local environment, making it more tangible and relevant to students' everyday experiences.	X	XX	XX
		- Engage with local industries, organizations, and experts to gain insights and resources for STEAM projects.	Provides students with access to real-world expertise and resources, enhancing the authenticity and impact of their STEAM learning experiences.		X	XX

		- Analyze local phenomena (e.g., traffic, city development, environmental protection) using STEAM principles and methodologies.	Encourages students to apply STEAM thinking to local issues, fostering a sense of civic engagement and responsibility.		X	XX
		- Utilize local data and information sources to inform STEAM projects and decision-making processes.	Promotes data-driven decision-making and problem-solving, while also highlighting the relevance of local resources in STEAM fields.	X	XX	XX
		- Develop and implement STEAM solutions that optimize the use of local resources and promote sustainable development.	Challenges gifted students to think critically about resource allocation and develop innovative solutions that maximize the potential of local assets while minimizing environmental impact.		x	xx

Table 1 performance expectation framework for STEM education among primary and secondary school students in Hong Kong.

Policy Recommendations

This policy recommendation aims to enhance K-12 STEM education in Hong Kong by addressing key challenges and leveraging best practices identified by STEM education experts and stakeholders. The proposed strategies focus on curriculum development, teacher professional development, resource allocation, and community engagement to ensure that students acquire the necessary knowledge, skills, and mindsets to thrive in a rapidly evolving STEM landscape.

1. Curriculum Enhancement:
   a. Emphasize the integration of STEM disciplines through project-based learning and real-world problem-solving, ensuring students synthesize knowledge across STEM subjects.
   b. Incorporate cultural and social competencies into STEM projects to promote cultural appreciation and understanding, fostering students' sense of identity and belonging.
   c. Develop a framework that aligns with students' developmental stages and fosters curiosity, creativity, and critical thinking, encouraging them to explore and understand phenomena in the natural, social, and engineered worlds.
   d. Integrate an interdisciplinary approach in project-based learning that leverages the Framework for real-world problem-solving, ensuring students apply theoretical knowledge to practical situations in various contexts.
2. Teacher Professional Development:
   a. Establish a STEM professional teacher training platform to provide ongoing support and resources for in-service teachers, equipping them with the necessary skills to effectively implement the Framework and integrate STEM subjects in their teaching practices.
   b. Collaborate with STEM education associations (e.g., AiTLE, HKACE) to offer workshops, seminars, and mentorship programs, fostering a collaborative learning environment among teachers to share best practices, resources, and experiences in STEM education.
   c. Encourage teachers to engage in action research and share best practices within the STEM education community, promoting innovative pedagogical approaches that promote hands-on exploration, minds-on reflection, and creative problem-solving.

d. Provide targeted training for teachers to guide students in developing personal attributes and mindsets crucial for lifelong learning and adaptability in rapidly evolving STEM fields.

e. Encourage pre-service teachers to engage in research and innovation projects related to STEAM education to foster a mindset of continuous learning and improvement.

3. Assessment and Evaluation:

a. Develop a comprehensive assessment framework aligned with the Framework to evaluate students' performance and progress in STEM education.

b. Incorporate formative and summative assessments that focus on assessing students' ability to apply knowledge, think critically, and solve real-world problems.

c. Provide regular feedback to students and parents on their progress and areas for improvement in STEM learning.

d. Utilize assessment data to inform curriculum development, teaching practices, and resource allocation for STEM education.

4. Collaboration and Partnerships:

a. Foster partnerships between schools, universities, industries, and community organizations to provide students with authentic learning experiences and exposure to STEM careers.

b. Encourage collaboration among teachers, researchers, and STEM professionals to develop innovative teaching strategies and resources.

c. Promote cross-cultural collaboration and understanding through STEM projects and partnerships with schools and organizations in mainland China and internationally.

d. Engage with local industries, organizations, and experts to gain insights and resources for STEM projects and to contextualize learning within the local environment.

5. Resource Allocation and Infrastructure:

a. Provide adequate funding and resources to support the implementation of the Framework and the development of STEM education programs in schools.

b. Invest in modern infrastructure, including well-equipped laboratories, makerspaces, and technology-enhanced classrooms, to facilitate hands-on learning and experimentation.

c. Ensure equitable access to STEM education resources and opportunities for all students, regardless of their socioeconomic background or geographic location.

d. Utilize local data and information sources to inform resource allocation and decision-making processes in STEM education.

6. Public Awareness and Engagement:

a. Launch public awareness campaigns to promote the importance and relevance of STEM education for Hong Kong's future development and competitiveness.

b. Engage parents and the wider community in STEM education initiatives through workshops, exhibitions, and outreach programs.

c. Celebrate and showcase student achievements in STEM fields to inspire and motivate more students to pursue STEM careers.

d. Foster a culture of innovation, creativity, and entrepreneurship in STEM education to drive advancements in society and various professions.

Applying these policy recommendations to specific KPIs, we summarized the best practices in supporting students and recommendation for policies to support teachers, categorized by specific KPIs.

Specific Policy Recommendations to Support Students and Teachers by Specific KPIs	
Best Practices in Supporting Students	**Recommended Policies to Support Teachers**
Knowledge Integration in Real-World Application:	
a. Provide students with opportunities to engage in project-based learning that integrates knowledge from various STEAM disciplines to solve real-world problems.	a. Provide professional development opportunities for teachers to design and implement project-based learning experiences that integrate real-world applications.
b. Encourage students to participate in internships, apprenticeships, and mentorship programs with local industries and organizations to gain practical experience and insights.	b. Establish partnerships with industries and community organizations to offer teachers insights into real-world challenges and opportunities for collaboration.
c. Develop a platform for students to showcase their real-world STEAM projects and receive feedback from experts and the community.	c. Develop assessment guidelines and rubrics that evaluate students' ability to apply knowledge in real-world contexts.
Communication & Expression:	
a. Offer workshops and courses that help students develop effective communication skills, including public speaking, writing, and multimedia presentation.	a. Train teachers in effective communication strategies and the use of multimedia tools to facilitate students' expression of STEAM ideas.

b. Encourage students to participate in STEAM-related discussions, debates, and conferences to express their ideas and learn from others.	b. Encourage teachers to create a classroom environment that fosters open discussions and debates on STEAM topics.
c. Provide opportunities for students to collaborate with peers from diverse backgrounds and disciplines to enhance their communication and teamwork skills.	c. Provide resources and support for teachers to integrate arts into STEAM projects and assess students' creative problem-solving skills.
Design Thinking & Problem-Solving:	
a. Integrate design thinking principles and methodologies into the STEAM curriculum, providing students with a structured approach to problem-solving.	a. Offer professional development workshops on design thinking methodologies and their application in STEAM education.
b. Encourage students to participate in design challenges, hackathons, and innovation competitions that foster creativity and critical thinking.	b. Encourage teachers to engage students in problem-solving activities that involve synthesizing and debating various perspectives.
c. Provide resources and support for students to develop and prototype their ideas, such as access to makerspaces, 3D printers, and other tools.	c. Develop assessment tools that evaluate students' empathy, innovation, and critical thinking skills in problem-solving contexts.
Personal Development & Mindsets:	
a. Offer workshops and programs that help students develop self-awareness, self-motivation, and resilience in the face of challenges.	a. Provide training for teachers to foster self-directed learning and a growth mindset among students.

b. Encourage students to set personal learning goals and reflect on their progress regularly, fostering a growth mindset.	b. Encourage teachers to incorporate self-reflection and goal-setting activities in their lessons to support students' personal development.
c. Provide mentorship and guidance to help students explore their interests, strengths, and potential career paths in STEAM fields.	c. Develop assessment strategies that recognize and value students' effort, perseverance, and learning from challenges and failures.
Literacies & Competencies:	
a. Integrate information, digital, and media literacy skills into the STEAM curriculum, ensuring that students can effectively navigate and evaluate information in the digital age.	a. Offer professional development opportunities for teachers to enhance their own information, digital, and media literacy skills.
b. Provide students with access to relevant technologies and tools, such as computers, software, and scientific equipment, to develop their technical competencies.	b. Provide resources and support for teachers to integrate technology effectively into their teaching practices.
c. Offer workshops and courses that help students develop critical thinking, problem-solving, and decision-making skills in the context of STEAM subjects.	c. Develop assessment criteria that evaluate students' proficiency in using appropriate tools and technologies for learning and problem-solving.
Cultural Awareness & Perspective-Taking:	
a. Encourage students to engage in STEAM projects that explore and celebrate local Hong Kong culture and heritage, fostering a sense of identity and belonging.	a. Train teachers to incorporate culturally responsive teaching practices and integrate local and Chinese cultural elements into STEAM projects.

b. Provide opportunities for students to collaborate with peers from different cultural backgrounds, both locally and internationally, to develop cross-cultural understanding and perspective-taking skills.	b. Encourage teachers to facilitate cross-cultural collaboration and understanding through STEAM projects and partnerships.
c. Organize cultural events, exhibitions, and exchanges that showcase the diversity of STEAM practices and innovations across different cultures.	c. Develop assessment tools that evaluate students' cultural awareness, empathy, and social responsibility in STEAM contexts.
Making Use of Local Resources:	
a. Develop a student-friendly database of local STEAM resources, to encourage exploration and engagement.	a. Provide professional development opportunities for teachers to identify, evaluate, and integrate local resources into their teaching practices effectively.
b. Encourage students to seek mentorship and advise from local organizations and experts to experience authentic STEAM learning experience.	b. Encourage teachers to collaborate with local organizations and experts to design authentic learning experiences that leverage community resources.
c. Provide funding and support for students to participate in field trips, site visits, and community-based STEAM projects that leverage local resources.	c. Develop assessment strategies that evaluate students' ability to identify, access, and utilize local resources in their STEAM learning and projects.
d. Encourage students to identify and address community-specific challenges through STEAM projects, fostering a sense of social responsibility and connection to their local environment.	d. Allocate funding and support for teachers to organize field trips and site visits to local STEAM-related facilities and organizations.
e. Celebrate and showcase student projects that demonstrate effective use of local resources, inspiring others to follow their example.	e. Celebrate and showcase teacher-led initiatives that successfully integrate local resources into STEAM education.

The integration of these policy recommendations will fortify Hong Kong's K-12 STEM education system, creating a robust, inclusive framework that prepares students for the complexities of the 21st century. A comprehensive approach that includes interdisciplinary learning, cultural competencies, and aligns with students' developmental stages is central to this policy. This strategy, coupled with professional development opportunities fostered through collaborations with STEM education associations, will not only make STEM education in Hong Kong more effective but also more engaging.

Conclusion

This study has established a comprehensive performance expectation framework for STEM education among primary and secondary school students in Hong Kong. The framework identifies 7 Key Performance Indices (KPIs) that are crucial for developing STEM literacy: Knowledge Integration in Real-World Application, Communication & Expression, Design Thinking & Problem-Solving, Personal Development & Mindsets, Literacies & Competencies, Cultural & Social Competency, and Making Use of Local Resources. Each KPI is further broken down into Key Components with justifications and expected proficiency levels across different stages of learning. This detailed

framework provides a clear and structured approach to understanding and assessing STEM literacy development in students.

The Delphi study, involving 32 experts from various stakeholder groups, including practitioners from primary and secondary schools, university academics, and representatives from external bodies with an interest in STEM education, has generated valuable insights into the components constituting STEM literacy, associated performance expectations, good practices of STEM education, and priorities for policy options. The findings suggest that an effective STEM education should emphasize the integration of STEM disciplines through project-based learning, incorporate cultural and social competencies, foster curiosity and critical thinking, and leverage local resources for real-world problem-solving. These insights highlight the importance of a holistic and contextualized approach to STEM education that goes beyond the mere acquisition of technical knowledge and skills.

Based on these findings, the study proposes a set of policy recommendations to enhance K-12 STEM education in Hong Kong. These recommendations focus on four key areas: curriculum enhancement, teacher professional development, resource allocation, and community engagement. In terms of curriculum enhancement, the study suggests incorporating more interdisciplinary and project-based learning opportunities, as well as integrating cultural and social elements into STEM education. Teacher professional development recommendations include providing targeted training on STEM pedagogy, fostering collaboration among teachers from different disciplines, and encouraging teachers to engage in ongoing learning and research in STEM fields. Resource allocation recommendations emphasize the need for adequate funding, infrastructure, and materials to support high-quality STEM education, as well as the importance of leveraging community resources and partnerships. Finally, community engagement recommendations highlight the value of involving parents, local industries, and other stakeholders in STEM education initiatives to create a supportive ecosystem for student learning and development.

By implementing these strategies, Hong Kong can nurture a new generation of STEM-literate students who possess the knowledge, skills, and mindsets necessary to thrive in a rapidly evolving STEM landscape and contribute to the city's transition to a knowledge-based economy. The proposed framework and recommendations not only address the technical aspects of STEM education but also emphasize the development of critical thinking, creativity, communication, and collaboration skills, which are essential for success in the 21st century.

Public Dissemination

1. The Australasian Science Education Research Association (ASERA) 55 Conference
Title: Positioning Empathy in STEM education reform: insights from a diverse cohort of Hong Kong STEM education leaders (Paper persentation)

2. CITERS (Community Engagement in Learning)
Title: Discuss the impact of applying Attitude, Skills and Knowledge (ASK) model to on students' learning in STEM Education

Abstract
The evaluation of STEM Education has rarely evaluated students' learning performance, the perspective of attitude, skills and knowledge increase the complexity of learning processes of STEM activities. This study aims to collect the views of in-services teachers and ask their views about how to attain the performance expectation among primary and secondary school students.

With the advancement of information technology and the rapid accumulation and growth of knowledge, we are in an era of very fierce competition. Only through continuous learning can we face the ever-changing challenges. This study aims to establish a performance expectations framework that outlines pathways for STEM literacy development. This study conducted a Delphi study to find out the common opinions of various experts (the target number is 32 people), including in-service teachers, university professors, etc. and aims to collect their views include: 1) What constitutes STEM literacy and related performance assessments; 2) Models of STEM education; 3) Different STEM education policy options. By inviting various stakeholders to participate, their views about the performance expectation framework among the implementation of STEM education will become more effective for the teachers to evaluate the students' performance. The purpose of this study is threefold, including: 1) establishing a framework of performance expectations for STEM education to provide a baseline for the government to promote STEM education; 2) identifying models of STEM education to make education policies more effective and strengthened; 3) Provide more evidence for the Education Bureau to develop STEM education courses and teacher training projects. The findings of the project are that 1. Integrating STEAM education into natural fields and scientific and technological topics has improved the learning effectiveness of students. In addition, Integrating STEAM education into natural fields and scientific and technological topics can improve the learning motivation of students. Furthermore, the application of digital media can minimize the learning gaps among students.

Therefore, learning has become an important task, and how to improve learning effectiveness is an important issue in education. In recent years, as the application of digital learning is common in the education field, it has driven the development and craze of digital learning-integrated courses. The integration of digital learning into courses to assist teachers in teaching and students in learning has become an irresistible trend and is also a new era challenge that teachers must face. The use of online information technology to integrate courses can effectively arouse students' learning motivation, while also providing teachers with the diversification of teaching methods and improving teaching effectiveness. In fact, digital learning is not limited by time and space when learning. As long as students have the motivation and network equipment, then they can learn anytime. Through the integrated courses of digital learning, students can change the teacher-centered teaching method in the past and train students from passive learners to active self-directed learners. When students go to school, in addition to the development of personality education, the most important goal is to cultivate and improve knowledge and skills so that they can be competitive when they are employed in the future and can smoothly integrate into society. In fact, self-directed learning enables students to widen their motivation to access various resources as well as provide a platform for cross-regional teacher professional learning.

Therefore, how teachers teach effectively and how students learn effectively is important. Furthermore, learning is the process of acquiring knowledge or changing behavior as a result of experience. In order for students to learn effectively, they must be motivated to learn, develop good learning behaviors, and formulate effective learning strategies to achieve their goals. In the past, there were few studies on the relationship between learning motivation and learning behavior. This study integrated the views of in-service teachers, which should be helpful in improving learning motivation. Therefore, a structural equation model was constructed to explore the impact of learning motivation and learning behavior on learning effectiveness and influence so as to serve as a practical reference. In recent years, science and technology have developed rapidly, and thinking in a single discipline or knowledge field is no longer sufficient to cope with various complex problems and situations that arise in a rapidly changing society. The government has actively promoted STEM (Science, Technology, Engineering and Mathematics) education in primary and secondary schools to cultivate relevant talents, which will help increase the STEM employment population and enhance competitiveness in the future. STEM literacy broadly refers to the integration and application of relevant knowledge and skills. Although different institutions have invested many resources in STEM education, the expectations and understanding of students' STEM literacy remains very limited, which will hinder policymakers, curriculum developers, educators and teachers from evaluating the effectiveness of STEM education.

According to Ba, et al., 2014 “appropriate assessment and feedback are important for cultivating students' abilities of collaborative problem-solving and critical thinking in online inquiry-based discussions.” Therefore, this study aims to establish a performance expectations framework that outlines pathways for STEM literacy development. This study conducted a Delphi study to find out the common opinions of various experts (the target number is 32 people), including in-service teachers, university professors, etc. and aims to collect their views include: 1) What constitutes STEM literacy and related performance assessments; 2) Models of STEM education; 3) Different STEM education policy options. By inviting various stakeholders to participate, their views about the performance expectation framework among the implementation of STEM education will become more effective for the teachers to evaluate the students' performance. The purpose of this study is threefold, including: 1) establishing a framework of performance expectations for STEM education to provide a baseline for the government to promote STEM education; 2) identifying models of STEM education to make education policies more effective and strengthened; 3) Provide more evidence for the Education Bureau to develop STEM education courses and teacher training projects.

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Empowering Teachers to be Learning Designers: A Transformative Approach to Teacher Professional Learning

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Universities are undergoing significant changes due to technological advancements, increased demand for education access, diverse student populations, financial constraints, and competition from alternative educational providers (Goodyear, 2015; Bakhov et al., 2021). This context has led to a rise in teaching innovation and the adoption of technology-enhanced learning in higher education. This shift involves creating personalized, technology-enriched learning experience to equip students with the necessary knowledge, skills, and competencies to succeed in the 21st century. In response to this, there is a growing call for teachers to re-conceptualize their role as "learning designers" and create effective learning experiences and learning environment (Laurillard, 2013).

Despite this call, empirical studies reveal that higher education teachers' learning design practices are often iterative and non-systematic, lacking clear pedagogical underpinnings (Bennett et al., 2022). The transition to learning designers and the implementation of pedagogical innovations pose significant challenges to university teachers, especially those without formal pedagogical training or sufficient professional development opportunities. These challenges are compounded by fears of content loss, loss of control, and failure, further hindering attempts at pedagogical change.

In light of these challenges, there is a growing need for a transformative model of teacher professional learning that enables in-service higher education teachers to transition to student-centered learning design (Agostinho et al., 2022).

This paper aims to propose a transformative teacher professional learning model aimed at facilitating teachers' transition from content-driven instruction to student-centered learning in educational settings and empowering educators to reconceptualize their role as learning designers. It will investigate the changes that occur in teachers' understanding of learning design and design practices. The paper will also discuss the inquiry process and explore the challenges, successes, and lessons learned during their engagement with the transformative model.

The study is grounded in the Learning Design Triangle (LDT) framework (Law & Liang, 2020), The LDT framework comprises three central elements: learning outcomes, disciplinary practices, and pedagogical approaches. The seven 7-step procedural works as conceptual scaffold to guide guides the multi-level decision-making process for transforming abstract pedagogical thinking into concrete learning contexts. The LDT mandates a structured, systematic approach to course design, starting with explicit learning outcomes, linking them to genuine disciplinary practices, choosing to fit pedagogical strategies, and mapping out a comprehensive educational journey for students.

As part of a broader design-based research project, this paper presents an intervention study that examines teachers' inquiry into their own learning design practices. Two guiding design principles shape the model: learner-centered collaborative inquiry of practice and iterative cycles of inquiry. These principles foster a culture of reflection, collaboration, and continuous improvement among educators.

Conducted at a mainland China university, the study involved six in-service teachers who had previously engaged in course redesign and demonstrated a desire to further enhance their teaching. Workshops were organized, transitioning to smaller design teams due to pandemic restrictions. Throughout this period, teachers engaged in collaborative inquiry cycles, sharing experiences, reflecting on practices, and co-constructing knowledge, with the aim of refining and improving their instructional strategies through planning, implementation, reflection, and adaptation. Data collection encompassed audio-recorded workshops, classroom observations, and reflective journals, with content analysis, thematic coding, and constant comparative analysis employed to identify patterns and themes related to the educators' pedagogical transformations.

Preliminary analysis reveals a significant shift from a content-centric to a student-centered methodology among participating educators. This transition is characterized by an evolving inquiry process, from understanding student-centered learning to visualizing student thinking and designing learning experiences prioritizing student engagement. The support of the LDT framework was instrumental in helping teachers reflect on their intuitive design models and adopt more systematic design processes.

This study contributes to the field by demonstrating the design and the impact of a transformative professional learning model in facilitating the shift towards student-centered learning among higher education teachers. By leveraging collaborative inquiry and iterative reflection cycles, educators can significantly improve their instructional practices, thereby enhancing student learning outcomes in higher education. The findings underscore the importance of structured, continuous professional development that aligns with teachers' authentic needs and challenges, offering valuable insights for institutions aiming to foster pedagogical innovation and improve teaching quality.

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Supporting Multiple Representations of Linear Relationships through Block-based Programming

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This paper introduces an ongoing project investigating the affordances of a blocks-based programming tool, Scratch, in mathematics education. Nowadays, educators and researchers have widely highlighted the integration of digital technologies in mathematics education. Researchers have focused on developing affordable digital learning tools to support mathematics learning. Scratch is one of the child-friendly programming tools that enables access to both computational and mathematical ideas. Due to the persistent calls for student-centred instruction with technology, research is needed to support teachers in understanding student thinking in technology-enhanced environment. In this study, we set out to characterise students' mathematical thinking processes as they engage in Scratch programming activities and identify the affordances of Scratch as well as the challenges it poses to students, hoping to generate research knowledge of student thinking to inform both research and teacher education.

Students' understanding of mathematical concepts in programming can be characterized by their representational activities of mathematical and computational ideas, which can be described through a multiple representational model, the Lesh Translation Model (LTM). Mathematical concepts can be described by different types of representations and transferred from one representation to another. Understanding a mathematical concept or solving complex problems requires flexibility in moving across multiple representations. In a programming-enhanced mathematical environment, combining the critical aspects of mathematics-related programming activities with mathematical representations can help unpack students' mathematical thinking. The LTM model provides an analytical tool to interpret and characterise students' mathematical thinking across multiple representations, which contains five types of representations: (1) representation through real-life contexts, (2) visual representation or pictures, (3) written symbols, (4) verbal symbols, and (5) manipulatives. In this study, we adapted the LTM model to characterise students' thinking sensitive to the programming-enhanced mathematical environment. Specifically, we defined the Scratch coding blocks as one form of *manipulatives* representation and the programming outcomes as one form of *pictures* representation. Considering that function is one of the key mathematical concepts in secondary curriculum, we designed tasks about linear relationships to see how students transform within and translate among mathematical representations and develop their understanding about linear relationship in a programming-enhanced environment.

To line up the research purposes, we conducted one-on-one semi-structured task-based interviews with five junior secondary students in Mainland China as they explored the concept of linear relationships in Scratch. Students were asked to work on the tasks and think aloud during the interviews. Meanwhile, the interviewer asked prompting questions to elicit, clarify, and support the students' thinking. The task design included components both in a paper-and-pencil environment and a programming-enhanced

environment. Focusing on the concept of linear function, our task included two subtasks: Part I and Part II. In Part I, students were asked to watch an animation about tiling designed by Scratch and discuss the relationship between the tiling areas and amounts of tiles. For Part II, students were asked to produce coordinate graphs of the relationship with different methods. We encouraged students to draw the graphs in different ways and talk about the properties of the graphs. The data sources included the video recordings of all the interview sessions from two camera angles. The computer screen is also screen-recorded to capture all student work on Scratch. We conducted interactive coding analysis with interviewing videos across cases based on the adapted LTM model to capture the representations students used and the translation pattern among different representations.

We identified empirical evidence of students translating between different representations of mathematical concepts when working with Scratch. We focused on two themes characterising the students' representational activities associated with linear functions, including their representations of the amounts of change and representations of slope. Accordingly, we described the students' thinking processes by characterising representational fluency through the LTM model. We support the idea that Scratch offers an opportunity to explore the properties of mathematical objects which are not commonly discussed in mathematics classrooms. However, evidence also shows students struggled to translate from manipulatives representation to pictures representation in Scratch. The findings imply the importance of proper use of Scratch in mathematics education, especially attending to mismatches between mathematical and computational thinking in the Scratch programming environments.

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Using Soybean as A Theme to Actualize School Entrepreneurial Initiative in The Community

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Objective

To actualize school entrepreneurial initiative in the community via STEAM education.

Conceptual perspectives

Our School has developed our 3 year plan in STEAM education development.

During Year 1, a Theme-based Learning across Curriculum360, namely 'STEM Soybean 1.0' is figured out, during which a high degree of teacher collaboration of multi-disciplines was made. With curriculum mapping, the curriculum content includes soybean farming, e-commerce of personalized soybean handmade soap stamped on with 3D printing - brand logo, soybean painting, tofu pudding making, self-directed learning about soybean and life education arise from soybean seeds.

During Year 2, the element of 'Arts' is added into STEM to make up 'STEAM Soybean 2.0', which further unleash student potential in innovation and apply design thinking to solve 2 authentic missions given by a traditional soybean shop named Kung Wo Beancurd Factory which is located in the nearby community. Kung Wo Beancurd Factory is a significant icon in the community to Hong Kongers and tourists. It is really an interesting place to study STEAM. In coincidence, Kung Wo Beancurd Factory is going to celebrate its 65th anniversary. In the celebration of this important milestone, our students are invited to commit 2 authentic missions, One is to make soybean handmade soap bar with a creative design for the 65th anniversary soap stamp logo for loyal customers, as well as to design a crew T shirt for the working colleagues.

During Year 3, the school-based STEAM professional learning community is aspired to move STEAM Soybean 2.0 forward to STEAM+ Soybean 3.0 for emphasizing the entrepreneurial initiative, to foster synergy within the community network and to lead students into mainland China, learning more about the motherland, especially opportunity brought about by the development of the Greater Bay Area. Community network is not only restricted to that in Hong Kong or Mainland China, it may even connect to other areas in the World, stepping up the School STEAM development to STEAM+ Soybean 4.0.

Methodology

Different methodologies can be applied for nurturing STEAM literacy and showcase the students' learning outcome:

1. 'Hand on' and 'Mind on' activities, creating something from none can showcase students' capacity in terms of the integration and application of the knowledge from different disciplines.
2. The use of Design Thinking to solve real-life problems, and making informed decisions can showcase students' generic skills.
3. The use of web application for recording students' reflection can showcase

Students' positive thinking and values
4. The use of Scientific Investigative Method aims to scaffold students' Science knowledge in all disciplines.

Results:
STEM Soybean 1.0 comprises of enriched learning and teaching activities for students to integrate and apply cross multi-disciplinary knowledge and skills in problem solving to create solutions and make products with hands-on and minds-on activities.

STEAM Soybean 2.0 successfully mobilize students to understand the community and support community needs, enhance caring culture & atmosphere in the community and build a community network.

STEAM+ Soybean 3.0 successfully mobilize students to successfully build a community network with entrepreneurial initiatives. Students are take the initiative to understand deeply the Mainland China, our home country, especially the STEAM, industrial and economic development in the Greater Bay Area.

Academic significance of the work
The 3 year plan in STEAM education development envisages the school vision and mission in line with the Organization for Economic Co-operation and Development (OECD) Learning Compass 2030, which aims to inspire students, the next generation, to get ready for the local and global changes. Not only solely based on the academics, students should be equipped with generic skills, required multi-disciplinary knowledge and skills, positive values and attitudes and self-directed and life-long learning, which are aligned with the Updated Seven Learning Goals of Secondary Education.

Not only students gain benefits, teachers do gain. A School-based STEAM Professional Learning Community is established. The members of this Community are teachers from different disciplines / academic subjects. Members are encouraged to participate in variety of professional development programmes in tertiary institutions to enhance the professional capacity in implementing STEAM education.

With the keen support from tertiary institutions, teachers are building up their professional capacity for innovative STEAM development through sharing of sustainable and scalable pedagogical and assessment innovations. Open Classrooms are always conducted to provide good opportunities for teachers to exchange classroom management, teaching pedagogy and practice, in turn to actualize the collective measures and tactics in future lessons. With the partnership with STEAM professional bodies, teachers' entrepreneurial behavior is always developed. Teachers are more knowledgeable and experienced to actualize new initiatives, including advocating innovation, seeking resources from community, mitigating risks, recognizing opportunities and organizing development and change in schools.

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Students' Perception about the Effects of Digital Multimodal Composing on L2 Writing Development: A Study of EFL Postgraduate Students

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Despite the growing research interest in digital multimodal composing (DMC) in the education context, there were fewer studies attempting to explore postgraduate students' perception of DMC. This study aims to examine the perception of EFL students at the postgraduate level about how digital multimodal composing task used in class affects their L2 writing development. To achieve this objective, two research questions will be addressed. (1) How do EFL postgraduate students perceive in-class DMC tasks as an L2 writing practice? (2) What perceptions do EFL postgraduate students have regarding the effectiveness of DMC in enhancing L2 writing abilities?

Having a qualitative research design, this paper drew on in-depth interviews with 8 postgraduate students from the Linguistics Department of the University of Hong Kong as the main source of data collection. Thematic analysis was applied to deal with the interview data, which was coded in NVivo 12 by using open and axial coding techniques.

Analysis of the interview contents, with students' writing materials as supporting evidence, indicated that students perceive both advantages and disadvantages of DMC. DMC was perceived as an effective L2 writing task in developing tenable arguments and raising audience awareness, which was claimed by career-oriented students as useful writing skills. However, its inefficiency in preparing students to follow citation rules and write with coherence and cohesion was reflected by students with academic pursuits. Challenges that students have encountered in their DMC task has also been reported.

Findings of this study provide insights into postgraduate students' perception of DMC and its effectiveness in developing writing skills for occupational and academic purposes. This study will also help inform education practitioners to consider a more effective task that could meet the needs of postgraduate students in this digital age. The intention of this study to understand students' perception towards DMC is significant for discussing the development of digital literacies for future readiness.

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Digital Language Learning (DLL): A Personalized Online Platform for English Preposition Learning

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This project seeks to develop an online preposition learning platform to address the challenges faced by English as a second language (ESL) learners regarding their use of prepositions. Prepositions play a crucial role in language application by indicating the semantic relationships between elements in sentences. However, the polysemous nature of prepositions often lead to confusion and incorrect usage. Traditional language teaching resorts to rote learning strategy as they believe preposition meanings are arbitrary.

The proposed learning platform will serve two purposes: diagnosing problematic form-meaning mapping and providing personalised training. By analysing the errors learners committed when using prepositions in authentic contexts, the platform provides sufficient meaning-oriented training to facilitate learners' acquisition of the English preposition system.

Prior computational linguistic studies have focused mainly on prepositions in controlled texts (Xiao, Wang, Zhang, Tan, & Chen, 2018; Barak, Yang, Rank, & Shafto, 2020). The current study adopts an AI-assisted methodology for developing a framework for preposition error analysis in L2 narrative texts. A widely adopted AI grammar checker, Grammarly, has been found useful among post-secondary students for correcting grammar in their writing (Fitriana & Nurazni, 2022; Rahma Hakiki, 2021). Therefore, the project aims to bring practical implications on pedagogy by adopting Grammarly in error detection.

31 narrative essays produced by a class of Cantonese or Mandarin-speaking undergraduate students enrolled in a general writing course were collected for the analysis. The narrative essay was part of their summative assessments. Grammarly identified a total of 230 instances of preposition errors, with 5 excluded due to poor writing or typos. This study focused on the two mostly misused prepositions, "IN" and "AT", which comprised of 42.61% of the errors. The most frequent error type was substitution, followed by omission and addition. The preliminary analysis aligns with the literature where Chinese learners are found to have often confused the functions of the English prepositions *in*, *at*, and *on*. In Chinese, the lexical character zai4 (在) is used to indicate general location (Sinha, Thorseng, Hayashi, & Plunkett, 1994). Specificity is optional which explains why Chinese learners find the semantic distinctions between these three preposition forms challenging.

The findings on preposition error analysis confirms the pedagogical of Concept-Based Language Instruction (C-BLI) in facilitating learners' conceptual understanding of prepositions ((Masuda, Arnett & Labarca, 2015; Lantolf & Thorne, 2007). C-BLI enables learners to interact systematically with complex semantic intricacies of

prepositions with the aid of schematic diagrams (Tyler & Evans, 2003; Wong, Zhao & MacWhinney, 2018). The learning tasks will be structured based on the three stages proposed by Negueruela (2003):

a) **Materialisation stage:** Interactive lectures which introduce the concept of schematic diagrams and their use in visualising preposition meanings.
b) **Verbalisation stage:** Multiple-choice questions which require learners to recall preposition usage. The level of explicit hints and detailed explanations will gradually increase if a low accuracy of responses is detected.
c) **Internalisation stage:** A picture elicitation task which require learners to produce sentences using the targeted preposition based on a picture stimulus. A simple explanation will be given for incorrect responses.

By leveraging technology to provide personalized learning experiences, this project will provide a comprehensive and effective solution to the challenges faced by EFL learners. It will potentially revolutionize the way prepositions are learned beyond formal teaching.

Keywords: digital language learnin, English preposition, concept-based language instruction

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Exploring the Technological Development, Strategies, Outcomes, and Challenges of Learning Analytics-Integrated Learning Design in Educational Settings: A Systematic Review

Recent advancements in educational technology have underscored the significance of harmonizing Learning Analytics (LA) and Learning Design (LD). However, there is still a lack of systematic discourse on their development and effective integration from a technology-enhanced perspective. In addition, the advancements in technology-enhanced LD, the integration strategies and theoretical frameworks employed in studies integrating LA and LD, the outcomes and effectiveness of particular platforms or tools, as well as the needs and barriers to using technical support for integrating LA into LD, remain unclear. To address these gaps, this study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to comprehensively explore the technological development, strategies, outcomes, and challenges related to the integration of LA into LD in educational settings. A systematic search was conducted on various electronic databases, including Web of Science, ACM DL, IEEE Xplore, Wiley, and EBSCOhost, to identify relevant articles. Both electronic and manual searches employed specific keywords related to LD and LA. The search criteria were designed to locate articles focusing on the technical development of LA-integrated LD and specific platforms or tools that facilitate this integration. After applying the screening criteria, out of the initially identified 217 articles spanning from January 2019 to March 2024, a total of 24 articles were included for the final synthesis following the study selection process outlined in the PRISMA flow chart. Then, the data was analyzed using the bibliometric analysis approach, and the findings were reported.

Keywords: learning design, learning analytics, LA-integrated LD, systematic review, technology-enhanced LD

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Tin Hau in Tai Kwun-Goddess in a Police Station!?: Augmented Reality Technology to Engage Community in Arts Education

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Community engagement in learning is defined as the collaboration between educational institutions and communities of all levels as partnership or interdependence through knowledge or resources exchange (Carnegie Foundation for the Advancement of Teaching, 2015). It possessed a diverse array of programmes and instructional approaches that benefit the socio-cognitive development for learners from education institutions and the public community. Cooperation and exchanges between educational institutions and their greater community were also fostered as a result from the collaboration (Pasquesi, 2020), under the impacts of external environment and internal issues, motivations of engagement, and their organizational capacities (Thomson et al., 2011). Based on a case study of "Augmented Reality (AR) in Arts Education Project (thereafter, ARAEP)" (Osage Art Foundation, 2022), this paper critically examines how augmented reality technology can facilitate community engagement in learning by achieving multiple learning purposes in arts, culture, technology, and history across learners such as: (a) secondary and tertiary students, (b) secondary school teachers under formal settings, and (c) public audience under informal settings by document and video analysis on website, leaflets, news clips, and a public sharing video.

Funded by the Hong Kong Jockey Club Charities Trust and operated by the Osage Art Foundation, this project took place at Tai Kwun, a historical site served under multiple purposes as the former Central Police Station, the Former Central Magistracy, and the Victoria Prison (Tai Kwun, 2024). The site provides a unique cross-disciplinary learning opportunity for both secondary and tertiary students to immerse and integrate knowledge across art, culture, technology, and history disciplines. Four tertiary institutions have collaborated the community engagement project, i.e. Department of Architecture of the University of Hong Kong, the Academy of Visual Arts of the Hong Kong Baptist University, the Hong Kong Academy for Performing Arts, and the Hong Kong Design Institute (Osage Art Foundation, 2022). Since student learning and engagement greatly depends on teachers' facilitation (Howard & Butcher, 2007), thirty two secondary school teachers from sixteen secondary schools are first recruited to become facilitators by train-the-trainer approach. Teacher learnt to appreciate community as learning contexts for mutual benefits for institutions and students (Howard & Butcher, 2007). Two hundred and forty secondary students from participating schools, as well as fifty-six tertiary students from four tertiary institutes were recruited to learn how to create AR arts through research, ideation, scene design, and 3D photography (Osage Art Foundation, 2022). ARAEP also engaged over 400 thousand public audience in the final showcase at Tai Kwun (Osage Art Foundation, 2022). Public participants were invited to install the project app and interact with twenty-eight AR 3D models created by secondary school students at different locations in Tai Kwun. They could enter the virtual world at the present to interact with AR

models derived from narratives in the past, with aims to recreate novel narratives on their own about the future.

Based on grounded theory analysis, this study identifies multiple learnings across learners. Students developed 1) cross disciplinary knowledge over art, history, culture, and particularly technology; 2) empathy, values, and ethics; 3) design research skills; and 4) problem solving skills. Teachers gained facilitation skills and professional knowledge. Public raised awareness on history and culture, heritage preservation, and new technology. Findings align previous literature on how community engagement creates meaningful knowledge exchange between theory and practice throughcommunity relationship building, social analysis, as well as self reflection (Howard & Butcher, 2007).

The study has two major limitations, i.e. retrospective bias, and courtesy bias. First, teachers and students may mistakenly distort memories and report wrongly in their retrospective experience, differed from their true experience. Second, video data came from a public sharing leading to potential courtesy bias when participants felt embarrassed to talk about their negative opinions to avoid discomfort to other attendees. Such results will give insights on the affordances in AR use when designing activities for community engagement in learning projects to serve the diverse learning needs across learners.

Keywords: community engagement, learning, oral history, augmented reality, arts education

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Reflection on Blended Learning of Learning and Teaching with Digital Technologies

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前言

混合式教育（Blended Learning）的起源可以追溯到二十世紀九十年代初期，當時美國的幾個大學開始探索將網路技術與傳統教學相結合的方法。隨著 WEB2.0 的成熟發展與普及以及近年 WEB3.0 的興起，混合式學習已受到學界的關注與研究。(Means, 2010) 研究結果亦提出線上學習可以與傳統教學相當，甚至在某些學習範疇更有效.

COVID-19 促使學校的教與學急速過渡到線上教學,以確保學生的學習不受影響。然而,部分學生未必適應網上學習(Hodges et al., 2020)。網上學習需要更高的自主性,但部分學生的自主學習能力可能仍在發展中(Bol, 2020)。雖然 COVID-19 推動了網上教育普及化,但混合式教育仍然是未來發展的重點(Zhang, 2020)。混合式教育結合面授課堂與網上學習的優點(Graham, 2006),能提高學生的學習體驗。當中亦有不乏挑戰與機遇。COVID-19 令教師及學生提高了電子學習的運用,加快混合式教育的發展(Trust & Whalen, 2020)。本文旨在討論在 COVID-19 的疫情，本人在教學上的模式改變以及對學生學習的一些影響，希望能對教育界同工提供啟發幫助及帶來正面的幫助。

Keywords: blended learning, self-directed learning, e-learning, catering learning diversity.

1. 自主性學習

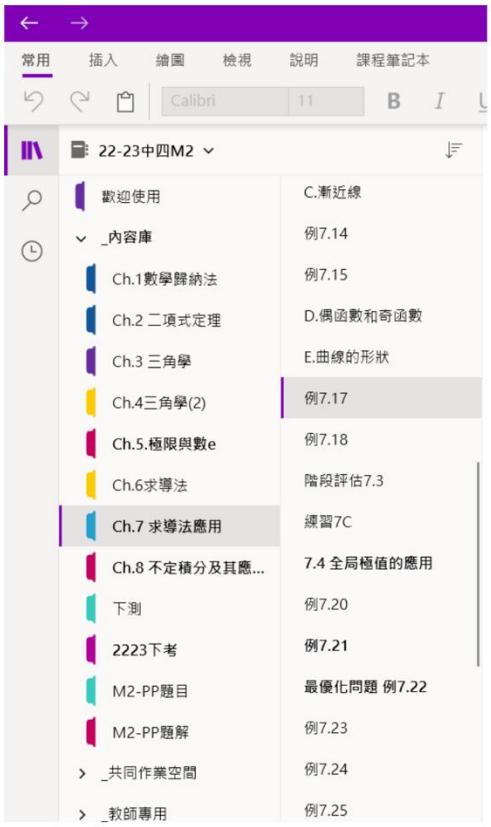
自主學習需要學生主動管理學習(Knowles, 1975)。COVID-19 的爆發，促使並強化學生自主學習的重要性,學生要學習並管理自己的時間以適應線上學習(Bol, 2020)。儘管線上學習富有挑戰,它能一定促進學生自主學習的機會及成效(Zhang, 2020)。自主學習有助學生適應未來學習(Candy, 1991)，香港教育局（2017）的報告內提及香港政府一直致力於推動自主學習以及終身學習並提供支援及不計劃給予學校。然而，自主學習需要學生更自律以及更好的時間管理，但往往在中小學階段，大部分學生未必能掌握這些能力，令疫情期間嚴重影響學生的學習。

2. ONENOTE 電子筆記

在疫情期間，由於未能與學生實體進行課堂教學，於是我開始思考如何使用網上學習及筆記幫助學生學習，開始探索不同的學習工具並開始使用 Microsoft ONENOTE 作為主要電子筆記及網上教學工具，一直到現在。ONENOTE 是一款能讓學生更好地組織和管理筆記內容，幫助他們快速查找需要的學習資訊同時亦可

以隨時隨地查看筆記。根據加拿大麥克馬斯特大學（McMaster University）的一項研究，使用 OneNote 可以幫助學生更好地組織和管理學習時的筆記和資料。研究結果顯示，使用 OneNote 的學生更傾向於將學習資料整合到同一個平台上，從而使得學習更加高效。同時亦有其他研究同時指出 ONENOTE 對學生的學習有正面的影響的有研究探討了 OneNote 在大學生學習中的應用。報告指出，學生使用 OneNote 可以提高他們的學習效果和學習態度，並且提高他們的自主學習能力和學習動機。(周俊良和李文慧, 2018)

對於一些能力比較弱的同學，在 ONENOTE 提供筆記能提供有系統且穩定的平台讓學生可以隨時隨地查看並溫習，每個學生均有自己的學習進度，傳統的黑板教學是“一次性”的教學，研究(Hattie, 2012)亦指出，傳統黑板教學是一種低影響力的教學方法，對學生學習成效的貢獻較小。取而代之，電子教學策略更能提高學生的學習動機及成效(Hwang et al., 2015)



筆記內的內容庫(Content Library)

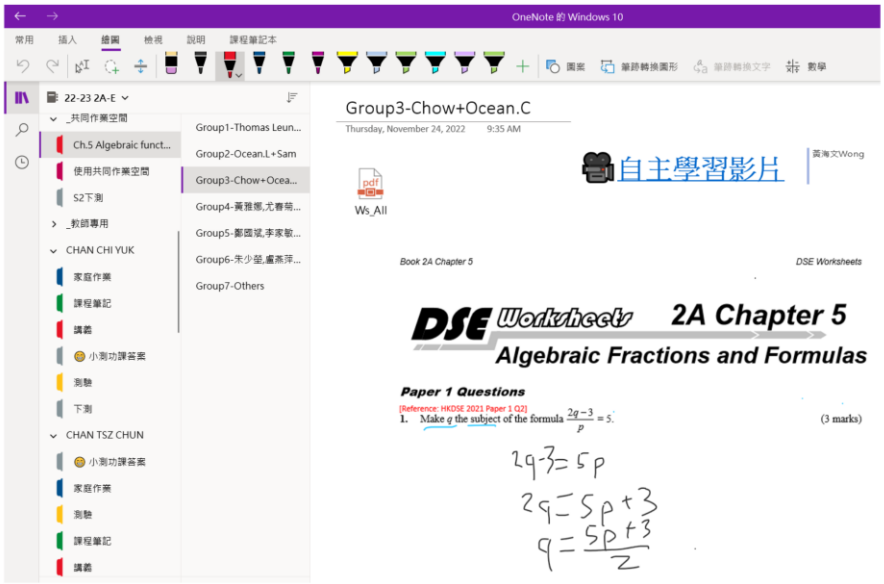
提供分章節筆記(課題),每個章節內老師都可以加入教學材料及筆記，在內容庫的資料，是唯讀的，學生不能更改或書寫，只有教師可以編輯。同時，教師可以將該章節或該頁面內容使用課程筆記功能發布給班內或者指定同學，在照顧學習差異層面，這個做法可以更好地照顧不同能力同學的學習情況，同時亦可以避免在課堂派發兩份不同筆記的畫面。另外亦可以在情意層面照顧學生更多，令部分能力較低的同學更容易接受一份程度較低的練習筆記。

除外，照顧學習差包括照顧能力較強的學生，教師亦可以個別安排發布額外/教富挑戰性的學習材料給同學。

在這裡我有一點的反思，我發現課堂上，同學開始習慣課堂可以使用自己 IPAD 查看教師的筆記，特別部分進度比較落後的學生，他們會自行在 ONENOTE 查看上一題的筆記，在這層面，我相信能照顧學生的學習多樣性學習差異，學生學習能力及已有知識基礎可以大為不同，與以往比較，一些跟不上課堂進度的同學感覺似乎”沒有選擇”，只可以在課堂上繼續聽下去，沒有空間或者選擇讓他們梳理及再次思考，儘管他們未能明白或者消化剛剛老師的講解。當然，要平衡利弊，要避免讓學生過分依賴可以自行查看 ONENOTE 筆記而忽略老師當下的講解。

3. 學習差異(Learning Diversity)的反思

學習差異一直是老師教學的一大挑戰，除了可能要照顧 SEN 學生或學習能力較弱學生，同時亦不能忽略班內能力較強的同學。班內的學習差異容易就全班整體學習做成負面影響，若老師能適當處理並拉近他們的差異，整體學習成效並會提升 (Jang & Hong, 2016).



在共同作業空間中，全班同學都可以在此地方編輯，而內容亦是老師發布的內容，在以上例子中，我用了分組的方法，讓不同程度的同學在一組完成課堂練習，同時亦以分組形式上課，用「以強帶弱」的策略照顧班內學習差異，分層教學及強帶弱的策略可以在一定程度提升學生的學習成效(Hattie, 2012)。

另外，同學亦可以隨時看到其他組同學的回答，同儕學習是一種有效提升學生學習成效的模式，同時亦能提高同學的學習成就及自尊心 (Falchikov, 2001)，我觀察到學生在進行共同作業分組堂課時會比平時更認真作答，因為他們知道自己的答案會被全班同學看見，多數同學都會更努力作答。

在正常面授課堂開始恢復，同學的學習差異差距逐漸浮現，學習動機弱以及基礎較差的班別情況更甚，在過去接近三年的非一般上課模式，較主動積極這的學生在這樣的課堂模式學習對學習成效當然有負面影響，但相對於被動，在課堂更需要老師鼓勵，提醒的同學，這類同學在網課的影響下，情況更容易每況愈下，需要更大的自主性，自覺性及自律性，這些對中學生來說都是不容易的挑戰。

4. 混合式學習(Blended Learning)模式的改變

剛剛討論到，學生的學習差異以及能力差距在後疫情時代顯得更顯著，在學習上，自理能力，21 世紀共通能力（21st Century Generic Skill ）學習上亦有一定的影響。在推動電子學習以及混合式教育的同時，我更反思究竟我們在培養同學們的什麼能力，是電子平台學習能力、資訊素養、自理能力、自主學習？思考良久後，認為對於學生的競爭力與自我成長，在學校，老師角度，最想培養

同學的應該是學生的 21 世紀共通能力，在這個資訊氾濫以及信息流通性極高的世代，學生需要學識分辨資訊的真假，從而做出明智的決定，在未來充滿挑戰工作及多樣性職場，學生更需要掌握共通能力裡常提到的「6C」即批判思考（Critical Thinking）、創造力（Creativity）、協作（Collaboration）、溝通（Communication）、人格特質（Character）、文化認同（Culture）。這些能力都是互通的而且對學生未來的發展亦是極其重要的。(Fullan, 2013)

5. 總結

在自主性學習角度，學生很多是都認為是老師編排好學習內容，學習範圍，但真正的自主性學習講求學生自我對學習的追求及渴求，反過來說，我們在教學上，很多時在繁重的工作上未必有很多空間思考如何更好培養學生真正的自主學習，能如何引起學生對學習某一科目的興趣，培養他們對學習的自信及追求。我的經驗是，在推動翻轉教室/電子學習/混合式教育層面上要小心墮入「為用而用」的陷阱，例如電子評估的使用應該是為了促進學習(Assessment for learning)，另外如何適當使用評估素養亦是非常重要。在設計電子評估以及電子學習資源亦需要貼切地照顧學生不同學習情況及學習差異。21 世紀共通能力在不同層面上都越顯得重要，學生的解難能力，協助能力，溝通技巧及創造力都應該是我們在教學上除了傳遞學科知識外，亦需要培養學生應有的能力，這些能力能讓學生未來應對不停轉變及充滿挑戰的社會，更具備競爭力。

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Development of an Online STEM Curriculum with Problem-Based Learning to Improve Grade 7 Students' Problem-Solving Skills

Abstract
This study aims to develop an online STEM curriculum with problem-based learning, of which topic is Plastic Free Challenge, to improve grade 7 students' problem-solving skills. This curriculum is developed on WIX, according to ADDIE model. The design of the learning pathway is guided by the 5E model. Results indicate the course's effectiveness in developing grade 7 students' problem-solving skills.
Keywords: STEM education, STEM curriculum development, problem solving skills

Extended Abstract
As the world becomes increasingly interconnected and complex, students in the 21st century need to be equipped with the skills and knowledge to investigate and solve problems. Although problem solving is the core of STEM education, it is underutilized in the practice of developing STEM curriculum. Besides, grade 7 students are in the formal operations stage, it is the golden time to fuel their abilities to think critically and solve problems. Therefore, this project aims to develop an online STEM curriculum with problem-based learning, of which topic is Plastic Free Challenge, including three sessions, what is plastic, how does plastic get in the sea and problem-solving process, to improve grade 7 students' problem-solving skills.

The curriculum learning design is based on the ADDIE model and the RASE model, and the instructional design is based on the 5E model, which promotes collaboration and active learning, and students construct new knowledge from personal experience and the whole process of problem solving. In order to encourage full participation, we make the following improvements: 1. Provide students with suggestions for study time in online courses, and remind students of homework deadlines by email; 2. Connect intrinsic motivation and extrinsic motivation to play a role in student learning effect. Weave an episodic narrative where the learner is at the center, engages the learner, and inspires the learner's sense of purpose. At the same time, by adding game mechanics (such as badges, levels, and leaderboards) to the curriculum, the curriculum platform celebrates students' actions of completing tasks or sharing knowledge, and emphasizes the impact of individual students ' knowledge on the overall narrative, linking extrinsic rewards to students' intrinsic related interests.

Providing timely and effective feedback was another important factor affecting student engagement in our online courses. Therefore, this online course defines the timing of email responses, creates Q&A forums, creates online group collaboration projects and uses the Padlet application to facilitate online discussions for students.

This course focuses on cultivating students' problem-solving path thinking, and guides students to look at the same problem from different perspectives, so as to understand the problem more comprehensively and get closer to the essence of the problem. Based on learning objectives and course topics, each session builds a real problem situation, guides students to use interdisciplinary knowledge, and solve problems with the help of various problem-solving methods, strategies, and provided resources. The majority

of the post-course survey respondents had a high degree of satisfaction and recognition of the course. These participants reported that the knowledge content of the course deepened their awareness of the importance of environmental protection; the diverse resources met their individual learning needs; and the activity design was engaging and stimulated their desire to explore and solve problems.

Overall, despite the limitations imposed by the asynchronous nature of the online course and the length of the experiments, the study was effective in achieving learning outcomes, especially in students' problem-solving thinking and confidence. This study will continue to follow up students' learning and problem-solving skills development to further verify the effectiveness of the course.

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The Effects of Computational Thinking on Students' Development as Problem Solvers in a STEM Learning Environment: A Study on Grade 7 Students

The purpose of this study is to explore how computational thinking affects seventh graders' ability to become problem solvers in STEM learning environment. To solve the following two problems: Does the integration of computational thinking strategies help to improve the students' abilities as problem solvers of 7th graders? What are the perceptions and experiences of grade 7 students regarding the use of computational thinking in enhancing their abilities as problem solvers in a STEM learning environment? This experiment recruited 70 seventh graders and randomly divided them into two groups, 35 of which received regular instruction and 35 of which received teaching content that would incorporate computational thinking. Therefore, this study adopted a mixture of quantitative and qualitative methods. Firstly, questionnaires will be used to conduct quantitative measurements before and after intervention, and semi-structured interviews will be conducted with students and teachers to understand their views on the relationship between computational thinking and problem solving ability.

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Digital Humanities: Deriving Insights from Singapore Historical Data with Computational Text Analysis

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The increasing availability of digitised historical texts has led to new possibilities in the digital humanities. Natural language processing (NLP), encompassing computational techniques for analysing and manipulating human language, allows historians to enhance their research with computer-based methods (Piotrowski, 2012).

This study adopts a hands-on approach to the digital humanities, applying NLP techniques in a survey of Singapore's post-independence history. The dataset was collected from the Singapore parliament website, comprising 2005 reports of speeches and debates from the 1st to 3rd parliaments of Singapore (1965-1976). We performed our analysis with topic modelling, a machine learning technique for discovering latent themes in a collection of documents (Churchill & Singh, 2022).

The BERTopic Python package was selected for its robustness and usability. Leveraging pre-trained language models, this tool has proven effective in generating coherent and easily interpretable topics (Grootendorst, 2022). During initialisation, the n-gram range was set to retrieve up to three-word phrases in topic representations, while the minimum topic size was specified to prevent micro-clusters. This configuration of parameters is well-documented and intuitive, making BERTopic suitable for programming novices.

The topics generated enable us to derive meaningful insights from Singapore's parliamentary discourse. We observed that the largest clusters were education, legislation, and transport infrastructure, offering a window into the nation's legislative priorities at the time. Additionally, we drew correlations between individual Members of Parliament (MPs) and the topics they frequently engaged with.

Our paper illustrates how computational methods can be integrated with traditional historical analysis, underscoring the transformative potential of digital tools in supporting scholarly research within the humanities. It aligns with the symposium's theme by exploring how historical epistemologies intersect with the competencies associated with artificial intelligence (AI) and data science.

Keywords: digital humanities, historical data, computational text analysis, machine learning, natural language processing

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Community Engagement in Coding Education

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Introduction

In recent years, the demand for coding education has grown significantly as schools recognize the importance of equipping students with essential digital literacy skills. To meet this need, The Hong Kong Competence Education Research Institute (HKCERI), along with leading IT associations including AITLE, HKACE, JSIT, and iFuture, and supported by the Office of the Government Chief Information Officer (OGCIO) has successfully organized the Swift Coding Club. This poster presentation explores the benefits of integrating the club into K12 schools and highlights the advantages of using community engagement as a method to promote coding education.

Over the past two years, the club has gained momentum, with approximately 200 schools in Hong Kong joining the initiative. The club offers a range of activities, including Hackathon competitions, free workshops, and coding camps, all aimed at promoting Swift programming among K12 students. By leveraging the collective resources and expertise of the community, the club has created a vibrant learning environment that surpasses what individual schools can achieve on their own.

Benefits of Integration

Enhanced Learning Opportunities: Integrating the Swift Coding Club into K12 schools provides students with access to a wider range of learning opportunities beyond the traditional classroom setting. Through workshops, camps, and competitions, students can engage in hands-on coding experiences, fostering creativity, problem- solving skills, and collaboration.

Professional Network and Support: Partnering with HKCERI and the collaborating IT associations allows schools to tap into a vast network of industry professionals, educators, and coding enthusiasts. This network provides ongoing support, mentorship, and access to the latest coding resources and trends, ensuring that students receive high-quality instruction and exposure to real-world applications of coding.

Resource Optimization: By pooling resources through community engagement, schools can overcome financial and logistical barriers. The Swift Coding Club facilitates the sharing of resources, such as curriculum materials, coding tools, and
expertise, enabling schools to offer comprehensive coding education programs without significant financial burdens.

Collaboration and Knowledge Sharing: Integrating the club promotes collaboration among schools, fostering a culture of knowledge sharing and best practice exchange. Schools can learn from each other's experiences, share successful strategies, and collectively address challenges, ultimately raising the overall quality of coding education in the region.

Community Engagement as a Method

The success of the Swift Coding Club lies in its community engagement approach. By actively involving various stakeholders, including educators, students, parents, and industry professionals, the club creates a supportive ecosystem that nurtures coding education. Community engagement ensures a diverse range of perspectives, expertise, and resources, leading to more comprehensive and effective coding programs.

Conclusion

The integration of the Swift Coding Club into K12 schools offers numerous benefits for promoting coding education in Hong Kong. By leveraging community engagement, schools can tap into a wealth of resources, expertise, and support, ultimately enhancing students' coding skills and preparing them for future success in the digital age. As schools continue to embrace collaborative approaches, the impact of coding education will undoubtedly extend beyond the classroom, empowering students with the skills and mindset needed to thrive in the ever-evolving world of technology.

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Harnessing Large Language Models for Essay Evaluation: Action Research on Teacher Feedback in an EFL Course

Providing effective feedback for student essays has been a longstanding challenge for EFL teachers. Recent advancements in large language models (LLMs), however, have presented new prospects for automated writing evaluation, which may further ease EFL teachers' pressure in feedback provision. Although recent research has conceptualized the potentials of LLMs in improving automated feedback and explored students' preliminary experience with LLMs for writing training, few empirical studies have been conducted in educational settings to demonstrate the possible impact of LLMs on teacher feedback. The present study, adopting the approach of participatory action research, examined how large language models may contribute to EFL teachers' feedback provision from the perspective of a university teaching assistant (TA) in a mainstream College English course in China. Beginning with identifying the needs of feedback for writing instruction in the course, the TA devised an initial plan to employ ChatGPT (3.5), a typical LLM chatbot, to offer written feedback for student essays from four different classes. According to the course schedule, two writing tasks were administered respectively in the first half and second half of the semester, which constituted two action-reflection cycles. Data were collected through a combination of ChatGPT records, reflective journals, written feedback, student questionnaires, course observation, instructor comments, and semi-structure interviews.

The first cycle suggested ChatGPT generated responses that can be incorporated into the written feedback for the students, though the average evaluation time was not significantly saved. Different types of prompts were used in the chatbot to elicit responses from the machine but the quality of responses seemed to vary. The TA gradually became aware of both affordances and limitations of ChatGPT in essay evaluation, and summarized frequently used prompts as a toolkit. Questionnaires showed the students were generally satisfied with received teacher feedback while demanding more specific suggestions on collocations and lexical diversity. With modified use of ChatGPT in the second cycle, the TA tried to improve her feedback by leveraging the strengths of the tool and mitigating its weaknesses, all the while addressing the needs of the students. The process of feedback provision turned out more efficient for the second essay task. The students, though more content with teacher feedback aided by LLMs, expressed in the interviews individual preferences for feedback types and levels that may be considered in further teaching. It can be implied from this study that LLMs like GPT3.5 may help instead of replacing EFL teachers in feedback provision and that the effectiveness of LLM assistance may largely depend on the performance of LLM-powered tools, the way they are used, and human judgement. To maximize the efficacy of LLMs in reducing teachers' burden and enhancing feedback support for students, teacher training in digital literacy and feedback literacy is essentially needed.

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Empowering Project-Based Learning through AI: Harnessing Digital Platforms for Enhanced Student Experiences

Background

In the evolving landscape of education, project-based learning (PBL) emerges as a pivotal methodology to foster interdisciplinary skills and real-world problem-solving abilities among students. This study focuses on an innovative PBL initiative titled' 'Elderly-Friendly Technology Creation Project',' aimed at integrating technology with empathy and creativity to address the needs of the aging population. The project underscores the importance of leveraging advanced technological platforms to enhance learning experiences and outcomes.

Project Objectives

The primary objective of this project was to engage students in a collaborative, interdisciplinary endeavor that combines elements of science, technology, engineering, arts, and mathematics (STEAM) to create solutions for the elderly. To facilitate this, the Cocorobo Cloud Platform, an AI-powered e-learning environment, was employed. This platform enabled students to work together seamlessly, from brainstorming ideas using mind maps to conducting data analysis with AI tools, generating AI-created images, and compiling their design reports. The platform also provided teachers with the capability to monitor progress, gauge student engagement, and interact with students effectively, thereby enriching the learning process and enhancing student interaction. Through this project, students were not only able to develop their technical skills but also cultivate empathy and understanding towards the elderly, showcasing the potential of integrating AI and e-learning platforms in educational settings to foster meaningful learning and innovation.

Challenges of ICT-Enabled Teacher Professional Development in Indonesia: An Activity Theory Perspective

When Indonesian Emancipated learning initiative (*Merdeka Belajar*) launched the new curriculum and emphases student-centered learning and education digitalization, schoolteachers engage in various professional learning activities to update their pedagogical and technological knowledge and skills. Guru Binar, a national teacher professional development (TPD) platform in Indonesia, collaborates with local governments to conduct customized online/blended PD programmes in different regions. Taking the activity theory (Engeström, 1987, 2015) as the analytical lens, teachers' challenges encountered in Guru Binar PD are contradictions of the PD activity. Such contradiction caused tensions that hinder teachers' PD quality, equity and efficiency, also motivated the improvement and transformation of PD activity. Adopting a qualitative approach that combines document analysis and interviews, this research aims to investigate teachers' challenges encountered in Guru Binar PD programmes in the local contexts.

The initial findings reveal **the primary contradictions** focus on teachers (subject of the PD activity) and ICT devices (tools of the PD activity) of Guru Binar PD. First, teachers as subjects (particularly those from frontier, outermost and least developed regions) have the motivation for PD, but they also lack digital literacy and skills to independently engage in Guru Binar online PD programmes that encourage self-paced learning. Hence, teachers heavily rely on PD facilitators' online support to solve technical problems in online PD programmes, and face-to-face demonstration in blended PD programmes. Second, teacher need devices and Internet as tools to access Guru Binar PD courses. However, teachers who lack desktop or laptop rely on cell phone or school computers, some even did not have stable internet connection. Such contradictions also brought challenges to both teachers and facilitators on PD learning and support.

This research also found that, teachers who conquered the abovementioned difficulties have enhanced their pedagogical and technical skills for the Emancipated learning curriculum. They witnessed students' increased learning interest and engagement in the classes and changed their perceptions of education. Some of them even further collaborated with Guru Binar to be PD ambassadors for sharing good practices or co-developing online courses. The findings bring insights about ICT-enabled and localized PD develop Indonesian teachers' digital literacy and pedagogical knowledge and eventually promote quality classroom teaching. Besides, stakeholders' collaboration (the community and division of labour of the PD activity) is also the key to implement such PD for supporting teachers in Indonesian's context to equally access to quality PD and transform education eventually.

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Examining Factors of Using Mobile-assisted Vocabulary Learning APPs among Chinese College English Majors

With the rapid development of mobile technologies, studies on the effectiveness of mobile-assisted language learning (MALL) in general and mobile-assisted vocabulary learning (MAVL) in particular have received considerable attention. However, few studies have neither examined the influencing factors that affect English-as-a-foreign-language (EFL) learners' choice of a particular type of MAVL platform, nor the moderating effects across four grades. To bridge the gap, drawing on the Technology Acceptance Model (TAM), this study proposes to address the following three questions: (1) What are the frequently used mobile-assisted English vocabulary learning APPs among EFL learners? (2) How do each of the four factors--perceived ease of use (PEU), perceived usefulness (PU), satisfaction (SAT) --influence EFL learners' behavioral intention (BI) to use mobile-assisted English vocabulary learning APPs? (3) What are the differences of grades among freshmen, sophomores, juniors, and seniors?

A total of 197 valid questionnaires were collected in this study, and SPSS 21.0 was used to analyze the data, and the following conclusions were drawn: (1) The English vocabulary learning APPs that are popular among EFL learners have strong perceived usefulness, perceived ease of use, and satisfaction. The top three APPs in this study are *Bubeidanci*, *Youdaocidian*, and *Baicizhan*. While covering the above factors, they also retain their distinctive characteristics. (2) PEU has the greatest influence on EFL learners' BI of MAVL APPs, followed by PU and SAT. (3) For learners of different grades, PU and PEU have no significant difference among grades, but relatively speaking, sophomores pay more attention to PU, while seniors pay more attention to PEU; SAT and BI are significantly different among grades, respectively. Freshmen and seniors, sophomores and seniors have significant differences in terms of SAT; sophomores and juniors have significant differences in terms of BI. Implications were discussed based on the findings obtained from the study.

Based on the Technology Acceptance Model, this study examines the influencing factors of mobile-assisted vocabulary learning applications used by four grades of EFL learners. This not only broadens the dimension of follow-up research, but also puts forward suggestions from the perspectives of technology developers, education practitioners, and learners, which will help improve related APPs and promote language learning for learners.

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On the STEAM Concept-based Design Instructional Case for Junior High Students in Information Technology Courses

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The current research in STEAM education is focused on fundamental concepts and instructional design. Although its direct influence on information technology (IT) courses remains ambiguous, there is a potential for enhancing learning across K–12 education levels, including advancements in IT teaching methodologies. This study aims to address concerns regarding the monotonous, repetitive, and inconsistent interpretation of the current IT curriculum by embracing the STEAM education paradigm. By leveraging the STEAM framework, this study has designed an instructional design for junior high school IT courses. Through case studies grounded in the updated IT curriculum standards, the findings show that the STEAM education concept effectively boosts teaching outcomes in IT courses for junior high students.
Keywords: Design Instructional, Information technology course, Junior high students, STEAM education

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You Can Make (Almost) Everything

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You Can Make (Almost) Everything refence to “How to Make (Almost) Anything”, which is founded by Massachusetts Institute of Technology’s Center for Bits and Atoms (CBA) Professor Neil Gershenfeld. This is a new and creative course because it empowers students to create something what they want though digital fabrication tools and machines.

Therefore, You Can Make (Almost) Everything also empowers students to create their works in different ways and encourage students to try something new though “Learning by Doing”. After their learning and making their works, they have reflective thinking for feeling, finding, and understanding their success or failure. Finally, students increase their ability to work under pressure and flexibility. It helps students to become a fast and active learner for facing the challenge in their future.

For the junior students, they are already familiar with using Google slide, so I make a template for students to record their making process to understanding their works and difficulty. First, they can do some research about “Concrete Lamp”. After that, they can design a base of Concrete Lamp. They can decide on the normal level (base of shape: square, triangle or rectangle) or the hard level (they can do whatever they want). Moreover, students can name their Concrete Lamp that make student own their works. That is can student agency.

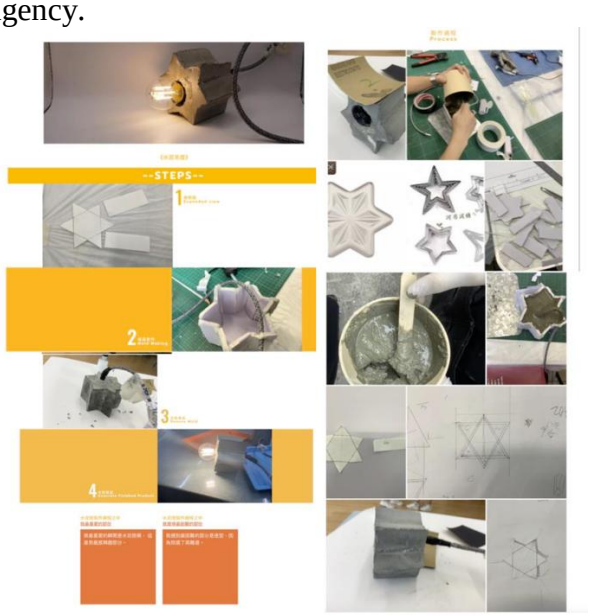

Figure 1 Student’s design process of making their own Concrete Lamp

For senior students, they are already familiar with recording their design process. They will level up to use “Markdown” for recording their design process. Markdown is a lightweight markup language for creating formatted text using a plain-text editor. Student also can pick favorite topic for learning digital fabrication tools and machines. Though hands-on experiences and learning by doing, they integrate all the fabrication

skills to finish the topic. Since the topic is pick by students, they have motivated to learn and finish their works.

One of my students use the same project as a design portfolio for interview PolyU Design in School Nominations Direct Admission Scheme. At the end, he success got the spot before release HKDSE results. Therefore, when students got motivated and understand their failure, they become an active learner.

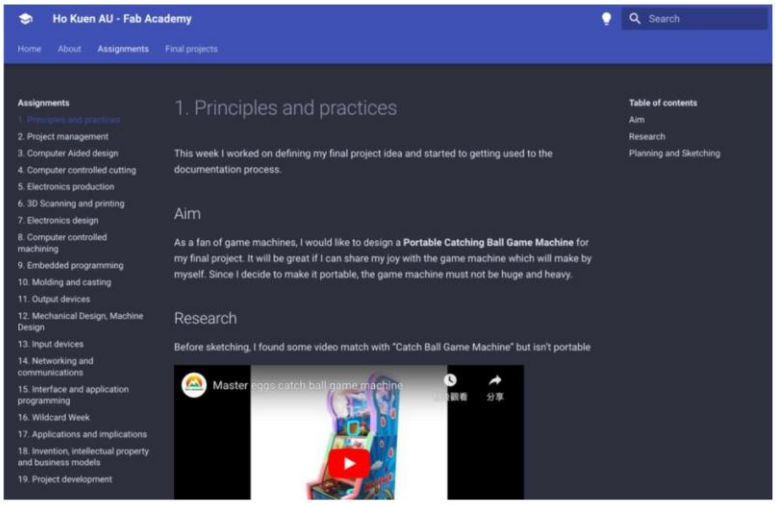

Figure 2 Student chooses game machines as a main topic for learning the digital fabrication tools and machines.

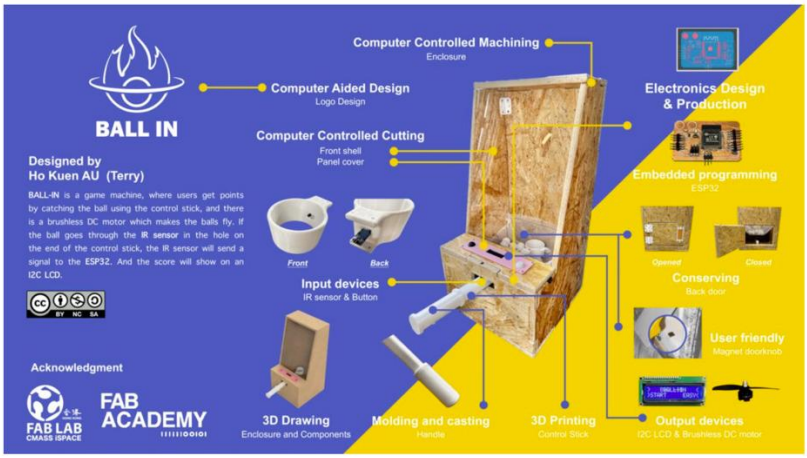

Figure 3 Senior students pick favorite topic for learning digital fabrication tools and machines, such as, 2D and 3D printing, electronics design and production, embedded programming and molding and casting.

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Research Hotspots and Trends Analysis of Digital Education in The Field of Nursing and Midwifery

Objective: Analyze the research hotspots and trends of digital education in the field of nursing and midwifery at home and abroad, and provide references for further development of digital education.

Method: Visual analysis of digital education- related research literature from 2012—2022 in the core databases of China National Knowledge Infrastructure and Web of Science was conducted with the CiteSpace 6.2.R2 software.

Results: A total of 11,741 related articles were included. The number of Chinese articles first increased year by year and then declined slightly, and the number of English articles showed a trend of increasing year by year. Highly productive authors and cooperative groups at home and abroad have initially appeared, but the number and scale of core institutional groups abroad are larger than those at home. Common hot keywords at home and abroad are nursing, education, teaching mode, teaching method, online teaching, etc. Research trends at home are Network, qq group, micro-course, new media, online course, cloud class, smart classroom, etc. The research trends abroad are online learning, educational technology, social media, mixed methods, virtual simulation, augmented reality, etc.

Conclusion: In the past ten years, the total number of domestic research articles on digital education has been lower than that of foreign countries. A large cooperative group of authors and institutions has been formed in foreign countries, while domestic authors and institutions need to further strengthen their cooperation. Relevant researches at home and abroad are focused on nursing education and teaching method reform, but domestic lags behind. In the future, we need to focus on the innovation and verification of digital education methods in order to improve the teaching effectiveness of digital education.

Keywords: digital education, nursing, midwifery, hotspots, trends, CiteSpace

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Establishment of The Index System Of Stepped Informatics Comprtencies Evaluation(ISSICE) for Nursing Graduate Students under the Background of New Medicine

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This article constructs the Index System of Stepped Informatics Competencies Evaluation **(ISSICE)** based on a scientific and reliable methodology. The **ISSICE** can be used to assess the informatics competencies of graduate nursing students and help to improve the information competence of graduate nursing students, and improve the efficiency of care.
Keywords: Informatics Competencies, Postgraduates, Nursing

BACKGROUND

To address the demands of the technological revolution and industrial transformation, the state has introduced the concept of establishing a new paradigm in medical science, positioning it as one of the four pioneering initiatives that will shape the future landscape of higher education. This novel medical science framework underscores the significance of fostering interdisciplinary collaboration, integration, and innovation. A pivotal objective moving forward is the cultivation of individuals equipped with cross-disciplinary knowledge capable of addressing cutting-edge challenges within the medical field.

The informatics competencies of nurses hold profound implications for the advancement of the nursing discipline. These competencies encompass the amalgamation of knowledge, skills, and attitudes pertinent to nursing information management, as evident in various nursing practices. Augmenting nursing informatics competencies has the potential to reshape nursing methodologies and enhance service efficiency and quality.

Currently, nursing informatics education in China is nascent, with a dearth of research focusing on the evaluation and cultivation of informatics competencies among nursing graduate students. Hence, this study aims to develop the Index System of Stepped Informatics Competencies Evaluation (ISSICE) tailored for nursing graduate students, with due consideration to the requisites outlined in the construction of the new medical science paradigm for nurturing nursing talents.

METHODS

Generating the item bank

To generate the items, a research team consisting of 5 members was initially formed, including Nursing Informatics Researchers, Nursing Graduate Instructors and Current Graduate Students.

The team conducted a comprehensive literature search using both Chinese and English search terms related to informatics competencies in nursing postgraduates. Drawing

insights from the literature and referencing the criteria proposed by Staggers and TIGER, the research team developed a preliminary version of the stepped information competency evaluation index entry pool for nursing graduate students. Subsequently, interviews and discussions were conducted with nursing informatics experts, nursing postgraduate supervisors, and postgraduate student representatives. This collaborative effort led to the formulation of a preliminary evaluation index system for nursing postgraduate students' stepped information competence, comprising 4 primary indicators, 10 secondary indicators, and 45 tertiary indicators.

Items evaluation and revision

The evaluation and revision towards the items were achieved by 3 rounds Delphi expert consultation. A total of 16 experts were included based on the following criteria: 1Possession of a Bachelor's degree or higher with an intermediate or higher professional title, 2More than 5 years of work in related fields; 3More than 3 years of experience in supervising or training postgraduate students; and 4Willingness to participate actively in the study. Experts were asked to assess the importance of each item on the scale using a rating scale ranging from 1 (least important) to 5 (most important). After three rounds of consultation, the system was refined to include 3 primary indicators, 9 secondary indicators, and 45 tertiary indicators, as shown in Table 1 of the Appendix.

Level setup

Each tertiary indicator is graded across six levels: L0 (no experience/competence), L1 (limited experience/competence, fulfilling a small portion of learning and work requirements), L2 (moderate experience/competence, meeting approximately half of learning and work requirements), L3 (advanced experience/competence, fulfilling most learning and work requirements), L4 (excellent experience/competence, meeting typical learning and work requirements), and L5 (exceptional experience/ability to innovate and optimize beyond fulfilling learning and work requirements).

Within the three primary indicators, there are 17, 17, and 11 tertiary indicators respectively, with corresponding score ranges of 0-85, 0-85, and 0-55. The correspondence between the grades and the scores is detailed in Table 2 of the Appendix.

Conclusions

Through the implementation of innovative assessment practices and the integration of new paradigms, this research significantly enhances the adaptability of nursing education to the dynamic healthcare landscapes shaped by technological advancements. By fostering Education Transformation, this work not only addresses critical gaps in nursing informatics but also paves the way for the evolution of educational practices to meet the demands of a rapidly changing healthcare environment.

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Exploring Learning Analytics Integrated Learning Design's Impact on AI Literacy Education

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The advent of artificial intelligence (AI) has transformed different industries, e.g. education, science, art, business and so on. The contemporary world have been shaped by emerging revolutionalry AI technologies, such as ChatGPT, Midjourney, etc. Eventually, AI will change many facets of the society and exist in many parts of our daily life. Therefore, the importance of fostering AI literacy becomes vital, influencing not only individual competencies but also societal progression. It is crucial for individuals to foster AI literacy in the new trend.

The term of "digital literacy" emerged in the 1970s, which is more well-known than the term of "AI literacy". As AI literacy is an emerging field in the 21st century, relevant researches and practices are still limited. Studies on AI literacy teaching remain scarce (Chai et al., 2020a, 2020b). Mastering the knowledge and skills in AI presents a substantial teaching challenge for both specialist and educators, as well as a cognitive obstacle for learners (Micheuz, 2020).

As AI's growing influence, the pervasive spread of AI technologies across various sectors and its implications for future job markets in recent years, there remains a significant gap betweenpublic understanding & utilization and AI literacy education. Ng, Leung, Chu, & Qiao (2021) point out the the concept of "AI literacy" are still under-explored and emphasize the importance of fostering AI literacy.

To address the impact of Learning Analytics Integrated Learning Design on students' learning trajectory and outcome of AI Literacy, a 7-step model developed by Law and Liang (2020) is chosen, which integrates the Learning Design Triangle (LDT) and learning analytics into the course creation process. This model outlines steps ranging from establishing the LDT's foundation to selecting learning analytics solutions and ensuring everything aligns with educational goals.

This research endeavors to explore the following key questions:

1) How does the Learning Analytics Integrated Learning Design of AI literacy course influence students' learning experiences?
2) To what extent does students' prior digital literacy correlate with their performance in the AI literacy course, especially considering some students' previous enrollment in the researcher's digital literacy courses?
3) What are the trajectories of students' learning experiences throughout the AI literacy course?
4) Can distinct patterns and outcomes be identified in connection with students' background characteristics and interaction patterns within the AI literacy course?

These research questions collectively form the framework for a comprehensive exploration of fostering students' AI literacy, offering valuable insights into course design, student learning experiences, and the broader educational landscape.

This study is based on a course about AI literacy designed by the researcher. In 2023, 306 adults participated this half-year AI literacy course. The course outline of 1st version was designed with limited theoretical and analytical thinking. This course will be re-designed based on 1) the multilevel framework of Learning Analytics Integrated Learning Design 2) adjustment of learners from only adults to adults and minors 3) systematic design of learning: learning outcomes, assessment methods, learning activities, teaching methods and learning analytics.

The significance of this research lies in providing a deeper understanding of AI literacy education, offering valuable insights for educational practice and policy-making, optimizing the design and implementation of AI literacy education courses to better meet students' learning needs and developmental goals.

Keywords: AI literacy, learning analytics, learning design, learning outcomes, digital literacy

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Bridging Minds: Unraveling the Convergence of Human and Artificial Intelligences with Insights into Prompt Engineering

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The one-hour workshop will explore the intricate relationship between human intelligence and its artificial counterparts. It will include various carefully crafted active and passive learning activities, enabling attendees to identify the broader meaning of human intelligence, its psychological and physiological underpinnings, and how it inspires and sometimes transpires artificial intelligence (AI). The workshop will also help participants differentiate AI's critical characteristics from human intelligence.

In the first segment, the discourse will pivot around the psychological learning theories of constructivism and constructionism to ascertain the psychological interpretations of the learning process for humans and AI. Afterward, the session will delve into the physiological, neurological processes within the human brain when we engage in so-called "learning." Through various interactive activities, participants will appreciate interesting neuroscientific breakthroughs that shed light on how humans construct knowledge and develop skills based on their daily experiences. The discourse will then pivot to whether AI can mimic human intelligence-related processes or if its intelligence is just a facade of our anthropomorphism.

Progressing into the second segment, the workshop will further the discourse and illustrate how to apply our newly found understanding and appreciation of human intelligence and AI. A brief discussion on transformer models and concepts, such as high-dimensional space, will set the stage. The segment will link these concepts to the broader context of prompt engineering, focusing on how to prompt and harness AI models effectively. A concise explanation of various prompt engineering techniques will ensue, focusing on a few critical ones useful to both novices and regular users. Multiple relevant examples of these techniques will be provided, and attendees will have an interactive, hands-on experience exploring these techniques.

The session will end with a robust discussion on increasing productivity through human-AI partnerships—how humans and AI can work together to level their strengths and overcome weaknesses. In brief, the workshop is designed to appeal to both technical and non-technical audiences, ensuring an insightful demystification of the symbiotic relationship between humans and AI.
Keywords: human intelligence, artificial intelligence (AI), neuroscience, prompt engineering, human-AI partnerships

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Generative AI in Education: Leveraging Tools for Storytelling, Visualization, and Gamification

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In today's educational environment, the power of storytelling combined with interactive gaming can revolutionize the way students learn. Our workshop focuses on equipping educators with the skills to craft compelling storylines that transform fundamental lessons into engaging narratives, through the use of generative AI.

Participants will delve into the art of weaving essential information into captivating stories, making complex concepts accessible and enjoyable for students. The workshop will provide invaluable insights into **leveraging the power of storytelling to enhance the delivery of educational content.**

Educators will be introduced to powerful tools such as **Mentimeter and Canva**, designed to introduce the concept of gamification in classrooms. These tools will enable educators to develop interactive experiences that complement their narratives, creating a dynamic learning environment that **promotes active engagement and participation.** This approach not only **makes learning more fun** but also **enhances students' problem-solving abilities by applying theoretical knowledge in practical, game-based scenarios.**

Through practical activities and a brief introduction to Canva's AI capabilities, educators will have the opportunity to design their own story-driven games with a gamified edge, gaining firsthand experience in integrating educational content with entertainment.

By the end of the workshop, participants will be adept at:
1. Integrating educational content with entertainment effectively.
2. Incorporating Mentimeter as a tool to create interactive and engaging presentations, quizzes, and polls.
3. Utilizing Canva's AI to design visually stimulating and gamified content, integrating graphics, animations, and interactive elements to captivate students' attention.

Note: Attendees are encouraged to bring their own laptops or tablet devices to fully engage in the interactive workshop activities.

Keywords: ai integration, generative ai, educational technology, ai in education, gamified learning experiences

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Professional Development Workshop for Teaching and Learning AI Ethics in K-12 Settings

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The rise of artificial intelligence (AI) necessitates building up essential AI literacy (*i.e., AI concepts, AI applications, AI ethics*) for our next generations, in the context of K-12 education. However, it may be a daunting task for teachers to teach AI literacy in the classrooms, due to the general lack of clear pedagogical content knowledge (PCK) for teaching and learning AI. Most notably, while a few AI literacy frameworks highlighted the significance of AI ethics, most teachers had limited experience in teaching AI ethics, according to the preliminary findings of my on-going interview study. On the one side, it is difficult for them to teach the high-level AI ethical principles that are formulated by policymakers or governments from a top-down perspective, especially for the younger students. On the other side, although our children have interacted with AI technology on a daily basis, they are still likely to be unfamiliar with the ethical issues around AI, even conducting some bad uses of AI unconsciously. Thus, teachers need to bridge the gap between the real-life problems and the AI ethical principles in their teaching practices. In this workshop, I will introduce several ethical dilemmas around AI by inviting the participants to play a multiple AI-agents game (*20mins-40mins*). The participants will engage in group debates of the ethical issues in these cases and discuss the possible solutions for the situations (*30 – 50 mins*). We will reflect the AI ethical principles and discuss how to teach these principles in the K-12 settings at the end of the workshop (*10mins – 30 mins*). The time duration will depend on the arrangement of the symposium's schedule and the number of participants.

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Using a Board Game to Enhance Media and Information Literacy Skills in the Post-truth Era

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Welcome to a workshop designed to enhance your media and information literacy (MIL) skills in the post-truth era. This workshop addresses the dynamics of post-truth era regarding news issues. People are allowed to express different opinions, decide various attitudes and reactions to what they read. Meanwhile, implicit media bias and agenda setting behind news can limit people's understanding and critical analysis. Therefore, staying conscious and being misled can coexist within a dynamic sphere.

The purpose of this game-based workshop is to provide participants with an engaging and enjoyable experience that combines playing games with acquiring information evaluation skills. By leveraging the interactivity and collaborative nature of the board game, participants will evaluate and analyze news articles from various aspects, such as source evaluation, fact-checking, bias detection, and critical analysis. This game aims to empower individuals to become conscientious and rational information consumers, ultimately being able to make informed decisions in an era where misinformation can have far-reaching consequences.

The game will be conducted in a dynamic and interactive manner, with participants actively engaged in a playful experience that tackle with a series of tasks associated with media and information literacy challenges. Through strategic gameplay, participants will encounter different news scenarios, and tackle the complexities of discerning truth from fake news. Facilitators will guide players to experience the dynamics of public opinion, organize discussions and provide insights into various media literacy concepts, scaffolding a comprehensive understanding of news evaluation skills. After playing the game, participants will join a game reflection session in which facilitators will guide them to discuss and reflect on gameplay experiences, strategies they used, what worked well, what could have been improved, the lesson they learned from the game, etc.

Keywords: media and information literacy, fake news, game-based approach

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Informal Digital Learning of English in Hong Kong English Language Education

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Informal digital learning of English (IDLE), which is defined as "self-directed, autonomous English learning practices in out-of-class and digital environments" (Zhang & Liu, in press),has garnered attention in the field of computer-assisted language learning in recent years. It has been discovered to yield linguistic and affective benefits to EFL learners, such as higher English grades in standardized assessments, boosted vocabulary development, enjoyment, confidence, and learning efficacy (ibid.). In the Chinese EFL context, students' IDLE practices are positively predicted by resources regulation, support from important others, authentic second language experience, and the ideal L2 self (Liu et al., 2023, in press; Zhang & Liu, in press). More specifically, learners with higher levels of English proficiency and self-rated levels of spoken English have been found to be more proactively engaged in IDLE (Zhang & Liu, in press). Despite the extensive research on IDLE, most has been conducted in tertiary settings with limited understanding of secondary EFL learners' IDLE behaviour.

This session illuminates how IDLE can be promulgated in Hong Kong English language classrooms. It comprises three parts. The first part will introduce the concept of IDLE in relation to the context of Hong Kong English language education. In the second part, a secondary school student will share and analyze his experience of engagement in IDLE. The third part will be an interactive dialogue between the presenters as well as between the presenters and the audience with a focus of the benefits of IDLE as well as promotion of IDLE amongst secondary learners in Hong Kong.

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Pregrading Essays via Generative AI

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Grading essays is one of the most time-consuming elements of the teacher's job. Consistent scoring and detailed feedback are important, but the time and effort required for them – especially without the help of tutors or teaching assistants – can frustratingly take away from other teaching activities, like lesson preparation and interacting with students. This Interactive Session will introduce audience members to the use of generative AI in essay grading. Generative AI represents a new frontier of digital technology with the potential for immense impact on the practice of teaching. This impact is still in its infancy, however. Teachers are rightly concerned about the idea of handing over key teaching functions, such as grading, entirely to an automated system, so it is essential that the teacher retain final control over scoring and comments. Taking this concern into account, one fruitful way to think about the use of AI in grading is, instead, to pre-grade essays. In this model, the generative AI provides a consistent, well formatted starting point on which the teacher can add the finishing touches, thereby saving substantial time and effort for the teacher. In the presentation portion of this session, I will share my experience of implementing AI grading in an undergraduate course using the newly available Pregrade app (https://pregrade.ai). In the participatory portion of the session, the audience will have the opportunity to discuss and walk through the process of using Pregrade for AI-assisted grading. After the session, participants will be prepared to begin testing and implementing Pregrade in their own classrooms.

Keywords: generative AI, evaluation, new technologies

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Empowering Students: Interactive Teaching and Digital Integration in Arts Education

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Background

Our school has implemented a BYOD (Bring Your Own Device) policy, which allows students to use tablets for learning and interaction during lessons. Therefore, the school encourages teachers and students to be bold and try different creative approaches, such as incorporating various forms of arts and innovative learning elements, in order to unleash students' potential and enhance their self-directed learning abilities.

Project Objectives

Our goal is to foster engagement and instill confidence in students through interactive teaching and the seamless integration of digital tools in music and visual arts education.

Music

I place importance on students' interactivity and their willingness to try new things in music lessons. Therefore, I adopt a cooperative learning approach and integrate traditional teaching methods with technology in lessons. Through different learning activities, for example, using the built-in piano feature of GarageBand can be utilized to teach students how to play the school anthem. This allows students to learn and play the piano anytime, replacing the need for an actual piano. After learning the school anthem, they are also required to perform an ensemble in front of their classmates in class, and both students and teacher participate in the evaluation process. I aim to stimulate students' learning motivation, enhance their self-confidence, and foster their interest in learning.

Besides, using one of the famous Rhythmic Games “Taiko no Tatsujin” to foster their learning interests. Students can absorb music knowledge through playing games which can enhance their confidence to perform in the classes. Here is the performance video that shows the students performing with confidence. (https://drive.google.com/file/d/1hNkHyR-7AYUdGn6R3BBcInoxZoyal75Y/view?usp=sharing)

Additionally, the integration of GarageBand and traditional teaching methods enhances interactivity. Students have the opportunity to apply music theory concepts, such as utilizing chords, designing rhythms, and choosing instruments while creating demos in GarageBand. GarageBand is user-friendly and offers different elements for students to unleash their creativity and bring their musical ideas to life. Here are two examples: Firstly, students use “GarageBand” to create a basic song arrangement. As their interest in the software grows, they explore and learn more features. This leads to enriching the song with additional layers, making it more intricate and nuanced. (https://drive.google.com/drive/folders/1GNpmAXZIO3pJS916YitfCkg64LhWYhqo?usp=shari ng)

Visual Arts

As a visual arts teacher, I often come across students who don't seem to enjoy the art class. However, I believe that it's not a dislike for art itself but rather a lack of confidence in their creative abilities.

To make art learning more enjoyable and accessible, I have incorporated digital teaching elements into the visual arts curriculum (Table 1). Students can now use iPads or smartphones for research during class, which is more convenient than traditional paper-based methods like printing out images. I also integrate digital creation into projects such as iPad sketching and group-based stop-motion animation. These additions enrich the teaching process, expose students to diverse creative mediums, and boost their confidence.

Table 2 Teaching Plan - Sketching

For instance, when learning sketching, students first acquire the basic techniques of traditional sketching. However, for those who are less proficient, it can be challenging and monotonous due to the focus on realism. By incorporating iPad sketching as an extension, using apps like Sketchbook or Procreate, students can grasp composition and color principles while regaining their confidence by imitating the works of established artists (Table 2).

Students' artwork		
	Student A	Student B
Pencil sketching		
iPad sketching (pencil)		
	They can better grasp the line techniques used in sketching and portray the changes in light and shadow.	
iPad sketching (coloured)		
	Students can grasp composition and color principles while regaining their confidence by imitating the works of established artists.	

Table 3 Students' artwork

Likewise, group-based stop-motion animation enhances collaboration and communication skills as students work together to design stories, create storyboards, make props, shoot, and edit the final animation (Figure 1).

Figure 1 The process of students making stop-motion

(Students' completed stop-motion animation pieces - "走塑狂想曲" https://drive.google.com/file/d/1Ts02uBxDuA3X_JXgCuCzkPN7xtMfc1mq/view?usp=drive_link)

In summary, our approach involves engaging and empowering students in music and visual arts through interactive teaching and seamless digital integration. Comparing classroom performance using relevant technologies, we found that students have much more confidence to perform in class. In Music, it enhances their self-directed learning

abilities as students after learning the skills of Garageband, they will take the initiative to explore creating music and they derive a great sense of satisfaction from their accomplishments. They will also collaborate with their classmates to produce a song in Garageband, thereby enhancing their music skills through the relevant technologies. In the field of visual arts, particularly utilizing the iPad sketching as an extended creation unit which enables students to achieve higher levels of completion and demonstrate a greater willingness to revise their work. The feedback received from students indicates their enjoyment of using the iPad, the increased efficiency it brings to their artistic process, and their proactive approach to refining their creations. These testimonials provide compelling evidence of how electronic teaching enhances students' confidence in their arts education.

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Learning EFL Writing with ChatGPT: Secondary School Students' Motivation to Learn, Cognitive Load, and Satisfaction with the Learning Process

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The integration of ChatGPT into the English as a foreign language (EFL) writing classroom remains largely unexplored in terms of students' experiences and perceptions, although these directly impact students' learning behaviors, engagement, and writing outcomes. To inform instructional approaches for integrating ChatGPT into the EFL writing classroom, this study explores how Hong Kong secondary school students perceive learning to compose a written composition with ChatGPT support.

From an EFL teaching and learning perspective, adopting an explicit, instructional approach to writing can facilitate whether ChatGPT benefits students' acquisition of writing knowledge and skills. In this regard, process-based writing is a popular approach and comprises stages of planning, drafting, revising and publishing. Importantly, especially for EFL learners who lack English cultural knowledge, genre-based writing is an essential approach and comprises stages of setting the context, modeling, joint construction and independent construction.

Students' perceptions are defined as their subjective assessment of their learning environment. They are operationalized for study as students' motivation to learn about ChatGPT, cognitive load, and satisfaction with the learning process. Motivation to learn refers to a person's desire and willingness to engage with the learning materials and activities. Cognitive load refers to a person's capacity to process information during learning. Satisfaction is a basic measure of how a person reacts to a program or learning process.

The data come from 100 students from seven Hong Kong secondary schools of different academic bandings. Their teachers enrolled them in a two-hour workshop where they were introduced to either a genre- or process-based approach to writing a text with ChatGPT support. They practiced prompt engineering skills to support either approach and performed writing a 500-word task with ChatGPT's support. The data sources were a pre-workshop questionnaire and a post-workshop questionnaire with validated items. The former established a baseline for student motivation to learn and the latter retrospectively explored motivation, cognitive load and satisfaction. The questionnaire data were analyzed for basic descriptive statistics, and with the Wilcoxon signed-rank test to assess students' motivation changes from pre-workshop to post-workshop. Furthermore, perceptions of the genre-writing cohort and the process-writing cohort were compared.

It was found both genre-based and process-based workshops significantly enhanced students' motivation to learn about ChatGPT. However, there was no significant difference in post-workshop learning motivation between the two workshop cohorts.

Second, both workshops received a high level of satisfaction from students, with the process-based workshop achieving slightly higher mean satisfaction scores, albeit without statistical significance. Lastly, the process-based workshop induced a significantly higher level of cognitive load compared to the genre-based workshops.

This study demonstrates ChatGPT's potential to engage EFL secondary school students in the writing classroom. The substantial improvement in students' motivation and their high satisfaction levels with both workshop types indicate the effectiveness of introducing an explicit writing approach and related prompt engineering skills when integrating ChatGPT. Furthermore, that the process-based workshop led to an increased cognitive load for students suggests that not all students are competent, independent writers of English language texts. Therefore, to realize ChatGPT's benefits in the writing classroom without overwhelming students, educators should not only consider their theoretical approach to writing instruction but also design scaffolded prompt engineering activities and materials to support that approach.

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Use Virtual Environment and Blended Learning to Facilitate the Participation of Students with Special Needs in Art Creation and Appreciation

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Aims and Objectives

In accordance with the learning objectives of visual arts, our school has designed a series of digital resources, such as videos, virtual environment software and websites, for the purpose of nurturing creativity and imagination, developing the ability to appreciate art, understanding art contexts and developing skills and processes. We have set up an inter-school learning circle to acquire effective skills and pedagogical methods in the use of digital resources through repeated lesson observation and discussion.

Literature Review

The use of VR technology to support student learning is mainly based on Situated Learning Theory, which advocates that knowledge is contextualised and partly applied activities, as well as cultural and social contexts. The virtual reality technology can help instructional designers to construct simulated learning environments so that learners can construct relevant knowledge and skills through interaction with the virtual reality. (Zihua, Yang et al., 2007) In this project, we created a "model VR" of the masterpieces so that students could walk into the masterpieces and experience the space like never before.

At the same time, we are working with blended learning strategies to maximise the pedagogical impact of digital resources. The concept of student-oriented teaching mentioned therein is suitable for students with multiple special learning needs and highly personalised learning characteristics: i. Designing flexible curricula for students' different starting behaviours; ii. A hands-on approach, supplemented by lectures, allows students to build up experience through practical work and then accumulate knowledge through experience, complementing theory; iii. Virtual practice" is used to strengthen students' confidence, increase their interest in learning, and reduce the risk of practical work. (Wu, Huang-non and Chen, Mao-chang, 2007)

Teaching Steps

From the discussion of the Joint Learning Circle, we found that there are four major difficulties encountered by teachers of visual arts: there are many different mediums of visual arts creation and it is difficult for teachers to be proficient in each medium; it is inevitable that there are students taking turns in the practice of skills; it is difficult to allow the whole class to observe the detailed movements in close proximity during the demonstration of the skills; and most of the classical masterpieces have a sense of distance from the time period and it is difficult to immerse into the cultural context of the works.

We hope to design a series of teaching materials to meet the current teaching deficiencies as far as possible. In order to design a series of teaching resources that are most likely to be shared among schools, we shared our respective visual arts curricula and found that special schools have a wide range of visual arts curricula. How to design a series of digital resources to be included in the visual arts programmes is the most challenging part.

After a discussion at the conference, we concluded that visual art appreciation is centred on the four key elements of "overall feeling", "form analysis", "meaning interpretation" and "value judgement". Therefore, we took this as the design direction of the teaching material and selected four masterpieces to create a virtual reality. After reviewing the curricula of different schools, we found that Chinese paintings and Western paintings are the most common mediums for appreciation. We selected four works of different styles, namely, "Relativity" by Moritz Cornelius Eicher, "Self-Painting after Cutting off the Ear" by Van Gogh, "Along the River During Qingming Festival", and "Guernica" by Pegasso. After discussing these works at the conference, we concluded that visual art appreciation is inseparable from the four key elements of "Overall Feeling", "Formal Analysis", "Meaning Interpretation", and "Value Judgment". Therefore, we have taken this as the design direction of the teaching materials, and selected four masterpieces to create a virtual reality. Looking at the curricula of different schools, we see that Chinese paintings and Western paintings are the most commonly used mediums for assessment. We have selected four works of different styles, namely, "Relativity" by MC Escher, "Self-Painting after Cutting off the Ear" by Van Gogh, "Along the River During the Qingming Festival" and "Guernica" by Picasso.

Conclusion

The virtual reality of classic masterpieces allows students to walk into the masterpieces, arousing students' interest and allowing them to immerse themselves in the masterpieces and feel the ambience of the masterpieces. Overall, the blended learning mode can help teachers save time in teaching, facilitate repetition of key points and keep up with the learning progress; and in learning, it can help students increase the interest in learning and gradually promote self-directed learning. In conclusion, the blended learning model and digitised resources provide greater flexibility for learning and more choices for students, and this flexibility is becoming extremely important in the education sector.

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From Artificial Intelligence to History Education: The Case of Image Recognition

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In the traditional history class, using the form of courseware, the class is mostly teacher-centred, it is difficult to arouse the interest of most students. With the rise of artificial intelligence in recent years, it has gradually penetrated various industries, also brought new inspiration to the field of education. In this respect, history education can also benefit from the development of artificial intelligence. I will give an in-depth explanation of the help and examples of history education from image recognition.

Artificial intelligence image recognition technology can help students better understand and analyse historical images. Students are trained to accurately identify and classify historical images, artworks, or artifacts by training image recognition models. This enables students to gain a deeper understanding of historical events, cultural features, social changes, also enables students to spontaneously understand the details in images, resulting in a more complete historical understanding.

Example

Collect data online

Teachers use "Teachable Machine" principles and historical Renaissance art features (including architecture) in computer and history classes, and guide students to collect image data online and annotate them to train models.

Field trip

In the Secondary One course of our school, we need to teach Hong Kong traditional humanistic architecture, and we can also use image recognition teaching. Students made their own trip to investigate and build artificial intelligence models.

They can have a better understanding by assessing the accuracy of their models and their ability to correctly classify images.

In a word, history education is to present the truth, and artificial intelligence provides new possibilities for history education. Through image recognition, students can learn more autonomously. However, AI is only an auxiliary tool, the expertise and leadership of teachers are still indispensable.

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Reciprocal Digital Transformation in CLIL: The Multimodalities-Entextualisation Cycle (MEC)-On-the-Move

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The MEC encourages dynamic flows of translanguaging, trans-semiotizing and multimodal meaning-making resources in ecologically harmonized educational settings across ethnicities and communicative repertoires. In this interactive session, the presenter first introduces design-based research for digitally transforming content and language integrated learning (CLIL) in tertiary classrooms in Hong Kong. Through activating three key stages of the MEC, the presenter showcases empirical innovative MEC-guided classroom designs for CLIL in higher education, especially for disciplinary practice mapped with Public Relations and Digital Storytelling in Corporate Branding. This interactive session also highlights the research and pedagogical values for enhancing self-access learning and mobilizing entextualisation experiences digitally transformed by plurilingual, pluricultural tertiary students and teachers nowadays. This interactive session prioritizes to (1) explicate dynamic roles of AI-guided teacher-to-student and student-to-student dialogic scaffolding in CLIL through both formal and informal epistemological sources, ranging from academic sharing webpages hosted by Study Key-Opinion-Leaders to secret discussion forums regularly visited by tertiary students. In addition, this interactive session aspires tertiary educators to (2) co-create digitally transformative practice for overcoming observable challenges plurilingual, pluricultural students may face in the process of extending their affective meaning-making reciprocally outside formal CLIL tertiary classrooms. The research and pedagogical implications of engaging teachers and students with the MEC on-the-move in CLIL may shed light on co-building AI-transformative and multimodality-enhanced social semiotic landscapes in EMI tertiary education. The interactive session motivates educators to move beyond traditional monolingual knowledge-making boundaries and co-explore digital transformative modes for enriching reciprocity in CLIL. The interactive discussion harmonizes some forward-looking experiences for each participant to embrace rhizomatic access of non-hierarchical plurilanguaging and personalised discovery of learning science with Generative AI (Gen AI) tools and informal knowledge sharing socialisation platforms favouring reciprocal digital transformation in CLIL.

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"The Keychain Syndrome": Does Innovation Foster Learning?

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The primary objective of this session is to introduce a framework inspired by the Transformative-Learning-Technologies-Lab to validate various constructionist projects. The framework is being customized based on case studies at an international secondary school in Hong Kong (The ISF Academy), stemming from a specialized professional development program that fosters innovation among its teachers. A tool developed from this framework enables educators to evaluate innovative projects or activities against their intended learning goals.

In this session, we aim to explore the relationship between Innovation and Learning. By examining sample projects from the school, we can demonstrate where they fall on the Innovation and Learning continuum to determine whether they meet the intended learning goals. Innovation refers to the educational process rather than the outcome, and might include projects or activities that are more hands-on, open-ended, constructionist, and student-centered. Learning is characterized by higher-order thinking, such as deep comprehension, applying, creating, analyzing, and evaluating versus lower-order thinking, such as remembering and understanding (Forehand, 2005). We will also address the logistical aspects of implementing innovative practices in classrooms including considerations regarding timing and duration.

To foster rich interactions and conversations, our presentation will include interactive elements, such as opportunities for audience members to share their own experiences and insights. We will also dedicate time at the end of the session for participants to apply the proposed framework to a sample activity from their own educational environments and propose other dimensions to explore. Ultimately, the goal is to provide participants with a tool to evaluate their own activities or programs, enabling them to explore a number of educational factors when considering the value of Innovation, within the constraints of educational settings.

Keywords: Innovation, Learning, Evaluation tool

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The accessibility of Generative AI tools enables individuals to rapidly develop improved solutions for specific problems. A subset of digital literacy, termed AI literacy, has emerged and currently seems to be a focal point of university education. This presentation emphasizes the University of Hong Kong Libraries' crucial role and strategic initiatives in fostering digital literacy among university students, equipping them for future challenges.

In the era of Generative AI, the Libraries strives to offer students a holistic digital literacy experience by promoting awareness and providing educational support through various activities and resources. Rooted in the knowledge management cycle, the Libraries has transitioned from merely promoting resources to empowering students to effectively manage their personal knowledge, accommodating their individual learning needs.

In reaction to the Libraries' information, librarians have revamped and enhanced materials such as guides, workshop handouts, online courses, and interactive workshops by implementing the universal design for learning guidelines. This facilitates various modes of learning, including self-directed, synchronous, and asynchronous approaches. By promoting students' self- awareness and fostering their metacognitive changes in learning, the Libraries aims to help students learn more efficiently with accessible technologies such as generative AI tools.

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Exploration of Interdisciplinary Curriculum Practice in High School Science and Video Production

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This session introduces an innovative approach to high school education that combines science curriculum with video production to cultivate students' innovative abilities and practical skills. The project-based learning model encourages active student participation in the creation of science-themed videos, from concept development to final production. This interdisciplinary method not only enhances students' interest in scientific knowledge but also develops their media literacy and teamwork skills. The session will demonstrate the specific process of this teaching design and implementation, as well as how students present scientific concepts in an understandable and engaging manner through video. Participants will gain insights into evidence-based practices that can be applied in their own classrooms, promoting hands-on learning and critical thinking through technology.
Keywords: interdisciplinary, project-based learning, student driven, video production, science learning

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Supporting K-12 Students to Learn AI with Low-cost Open-source Devices: A Case of Self-service Supermarket

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In this workshop, we will present the construction and implementation of a K-12 AI course based on a low-cost, open-source device and a handy software based on the YOLO algorithm. Through our work, students are able to learn key AI concepts as well as design and develop innovative AI-driven projects by using low-cost devices. We will provide step-by-step instructions for using our software and device to support students to learn and experience object detection and the YOLO algorithm.
Keywords: AI education in K-12, open-source device, computer vision, YOLO algorithm

AI education is a rapidly developing field in which students and teachers should appreciate the big ideas of AI. To achieve this, K-12 students and teachers need to have hands-on experiences with AI, not just passive exposure to AI-powered functions. Furthermore, most existing products and tools for AI education are either too expensive, too large, or too superficial, and that they do not allow students to tinker with AI and understand how it works behind the scene. In this workshop, we will present the construction and implementation of a K-12 AI course based on a low-cost, open-source device and a handy software based on the YOLO algorithm. We describe the design and implementation of a K-12 AI course that uses our device and software to teach key AI concepts, such as data, models, algorithms, and ethics, and to enable students to create innovative AI-driven projects. We provide step-by-step instructions for using our device and software to perform object detection with the YOLO algorithm, and to customize the parameters and the data sets for different purposes. We demonstrate that our tool is effective, engaging, and accessible for teaching AI and robotics to K-12 students, as evidenced by the positive feedback and the diverse outcomes from our pilot studies.