EFFECTIVE PRACTICES IN AI LITERACY EDUCATION

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EFFECTIVE PRACTICES IN AI LITERACY EDUCATION: CASE STUDIES AND REFLECTIONS

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FOREWORD

When OpenAI introduced ChatGPT-3 on 30 November, 2022, it marked a pivotal moment for artificial intelligence (AI) in education. School administrators, students, and teachers suddenly had easy access to a sophisticated chatbot. As the Director of the Center for Education Innovation at the Hong Kong University of Science and Technology, I saw ChatGPT as both a threat and an opportunity for higher education. The potential for transformative change was clear. Education was on the brink of a significant evolution.

By January 2023, it quickly became apparent that teaching and learning experiences would be impacted by ChatGPT. The subject of academic integrity was obviously influenced by it; the significant attention on AI detection tools, like GPTZero, suggested this (Yin et al., 2023). However, I believed that this would only be the tip of the iceberg.

Generative artificial intelligence (GenAI) tools like ChatGPT have the potential to revolutionise our daily lives, professional environments, and interpersonal communications, fundamentally altering how we approach education. These tools, trained on vast corpora of text, are fine-tuned for optimised dialogue, enabling them to respond conversationally to prompts (Kohnke et al., 2023). ChatGPT's unique features have sparked research across diverse fields, including social sciences, medicine, engineering, computer sciences, and foreign language education (Dowling & Lucey, 2023; Lo, 2023; Qadir, 2023; Wei et al., 2024; Zhang & Tur, 2023). This broad literature underscores ChatGPT's versatility and potential in education.

However, there are notable limitations and concerns with GenAI tools like ChatGPT, including biases, outdated training data, lack of transparency and reliability, and generating grammatically correct but vague texts (Chan & Colloton, 2024). ChatGPT responds based on statistical associations rather than reasoning, which can lead to plausible-sounding but factually incorrect or nonsensical answers, a phenomenon known as 'hallucination'. For example, Athaluri et al. (2023) found that ChatGPT produced contextually relevant but significantly inaccurate responses, illustrating the issue of hallucination in AI-generated content.

Beyond GenAI, AI and machine learning have long impacted the education sector. AI can be broadly categorised into three types: artificial narrow intelligence (ANI), artificial general intelligence (AGI), and artificial super intelligence (ASI). While ANI is currently in use, AGI and ASI remain theoretical (Chan & Colloton, 2024). Machine learning, a key area of AI, includes unsupervised learning (finding patterns in unlabelled data), supervised learning (using labelled data to predict outcomes), and reinforcement learning (maximising rewards in a given environment).

Educators have been exploring how AI can augment or transform educational practices (Bond et al., 2024). For example, the use of chatbots as personal tutors or enabling personalised learning highlights the potential for AI to enhance educational outcomes. My hope was that ChatGPT would be the catalyst for change in education, itself. Assessment design, pedagogy – everything related to teaching and learning – seemed stuck. The rapid advancement of GenAI appeared to provide the push we needed.

In the months following ChatGPT's release, I had the pleasure of collaborating with colleagues across Hong Kong and internationally, many of whom are contributors to this book. The excitement was unmistakable. Conversations in the classroom with my students, discussions at conferences, media coverage, internal meetings, and professional development workshops all centred around AI and education.

However, it soon became clear that many joining the conversation did not always have a solid understanding of what GenAI is. For example, during professional development sessions at my university, discussions about academic integrity and the impact of AI on assessing students' learning outcomes revealed that some faculty members were unclear about what GenAI can and cannot do. This often led to an overreliance on AI detection tools, which are not reliable, and a focus on AI-proofing assignments.

From the students' perspective, I observed misuse of GenAI tools. For instance, some students treated ChatGPT as a search engine and became frustrated when it produced incorrect information. On academic panels that included students, I heard how students used GenAI to summarise course readings or assist with literature reviews. Additionally, I heard very little about the potential for human–AI collaboration or the role higher-order thinking, such as critical thinking, may be important when using AI tools to solve problems. These instances indicated that students lack AI literacy skills.

This is why publications such as this one are important. They add value to the ongoing discourse on AI in education and underscore the importance of AI literacy. The chapters in this book provide a comprehensive exploration of AI literacy education, offering practical insights and case studies that highlight

effective practices and challenges. Each chapter contributes to a deeper understanding of how AI can be integrated into educational practices, emphasising the importance of developing AI literacy among both educators and students.

For instance, Part 1 of the book lays a solid foundation by distinguishing between traditional AI and GenAI, discussing AI ethics, and presenting frameworks for AI literacy. This section sets the stage for understanding the broader implications of AI in education.

Part 2 discusses the practical aspects of teaching AI literacy to staff and students. Chapters in this section offer detailed strategies for AI preparedness, highlighting programmes that integrate AI literacy across various curricula. These examples underscore the need for comprehensive training to equip educators with the skills necessary to effectively incorporate AI into their teaching practices.

Part 3 showcases innovative approaches to teaching AI literacy through targeted activities and projects. These case studies illustrate how collaborative projects, constructivist approaches, and human–AI collaborative writing can enhance students' engagement and understanding of AI.

Finally, Part 4 offers a conclusion that synthesises the insights from the previous chapters and discusses the future directions of AI literacy education. This section reinforces the idea that AI literacy is crucial for navigating the evolving educational landscape and preparing students for a future where AI plays a significant role.

By bringing together contributions from experts worldwide, this book not only advances the discourse on AI in education but also provides actionable recommendations for developing AI literacy. Because we are on a threshold in AI and education, understanding both the opportunities and challenges is essential. This book serves as a valuable resource for educators, administrators, and policymakers, guiding them in fostering an environment where AI literacy is an integral part of the educational experience.

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PART 1

AN OVERVIEW OF AI LITERACY EDUCATION IN HIGHER EDUCATION

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1

INTRODUCTION

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TRADITIONAL AI VERSUS GENERATIVE AI

Traditionally, artificial intelligence (AI) knowledge and skills are used to solve specific goals and tasks in particular organisational contexts, such as inventory optimisation, and business process streamlining, and normally require users to have a detailed understanding of specialist knowledge. So that they could understand the capability and functionalities of AI and work with AI specialists to develop proprietary solutions (Jarrahi et al., 2023). For this reason, end users have typically been limited to science, technology, engineering, and mathematics experts (O'Dea & O'Dea, 2023).

The rise of generative AI (Gen-AI) has, however, helped remove these barriers. Gen-AI is a powerful AI technology that generates outputs like images, text, audios, videos, and 3D models with ease (Chiu, 2023, 2024; Ng et al., 2023; O'Dea, 2024). Recent advancements, like ChatGPT, have expanded its capabilities, opening new opportunities for Gen-AI applications in higher

education. ChatGPT enables students to generate essays, learning content, programme coding, and videos and receive feedback on their work (Chiu, 2024; O'Dea & O'Dea, 2023; Parker et al., 2024). These provide students with interactive, collaborative, personalised, and student-assistant learning experiences. Gen-AI goes beyond the traditional AI systems that are more widely used in administrative (e.g. automated grading systems and plagiarism detection) and teacher teaching (e.g. learning analytics and adaptive learning).

Compared to traditional AI systems, Gen-AI is more accessible, interactive, human-like, and student-assistant; thereby, it is more of a learning partner for students (Chiu, 2023, 2024). Gen-AI has the potential to benefit student learning but also raised numerous concerns. It is supported by the reaction from higher education instructors about establishing or revising the policy of using Gen-AI (Chiu, 2024). The concerns include student academic integrity, dishonesty, overreliance, and ethical considerations. Research into Gen-AI applications in higher education is ongoing (Chiu, 2024).

Curriculum design theory can inform practitioners and researchers how Gen-AI was planned in teaching and learning and what skills students need for the use of Gen-AI (Chiu, 2021; Kelly, 2009; Priestley, 2011); therefore, this chapter used the curriculum theoretical approach comprising content, product, process, and praxis to understand understanding how student learning and AI literacy in higher education might be improved using Gen-AI.

CURRICULUM DESIGN APPROACHES

Curriculum refers to all experiences that are planned and guided by teachers and learned by students, whether in groups or individually, inside or outside classrooms (Kelly, 2009). Curriculum theory explores values and views on educational curriculum and policy from educational, philosophical, psychological, and sociological perspectives. In this theory, four major curriculum approaches are described as content, output, process, and praxis in literature (Glatthorn et al., 2018; Kelly, 2009; Priestley, 2011). These approaches can be used independently or in an integrated manner to theorise Gen-AI in higher education (Chiu, 2021).

The curriculum-as-content approach emphasises knowledge transfer and involves creating a syllabus and finding efficient delivery modalities. It focuses on approaches to knowledge structure in relation to content arrangement (Glatthorn et al., 2018; Kelly, 2009). The curriculum as a product approach views education as instrumental to enhancing student learning outcomes. Its curriculum highlights emphasise student performance, skills, and competency (Glatthorn et al., 2018; Kelly, 2009). It prepares students for particular tasks

by focusing on what they need to know to study, work, live, etc. This approach is widely used in technical, skill-based, and training programmes that have specialised activities or jobs and clearly defined knowledge and concepts (Swanson & Pashby, 2016). Students have a limited say in their learning because the curriculum specifies competencies and tells them what to study and how.

The curriculum as a process approach views education as student growth and emphasises instructor–student–knowledge interactions rather than content and outcomes (Glatthorn et al., 2018; Kelly, 2009). It entails classroom activities and how teachers and students collaborate to prepare and assess student learning. Instructors and students choose content based on student needs and interests and produce learning goals that are not applicable to all students (Glatthorn et al., 2018; Kelly, 2009). This approach switches curricula from teaching to learning (Chiu, 2021). The curriculum as praxis approach views education as a dedicated and purposeful action, emphasising the need of integrating knowledge, and skills to solve real-world problems (Chiu, 2021; Glatthorn et al., 2018; Kelly, 2009). Students and teachers collaborate to analyse and enhance the problem-solving strategies and abilities they use to address the problems. Students should take action to learn new knowledge from other disciplines to solve the problems.

Overall, the adoption of a specific curriculum approach impacts pedagogy and learning outcomes. The curriculum approaches could explain how Gen-AI can be used in higher education.

USING GEN-AI IN HIGHER EDUCATION

Literature has revealed that strong AI literacy and relevant disciplinary subject knowledge are essential for effective learning using Gen-AI (Chiu, 2024). Before initiating the Gen-AI learning process, instructors should ensure that students possess prerequisite knowledge that strengthens their critical thinking skills. It takes strong subject knowledge to be able to think critically about existing facts, observations, and arguments. This allows you to make decisions based on fair and logical analyses and evaluations. Instructors are recommended to carefully plan the lessons to ensure students apply critical thinking skills when learning with Gen-AI. Moreover, literature suggests that the development of student AI literacy should be adopted using multi- and interdisciplinary approaches, given its interdisciplinary nature (Chiu, 2024). Students can effectively accomplish tasks they previously believed to be beyond their capabilities. Gen-AI facilitates the easy retrieval of information or knowledge from many disciplines and the creation of multimedia content. It enables students to

engage in interdisciplinary learning. In addition, research also indicates that AI is here to stay, and the future workforce is more inclined to collaborate, learn, and work with Gen-AI. This changes higher education by including outcomes to the ability to collaborate and work with Gen-AI, proficiency in fact-checking, and the development of entrepreneurship (Chiu, 2023). Instructors should explicitly add 'learning and working with Gen-AI' as learning objectives in their courses (Chiu, 2024). Overall, Gen-AI has transformed our higher education, and can be viewed as content and product, and process and praxis.

CURRICULUM AS CONTENT AND PRODUCT

The New Learning Outcome for the Future Workforce

With the continuous advancement of AI technology, the integration of AI in the workforce and learning environments will increasingly become more widespread. Gen-AI, the latest advancement in AI, is a disruptive technology that has the potential to change the way we work and learn. The future of the workforce requires skills and knowledge to collaborate with Gen-AI. Hence, the author emphasises the significance of incorporating the 'capacity to collaborate with Gen-AI for their careers' in the learning outcomes of their course. These outcomes emphasised the need of using Gen-AI in an ethical and productive manner. Increasing student awareness of AI and ethics is more likely to occur by highlighting the need of collaborating with Gen-AI in a more serious manner for their profession.

Student AI Literacy Development and Its Definition

Recent studies emphasise the significance of AI literacy (Chiu, 2024). Insufficient student AI literacy hinders their understanding of AI capabilities and limitations. They may lack the ability to assess the benefits and risks of using Gen-AI in learning and teaching. Gen-AI's capabilities include creation, more than just usage, communication, collaboration, and evaluation. This implies that Gen-AI extends beyond the typical definitions found in the literature, as exemplified by Long and Magerko (2020). Thus, the authors proposed that AI literacy should be considered a fundamental course for all higher education students, and existing definitions may not adequately address the pervasive presence of Gen-AI in education. Higher education institutes should plan a holistic curriculum at programme or university level and set rubrics or develop tests for measuring student AI literacy.

CURRICULUM AS PROCESS AND PRAXIS

Gen-AI and Interdisciplinary Learning

Gen-AI fosters interdisciplinary learning by providing a tool for creating and exploring new ideas across different fields of study (Chiu, 2024). It can encourage students to learn various disciplines by generating diverse and new ideas, as well as facilitating the creation of multimedia content. This enables students to use more holistic approaches to solve complex problems that traditional approaches may not have been able to address. Gen-AI can facilitate interdisciplinary learning by pushing boundaries with new ideas and skills. Hence, the author encourages course or programme design to take advantage of the benefits brought by Gen-AI to foster student interdisciplinary learning. Interdisciplinary learning enhances career development by equipping individuals with a diverse range of skills and knowledge applicable across various industries (Nandan & London, 2013).

Innovative Approaches in Teaching (Gen)AI

As the field of AI rapidly advances, particularly with the emergence of large language models and other Gen-AI systems, universities are exploring innovative approaches to teaching these cutting-edge AI technologies. Rather than solely focusing on the technical details, many institutions are taking more innovative approaches. This includes brainstorming ideas for project design (Furtado et al., 2024), customising their learning resources and questioning to deepen their subject understanding and creative thinking activities for students to experiment with and critically analyse Gen-AI tools. Some universities are exploring innovative curriculum and pedagogies to integrate AI literacy more broadly, such as AI literacy courses for all students, faculty development programmes, and creative pedagogies and guidelines to upskill instructors and students (Ng et al., 2023).

ORGANISATION OF THE BOOK

The organisation of this book was inspired by the authors' experiences in implementing AI literacy in higher education. While the demand for teaching university students AI literacy has been recognised, some universities have started providing AI literacy programmes at both the undergraduate and postgraduate level. There is a lack of pedagogical research on academic

practices and pedagogical strategies and approaches relating to AI literacy teaching across diverse university contexts and subject disciplines. This book is designed to meet this need and serves as a go-to guide for key university stakeholders, such as students, academics, and professional support staff. It provides the reader with applicable strategies and evidence-based practices through a comprehensive collection of international higher education case studies. The case studies cover innovative approaches in teaching AI literacy across a broad spectrum and discipline-specific approaches. Each case study is also complemented by the contributors' own reflections. The intention is to promote deeper engagement and critical thinking.

The book is divided into four parts. Part 1 provides an overview and theoretical foundation of AI literacy education in higher education. Part 2 explores discipline-appropriate approaches in teaching AI literacy and gathers successful case studies with course design, student feedback, and evaluation. In interdisciplinary fields, most of the articles not only use Gen-AI for problem-solving and hands-on experimentation but also started to explore AI's societal impacts, ethical implications, and critical analysis in their discipline. Interdisciplinary approaches that bring together diverse perspectives are valuable in developing comprehensive Gen-AI literacy. Part 3 identifies innovative approaches in teaching AI literacy. To establish AI literacy as a core competency and learning outcome for future workforce, this part documents approaches and instructional design in teaching AI. Finally, Part 4 explores innovative ways to leverage AI tools and technologies to enhance teaching/learning practices in higher education.

CONCLUSIONS AND RECOMMENDATIONS

The current definitions of AI literacy and competency are generic and could inform what students and teachers need for AI knowledge and skills. They are not specific to education and may not suggest what competencies students and teachers need for learning and teaching. Moreover, how to effectively develop student AI literacy and use Gen-AI to support teaching and learning remains unclear. Therefore, the author calls for more research to redefine what AI literacy and competency are for students and teachers in the context of learning and teaching and to suggest more effective pedagogy and curriculum approaches.

The development of AI literacy education in higher education is a critical priority as students prepare to enter an increasingly AI-driven workforce (Chiu, 2023, 2024; Ng et al., 2023; O'Dea & O'Dea, 2023). This book accumulates effective innovative case studies to integrate AI more broadly across disciplines,