Exploring the implications of generative-AI tools in teaching and learning practices

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Abstract

This study aims to explore the implications of using AI-generative tools (tools for generative AI (GAI)) in teaching and learning practices in higher education settings. This exploratory study employs a mixed-methods approach. Data was collected through focus-group discussions, participants' reflections and questionnaires. The participants of this study were 65 undergraduate students who enrolled in a university. The GAI tools were integrated into the course assignments. This study found that most students chose to use GAI tools alongside traditional tools to perform their assignments and exhibited a positive attitude towards using GAI tools to accomplish their tasks. The most significant impacts of integrating these emerging-technology tools in the course included a reduction in the time needed to complete the assignments and efficiency and creativity in producing different types of interactive digital content. However, notable challenges were identified regarding the quality and authenticity of the new content. In addition, the findings revealed significant differences between the pre- and post-tests mean scores using GAI tools in students' learning, further reinforcing the effectiveness of these tools. Finally, it is necessary to develop clear policies and guidelines while using GAI in higher education.

Keywords: Academic program, AI-generative tools, Artificial intelligence, Authenticity, Efficiency, Emerging technology, Quality.

Contents

> **Contribution of this paper to the literature**
> This research outlines best practices for teachers in higher education on how to integrate generative AI tools into course curricula. Additionally, it provides policymakers with insights into the importance of establishing clear guidelines for the implementation of generative AI in teaching and learning practices.

1. Introduction

Artificial intelligence (AI) is an aspect of the fourth industrial revolution. It is an emerging technology rapidly evolving and affecting all fields such as education, medicine and industry. It plays a critical role in reshaping the field of education. Generative AI (GAI) tools are among the most recent developments in AI. They are designed to create new material such as text, photographs, videos and other types of media that closely resemble content created by humans. These new technologies have important implications for educational settings as they resemble human-like behaviours using various data, patterns and existing knowledge. In the realm of education, GAI tools are predicted to reshape teaching and learning by offering personalized and adaptive learning experiences, assisting teachers with content creation and customization, and expanding access to educational resources (Chen, Chen, & Lin, 2020). However, this integration causes concerns about data privacy, ethics and the appropriate balance between human roles and machine roles in academic settings. The potential opportunities and challenges of applying these GAI tools in the classroom warrant further investigation and empirical evidence to encourage policymakers to develop policies for using these emerging technologies ethically in academic programs.

Currently, most literature focuses on applications of AI in administrative tasks rather than in classrooms. A comprehensive study is needed to address the implications of these emerging GAI tools in an educational setting. Valuable insights can be gained from examining the impact of GAI technology on teaching and learning in real-world settings. This research explores the opportunities and challenges associated with integrating AI tools into a classroom to provide teachers and institutions with effective implementation strategies, best practices, and guidelines. This study will address gaps in the current literature, build upon prior research and offer fresh perspectives and insights into the potential opportunities, challenges and best practices of integrating AI into teaching and learning. The primary research question guiding this study is: What are the impacts of integrating GAI technologies on teaching and learning practices in a college course compared to traditional tools? Specifically, this research addresses the following sub-research questions:

A. How does integrating GAI tools into coursework impact students' learning experiences compared to using traditional tools?
B. To what extent do GAI tools impact students' learning performance in completing course assignments compared to using traditional tools?
C. What are the primary benefits and challenges of using GAI tools for students to complete course assignments?

1.1. Problem Statement

Artificial intelligence is a relatively new concept in education, representing innovative smart technologies that require further investigation. Currently, there is a lack of evidence-based practice regarding the utility of these emerging GAI tools in teaching and learning, so there is uncertainty about the potential impact of these technologies and how to incorporate them effectively into academic programs.

This study explores the various dimensions of integrating GAI tools into settings of higher education. This study attempts to assess the impact of using GAI tools as a substitute for conventional software in classroom assignments. The goal is to provide insight and recommendations for teachers and policymakers on effectively leveraging GAI tools to enhance teaching and learning practices in this new era.

1.2. Definitions of Terms

Artificial Intelligence (AI): AI is grounded in computer science. It encompasses all aspects of replicating cognitive functions to solve real-world problems and develop systems that can mimic human capabilities such as learning and thinking (Poole, Mackworth, & Goebel, 1998).

Generative-AI Technology: Generative AI (GAI) pertains to a set of computer science, statistical, and engineering tools created by scholars that represent a shift from using AI for pattern recognition to using AI to generate new content such as text, images, and videos using algorithms trained on large datasets that are often collected from online sources (Bail, 2024).

2. Literature Review

AI was first mentioned in the literature in 1950, citing several limitations that hindered its widespread acceptance and application (as cited in Kaul, Enslin, and Gross (2020)). In 1955, John McCarthy established the term "AI" to represent computers' ability to perform various human cognitive activities, including communicating, reasoning, learning, and problem-solving (Guan, Mou, & Jiang, 2020). Frank Rosenblatt introduced the "Perceptron" model in 1957 influencing the creation of artificial neural networks and using "neural cells" for recognition (Gupta, Jin, & Homma, 2004). Artificial intelligence methods developed throughout the ensuing decades, with theoretical ideas becoming tangible tools, including the Mark 1 Perceptron, which could distinguish between genders in pictures with a fair degree of accuracy. During this time, the design of expert systems and computational programs for problem-solving was also developed. Rapid improvements in computing technology allowed scientists to use specialized programs and basic software to apply artificial intelligence theories (Jiang, Li, Luo, Yin, & Kaynak, 2022).

2.1. AI Applications in Education

Various forms of artificial intelligence have been extensively adopted in education particularly by educational institutions (Kaul et al., 2020). The concept of AI arose with the invention of computers for processing information. It evolved into web-based intelligent learning systems and embedded computer systems that could solve problems like humans. This evolution has included the development of robots and web-based chatbots to solve complex tasks. Teachers can use intelligent machines to perform administrative tasks such as reviewing and grading students' assignments and customizing content based on students' needs using these technologies.

Incorporating artificial intelligence into teaching and learning contexts has created opportunities for advanced technology-enhanced learning tools (Hwang, Xie, Wah, & Gašević, 2020). Many applications of artificial intelligence have been classified according to their use. Sharma (2021) pointed out that applications such as Alexa, Siri and Cortana are used in conversation. Google published a tool for answering questions and inquiries called the Language Model for Dialogue Applications (LaMDA) platform. It is a computer system that uses AI to generate real conversations. AI learning analytics assist in analyzing student performance and predicting students who may be at academic risk to enable institutions to take proactive measures to provide guidance. The purpose of this data mining is to apply the techniques of predictive analytics by discovering patterns through student responses. Thus, AI-based data mining promotes personalized learning to enhance students' learning experience (Pratama, Sampelolo, & Lura, 2023). Personalized learning applications use AI to teach each student according to the student's interests, preferences and needs. For instance, applications such as Knewton are used to learn math and chemistry, and Duolingo is used to learn English. Some applications use AI to automate tasks in the education field such as dealing with attendance and creating books, quizzes, videos, and lesson plans.

Some AI applications such as Grammarly, boost writing skills for teachers by using AI to correct spelling errors and suggest modifications to the text to make writing easier, more efficient, and error-free. Other AI applications contribute to recognizing and processing images such as the Google Lens application, a visual search-engine tool developed by Google. The value of Google Lens lies in its ability to recognize and interpret visual information, offering users a range of functionalities such as image recognition, text translation, and acquiring information about artwork, historical landmarks and other objects of interest (Nguyen, 2021). AI applications called chatbots can help students advance their studies by answering questions. Examples of chatbots are ChatSim at the University of British Columbia and Socrates at the University of Illinois at Chicago (Lieblang, 2021). There are also applications for sentiment analysis that use AI to analyze the behavior of learners in an educational environment. This task can be challenging for teachers but AI applications such as Mind Lab and Affectiva facilitate the analysis of feelings. Another category of AI applications called digital-learning scorecards identifies students struggling academically. An example is Querium. Speech-recognition applications (e.g., Nuance) convert speech to text which helps teachers and students create textual content.

Yousuf and Wahid (2021) highlighted the diverse range of artificial intelligence techniques that can be used to construct reliable models of student behavior and classroom performance. These models can provide accurate, comprehensive analysis of students' performance by using a wide array of data. Moreover, machine learning and big data analytics are used to develop precise predictive models that consider various data points such as previous performance, classroom participation, and demographics, thereby offering accurate estimations of students' future performance.

UNESCO reported that AI could solve many of the problems the education sector suffers from, as the use of AI in the teaching and learning process leads to new teaching and learning methods (UNESCO, 2021). AI applications have proliferated rapidly in education reaching functions such as facilitating conversation, improving knowledge sharing, and promoting self-directed learning (Yousuf & Wahid, 2021). These AI tools reduce routine burdens on teachers by automating administrative and educational tasks, allowing teachers to focus on more critical educational activities. Moreover, these technologies provide personalized, individualized learning for each student based on the student's needs and learning style. These technologies also improve communication between students and teachers by providing convenient and effective communication tools.

Amado et al. (2024) examined how GAI tools are transforming academic settings. The study found that these tools have made curriculum planning, grading and administrative tasks more efficient. However, there are also concerns regarding data privacy and ethical issues associated with the use of these GAI tools. The researchers emphasized the need for developing training and guidelines to help institutions utilize these technologies effectively.

2.2. Challenges of AI in Education

Artificial Intelligence Board of America (2021) stated that integrating AI into education has several challenges regarding the need for public policies that governments should support, including providing financial, moral, and political aid (Zhai et al., 2021). One source of support comes through providing research centers related to artificial intelligence. Another challenge is teacher preparation as some teachers need more analytical and creative skills to implement artificial intelligence in academic settings.

Pedro, Subosa, Rivas, and Valverde (2019) found that the use of artificial intelligence in education is fraught with challenges particularly in ethics. The first and foremost challenge is to strike a delicate balance among factors such as bias, automation, ethics, privacy, fairness and transparency. The second challenge is to design instructional concepts that align with theories of knowledge and ethics and to prepare teachers to adapt to and support the evolution of artificial intelligence. The third challenge is technical learning which involves understanding systems, frameworks, and curricula and how to effectively implement them in educational environments. Finally, curriculum design must be adjusted to align with the features of artificial intelligence with a focus on achieving literacy goals for students in reading and writing. Kuleto et al. (2021) also found that the challenges of AI in education extend to provide individualized learning experiences for students and guiding teachers in the design of teaching methods tailored to diverse student needs. Chergarova et al. (2023) found that these emerging GAI tools are costly. As a result, users tended to use the free tools which have limited features.

The ethical implications of artificial intelligence in education are of paramount importance. The professor in charge of artificial intelligence at Ume University stressed the need for ethical considerations in teaching about the

uses of artificial intelligence. These considerations include supporting AI systems that prioritize human values, provide openness and interpretability and consider AI technology's social and ethical drawbacks. However, ethical considerations also extend to ensuring that AI systems respect data privacy, human rights, and accountability (Dignum, 2019). In addition, UNESCO emphasized the urgent need to provide fair access to AI technology and eliminate the inherent biases that can potentially hinder its equitable use.

2.3. Advantages of AI in Education
Khanzode and Sarode (2020) highlighted that the advantages of artificial intelligence are extraordinary, marking a definitive evolution in the history of artificial robotics. Some of the main benefits of AI include completing tasks more rapidly than humans simplifying stressful and complex work, accomplishing difficult tasks in a short period, multitasking various functions simultaneously, achieving a high success ratio with fewer errors and defects, enhancing efficiency in a shorter time frame, requiring less space and smaller size, and handling calculations for long-term and complex situations. The integration of artificial intelligence in education offers numerous advantages. AI-based teaching and learning systems enhance both teaching quality and student learning outcomes. For example, Latin American countries have adopted platforms such as the Mathematics Adaptive Platform and MecFlix which personalize learning experiences and provide targeted assistance to students preparing for exams (Al Dhaen, 2022). AI tutoring systems equipped with algorithms for computer-generated assistance can supplement or even replace traditional teaching methods, as seen in the case of chatbots. These chatbots have been shown to significantly enhance learning outcomes and student satisfaction by delivering personalized support and feedback.

AI systems reduce the lecturing burden on teachers, freeing time for other tasks and facilitating collaboration among learners by forming adaptive groups and summarizing discussions. AI technology enables the automation of grading, enrollment processes, and advisory services. Furthermore, AI enhances personalized learning experiences by tailoring content and coursework to individual student needs, ultimately improving student performance. Finally, AI is crucial in preventing academic misconduct through the detection of plagiarism and the use of facial recognition technology for exam invigilation. AI's integration in education revolutionizes teaching and learning processes making them more adaptive, more efficient and more personalized.

In addition, Maphoto et al. (2024) conducted a qualitative study to investigate the potential impact of GAI tools on enhancing students' writing skills in an academic setting in South Africa. The study revealed that the use of these tools in teaching and learning can be beneficial when they are used purposefully and creatively to improve students' writing and innovation skills. The study highlighted the importance of making a balance in the use of GAI tools with traditional teaching methods. It was suggested to provide guidelines, training programs and user-friendly tools to ensure effective classroom utilization.

3. Methodology
3.1. Research Design
The current study is an exploratory study using a mixed-methods approach incorporating qualitative research design and quantitative research design. The study's goals are as follows: (a) Explore the impact of replacing traditional software with GAI technologies on students' overall learning experiences in the course. (b) Examine the impact of integrating these GAI tools on students' learning performance in completing coursework compared to the traditional tools. (c) Understand the potential opportunities to enhance students' learning experiences by integrating this GAI technology into the course curriculum. (d) Identify the challenges that emerge with integrating this GAI technology into the course curriculum. In the end, this study provides practical recommendations for teachers, policymakers, and educational institutions on effectively leveraging emerging technology in higher education settings.

3.2. Instruments
The study used three types of research instruments: focus group discussion, reflection, and questionnaires. The focus group discussion explored the impact of replacing traditional software with GAI technologies on students' learning experiences in the course. Thirty-two students participated in the focus group discussion which took place online through Google Meet. There were three goals in having the focus group discussions: (1) Gather in-depth insights from students about their experiences and perceptions of using GAI tools in their coursework. (2) Explore the benefits, challenges and potential ethical considerations of GAI integration into education. (3) Identify effective strategies for implementing these tools to enhance learning outcomes.

Reflection essays were used by the study's author at the end of the semester to further explore students' perceptions about their experiences of using GAI tools in conjunction with traditional tools to complete their work. Each student wrote a reflection essay after completing each assignment. These were the guidelines for students to use in writing a reflection essay: the type of technology tool they used (GAI or traditional); why they selected it; a comparison of the advantages and disadvantages of both tools (e.g., traditional mind map tools versus GAI mind map tools) in helping them complete the task; the difficulties they found; the quality of the product; and any additional comments regarding the use of the GAI tool.

The questionnaire for this study was developed by the study's author. It aimed to measure the impact of GAI tools on the learning process in terms of the GAI tool's effects on supporting students in completing course assignments. The questionnaire consists of four parts. The first part contained three items about the student's demographic information: email address, student ID, and academic year at the university. The second part contained five items about the benefits of GAI tools to the student. The third part consisted of seven items about implementing GAI tools in teaching and learning practices, specifically in completing the course assignments. The fourth part consisted of two open-ended questions to seek students' perceptions about the positive and negative sides of using these GAI tools in their coursework. This questionnaire uses a 5-point Likert scale with these options: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree. Participants were told to select the option that best reflects their opinion for each statement. Content validity was verified by a

group of four experts in instructional and learning technologies at Sultan Qaboos University.

3.3. Overview of the Sample

The selection of participants in this study is purposeful due to ease of accessibility. The representative sample consisted of undergraduate students who enrolled in TECH 3006 during the academic year 2023/2024, specifically in fall 2023 and spring 2024. The current study was carried out during the instruction of the course. The total number of students who participated in this study was (N=65), (n=32) in fall 2023 (14 females and 18 males), and (n=33) in spring 2024 (14 females and 19 males). Out of the 65 participants, 56% were male (n=37) and 43% were female (n=28). All participants were from the English department within the College of Education at Sultan Qaboos University. Each participant had a beginner-level understanding of technology integration in teaching and learning practices. They were unfamiliar with instructional design models such as the ADDIE and TPACK models. Additionally, they lacked skills in designing interactive presentations, videos, and mind mapping. This course aims to empower students with principles, models, and skills of learning technology that they can apply in their careers. The learning experiences of students in the course were similar for both groups and no changes were made to the course syllabus.

3.4. Setting

The study was conducted in the context of "TECH 3006: Technology for Learning", a course focused on integrating technology into education. The course covers a variety of learning technology production, including mind mapping, lesson plans, interactive presentations, interactive videos, assessments, and websites. A variety of instructional design models (e.g., TPACK, ADDIE, and ASSURE) were involved. Various performance-based assessments were used to deliver this course, including individual and collaborative assignments. The course is designed to provide theoretical and practical content and hands-on experience, to empower students with the required knowledge and skills.

In this study, the emerging GAI technologies were introduced in addition to the basic or traditional educational software and programs for creating educational content mentioned above. Therefore, the context of this study aimed to explore students' learning experiences and the potential opportunities and challenges associated with their implementation of this new generation of technologies.

These were the criteria used when selecting the current course for this study: (1) the course offered easy access to participants through the teacher. (2) The course included content generation in different formats (e.g., video, mind map, lesson plan, and engaging presentations). (3) The course is offered each semester, which offered the opportunity to conduct this study with multiple participants.

3.5. GAI Tools

These were the GAI tools implemented in this course along with traditional technology:
- GAI mind map (e.g., Whimsical and Xmind).
- GAI lesson plan production (e.g., NearPod and Curipod).
- GAI presentation production (e.g., NearPod and presentation AI).
- GAI video production (e.g., Steve AI).
- GAI assessment production (e.g., Edupuzzel and Flipgrid) was used by embedding it in lesson plans, interactive presentations, and other activities.

Whimsical. The Whimsical program is powered by GAI to create mind maps. This website has several advantages that make it an attractive choice for users. First, it is free to use with the option to upgrade to a paid account for additional benefits. Additionally, the program supports the Arabic language, making it user-friendly for Arabic speakers. The standout feature of Whimsical is its GAI allowing users to input concepts and ideas that the AI then uses to generate content. This function streamlines the process of creating mind maps and aids in organizing thoughts effectively. Furthermore, Whimsical offers a variety of pre-made templates and use cases, such as whiteboards, notes, and multi-purpose diagrams. This feature enables users to customize their diagrams according to their needs and uses. Finally, Whimsical allows for downloading and sharing, enabling users to download diagrams and share them with others as editors or viewers. Finally, they can share them collaboratively with teams through an electronic wall, facilitating collaboration and teamwork.

Nearpod. Nearpod is a collaborative tool that facilitates real-time communication between teachers and students. It empowers teachers to create lesson plans and interactive presentations, enabling them to create quizzes, exams, or even opinion polls to deliver content to students. Additionally, it provides the capability to track student achievements in real time. Nearpod is an award-winning educational program that engages students in interactive learning experiences. With Nearpod, students can participate in lessons featuring virtual reality, 3D objects, PhET simulations, and much more.

Curipod. Curipod is an AI platform encouraging teachers to design interactive digital learning environments. It allows teachers to create slides containing various activities such as surveys, graphics, questions, and more to engage students and pique their curiosity. Additionally, Curipod provides feedback and insights into student learning and progress, allowing teachers to monitor students' understanding and improve their progress.

Steve AI. Steve AI is an innovative AI-powered video-making application designed to streamline the creation of animation and live-action videos. It offers users a quick and cost-effective solution. Steve AI caters to diverse video-making needs with features including text-to-animated video, cartoon video creation and YouTube video generation.

3.6. Procedures

At the beginning of the course in two semesters (fall 2023 and spring 2024), the course instructor (an author of this study) introduced the study to students including its objectives. The teacher also explained the students' role in the research and the evaluation methods. The teacher explained that students' participation is voluntary and they can withdraw from the study at any time. The course syllabus was customized to meet the purpose of the

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study. GAI tools were added to course activities and assignments in addition to the related traditional technologies.

When the teacher was teaching the course, students were exposed to both the traditional tools and the GAI tools. The teacher allowed students to select the tools they would like to use to perform the assignments of the course. For example, students had the choice of whatever they preferred to use such as any traditional mind mapping software, the GAI Whimsical application, any other GAI tool, or any conventional tool such as Coogle or Xmind to design the mind map. For fall 2023, the teacher asked students to write a reflection essay about their experiences after they completed each assignment. In addition, at the end of the semester, a focus group was conducted for the students to explore their experiences with using GAI tools and traditional tools. For spring 2024, students were asked to respond to questionnaires online through Google Forms at the end of the semester.

3.7. Data Collection

Ethical approval to conduct this study was received from the university's affiliated entity. The information shared through this study is kept confidential. The only identifiable information collected from the participants on the questionnaires was data related to email and academic year. In addition, any identifiable information gathered from the focus group discussion is kept strictly confidential, accessed only by the authors and used only for research purposes. Pseudonyms were used to interpret the collected data to protect participants' privacy (Maxwell, 2013).

The period of data collection for this study was one academic year (fall 2023 and spring 2024). Data collection started by asking each student to write a reflection essay after completing each assignment. The following three reflection essays were written: Reflection one is about the mind map tools, reflection two is about the lesson plan and interactive presentation and reflection three is about the interactive educational video. Students were asked guiding questions. For example, students reflected on the following questions on performing the video production such as describing their experience using AI-generative tools to generate the transcript and create the interactive video using AI tools. Do you like it? What do you like about it and why? What do you dislike about it and why?

At the end of the fall 2023 semester, the focus group discussion was conducted online through Google Meet. It was recorded and lasted 42 minutes. The focus group discussion questions were developed to explore students' attitudes and experiences toward using GAI tools, the perceived benefits of these tools, the challenges and ethical considerations the students experienced when they implemented AI tools in their assignments, and the perceived pros and cons of these technologies. At the end of the only the spring 2024 semester, questionnaires were conducted; they took 5-10 minutes to complete. Thirty students responded to the questionnaires online through Google Forms. The open-ended questions provided insights into the positive aspects and negative aspects that students perceived based on their experiences.

3.8. Data Analysis

Qualitative analysis was applied to analyze the data from reflection essays and focus group discussions. Thematic analysis was conducted. To analyze the reflections essays, they were read line-by-line, and open codes were generated. Constant comparison analysis was applied by grouping the data into units for open coding. Themes were united into organizational themes after reading and coding all the reflections (Onwuegbuzie, Slate, Leech, & Collins, 2009). This thematic analysis was an iterative process of analysis. Thus, an ongoing change is made to reach an accurate interpretation (Saldana, 2016). Similarly, thematic analysis was used to analyze the focus group discussion data. The process included listening to the recording several times along with writing notes. A script was produced to start open coding. The script was read to understand participants' points of view and to generate the initial codes. Then, after iterative analysis and revision, these codes were grouped into themes to create organizational themes.

A paired sample t-test was conducted to compare two means of a dependent quantitative variable to analyze questionnaire data. The test was also conducted to examine the effect of GAI tools on students' learning performance in terms of completion of course assignments and the overall effect of GAI tools on the learning process.

3.9. Validity and Reliability

The validity of questionnaires was evaluated using content validity with four subject matter experts reviewing them. The experts' feedback was taken into account to make the suitable adjustment. The questionnaires aimed to measure the impact of GAI tools on teaching and learning specifically their implications on students' performance in completing course assignments compared to traditional tools. For instance, the study sought to determine whether students used GAI to produce interactive videos. The data gathered through questionnaires revealed whether the GAI helped or hindered students in their course assignments.

The reliability of the qualitative part of this study was achieved through triangulation. The questions of the focus group discussion were constructed to explore the impact of replacing traditional software with AI technologies on students' learning experiences. In addition, reflections were used to examine students' experiences with using GAI in completing assignments. Data obtained from both instruments provided data to address the questions of the current study.

4. Results

The study's results were obtained from the following three sources: focus group discussions, students' reflections, and questionnaires. The goal was to understand the multifaceted effects of integrating GAI tools into the course curriculum.

4.1. Focus Group Discussions

Key findings of the focus group discussions can be grouped into the following five themes:

4.2. Time Efficiency and Productivity

Students highlighted the significant time-saving aspect of using GAI tools compared to traditional tools. GAI significantly reduced the time required to complete tasks such as creating mind maps and interactive educational videos. Participants said, "It was exciting to see how AI can save us so much time."

4.3. Creativity vs. Efficiency

There was a recurring concern about the potential trade-off between using GAI tools for efficiency and maintaining creativity. Some students felt that over-reliance on GAI might hinder creativity. Others suggested that while GAI tools can provide a starting point or generate ideas quickly, it's essential for students to add their own creativity and personal touch to the content. Participants stated, "If we over-rely on AI, it can hinder our creativity or ability to learn and create original content."

4.4. Quality and Authenticity

Concerns were raised about the quality and authenticity of content generated by GAI tools. Students noted instances where GAI content lacked a human touch especially in videos where the voice sounded flat and the visuals could have been more engaging. Participants stated, "when you see the video, you can instantly notice it was created using AI. The voice is flat with no intonation or tone in the voice."

4.5. Ethical Considerations

Several ethical considerations were discussed including plagiarism, authenticity, and privacy issues. Students highlighted the importance of citing GAI content properly and being cautious about relying solely on GAI for information or content creation. In addition, students reported that they should be careful about not sharing sensitive data and personal information on GAI tools. Participants reported, "what about the ethical issues? It's also essential to develop the policy for the students and the teachers." In addition, concerns were raised about the security of personal data when using GAI tools and the need for clear policies and guidelines for ethical GAI use.

4.6. Challenges and Improvements

Participants in this study raised challenges such as the cost of some GAI tools, biases present in GAI content, and the need for better user interfaces to enhance accessibility and user-friendliness. Additionally, the limited features of free GAI tools were highlighted as another concern. Suggestions for improvement include establishing clear policies for GAI usage and finding a balance between efficiency with creativity to address these issues.

4.7. Students' Reflections
4.7.1. Students' Perceptions of Mind-Mapping GAI Tools

The majority of students selected to use a GAI tool to generate the mind map assignment. One participant stated, "for my assignment on analyzing a literary short story using the TPACK Model and creating a mind map, I chose to use the AI mind map tool Whimsical." Some participants used the GAI and traditional tools to complete the assignment. It was reported that they used GAI tools (e.g., Chatmind.tech) to generate the main ideas and sub-ideas with illustrative examples. Then, they transferred to the traditional tool (Xmind) to add more information and related images. One student reported this:

> First, we used the "chatmind" A.I. tool to generate the base of the mind map. It designed a mind map with eight subtopics for the main topic (speech types in English). Then, under each subtopic, there was a list of examples and characteristics of each speech type. After that, we exported the map to XMind to add a definition for each speech type and suitable images [and made the] final aesthetic touches to the design for better readability and navigation.

Participants' reasons for selecting GAI tools were to learn more about these emerging technologies, to explore how they work, and to produce engaging content. One participant reported, "I decided to select AI for completing this assignment because I am curious about how it could support creating mind mapping and how it will look." Another student indicated that they selected GAI because of its unique features:

> I selected Whimsical for a few reasons: (1) User-Friendly Interface: Whimsical has an intuitive and user-friendly interface, making it easy to create a mind map without a steep learning curve. (2) Collaboration Features: It offers real-time collaboration features, which were useful as I could work on the mind map with my peers, making brainstorming and analyzing the story easier. (3) Customization: Whimsical allows for customization with different shapes, colors, and formatting options, helping me visually represent my analysis effectively.

Regarding the comparison of traditional tools and GAI tools, participants reported that GAI tools make the mind map more engaging and compelling compared to conventional tools. In all reflections, the participants reported that GAI tools produce relevant ideas and concepts in seconds because of the automation feature and make connections between them without human effort compared to the traditional tool where users should write the inputs manually which takes time to brainstorm ideas and draw the visual connection among the ideas. On the other hand, traditional tools can work without an Internet connection (e.g., download applications onto the desktop for offline work) whereas GAI tools cannot function without the Internet.

Regarding the advantages and disadvantages of GAI mind maps, participants stated that tools like *"Whimsical and EdrawMind"* have significant features of real-time collaboration especially when working on group projects. The tool offers easy storage and access to the developed mind maps reducing the risk of losing hard copies. Moreover, students experienced that GAI mind map tools have plenty of samples that help to produce an excellent mind map and have content-suggestion features based on the topics or keyword inputs. For example, participants commented that students with the GAI tools pick up colors, shapes, and figures from a very large set and insert them just with the click of a button. Students do not need to waste time searching for information because the mind map program is already connected to the information network. A sequential series of information will appear in the blink of an eye as the student writes the topic inside the box and clicks it. The participants indicated that GAI

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mind maps save time and effort, provide various information, figures, symbols, and help students summarize information.

The disadvantage of GAI mind map tools is their dependence on the Internet. Furthermore, some GAI mind map tools may require a subscription or payment and can't easily be exported to image or Portable Document Format (PDF) format. Besides, participants need to check the validity of the information generated by GAI mind maps. Some participants reported that the diversity of buttons in the GAI tools makes it difficult at first, but once the student gets used to it, it becomes easier than expected. Students may struggle to link ideas and concepts together, but GAI mind maps make it much easier.

On the other hand, participants pointed out the advantages and disadvantages of traditional mind map tools forcing human brains to come up with ideas, and users have complete control over the design and layout of their mind maps. However, it takes a long time to finish the mind map. One participant commented, "Traditional mind map tools take longer time, but they encourage students to search and learn. On the other hand, AI tools are easier and faster. However, AI mind map tools don't require any effort or search as students will produce them with a click of a button." Another participant compared both tools by indicating that AI tools are easy to use and generally look better regarding visuals and design. However, they cost money most of the time, and the information generated might be irrelevant or wrong altogether. On the other hand, traditional tools like XMind are versatile and not too difficult to use with some practice. It allows for more freedom and flexibility with element design.

Most participants said that students should not depend on AI tools to complete the assignments. Teachers must encourage students to use GAI tools aside from their search to develop critical thinking skills and learn from their search process through these tools.

4.7.2. Students' Perceptions of the Production of Lesson Plans and Presentations Using GAI Tools

Regarding the use of GAI tools to generate interactive lesson plans and presentations, opinions differed among participants. Some participants expressed appreciation for using GAI tools to produce the lesson plan. One student stated, "Our experience was positive and amazing." GAI tools help create interactive lessons using activities such as open questions, polls, word cloud, drawing, and AI feedback. Students reported, "We would say that we're really blessed with this feature that with a click of a button will create a whole lesson according to your desired topic." For the teacher, GAI tools are beneficial tools that save the teachers' time and help them choose the activities that best conform to the level of their student's grades.

In addition, most participants commented that the advantage of GAI lesson plans (e.g., Curipod) is that the teacher can adjust the activities and the text once they download the ready-made lessons. Moreover, it's wonderful that teachers can set time slots for each activity which helps with time management. One participant stated, "What I appreciate most about Curipod is its seamless ability to generate comprehensive lesson plans."

Some participants stated that they did not like having GAI tools create a lesson plan because the GAI tools offered were not suitable for them. Participants reported some disadvantages in addition to the advantages of GAI tools: reliance on technology that might provide irrelevant or inaccurate information and limitations in templates and images that make it difficult to enrich the presentation.

4.7.3. Students' Perceptions of Video Production Using GAI Tools

Students used various programs to generate the script and video in the video-production assignment. For instance, participants reported that using GAI tools was more complicated. Students attempted to use Steve AI to produce a short video but it took hours to make what they planned to have in the video. This process involved changing the scripts many times, including the characters. However, the final production was unsatisfactory because the texts that should have appeared in alignment with the pictures were not obvious and some lines of text did not appear at all. Moving to the next step in video production, some students tried Vyond which is traditional technology and their experience with it was better because it allowed them to choose the length of the video. It has some disadvantages such as the limited number of characters. Furthermore, the option to edit videos was not accessible. Some of the editing options were not offered except in the premium version, so the quality of the videos was not high. In terms of interaction, the video could not be made to be more interactive with the audience. It was still rigid to some degree and this inflexibility went back to its rigidity in applying the features. The GAI tools in producing videos were not successful based on our students' experience, since the students lost a lot of time trying to create the best videos. In addition, the limited editing options available in the GAI tools restricted the students' creativity in making videos.

4.8. Results of Questionnaires
4.8.1. The Effect of GAI Tools on Students' Learning Performance

Thirty participants responded to the questionnaires at the end of the spring 2024 semester. A paired-sample t-test was conducted to analyze the impact of the GAI tools on students' learning performance, specifically on students' performance in completing course assignments. Before executing any statistical analysis, it is important to check that none of the assumptions made by the individual tests are violated. Descriptive analysis was performed and the mean and standard deviation values were recorded, as shown in Table 1.

Table 1. Descriptive statistics.

No.	Pre-post test	Mean	N	Std. deviation	Std. error mean
1.	Pre-test	36.00	30	0.00	0.00
	Post-test	43.40	30	7.95	1.45

Based on the values from Table 1, there is an increase in the mean of the post-test scores. In the pre-test section, the mean score was 36.00 while in the post-test score, it is 43.40. Therefore, the results show an increase in students' mean scores in the post-test.

Table 2 shows the results of paired sample tests. The final column, labeled Sig. (2-tailed) shows a probability

(p) value. If this value is less than .05 (e.g., .04, .01 and   .001), it can be concluded that there is a significant difference between the two scores. The t value is -5.09 and the degree of freedom is (df = 29). The mean difference in the two scores is -7.4 with a 95 percent confidence interval stretching from a lower bound of -10.37 to an upper bound of -4.42. Hence, there is a significant difference somewhere among the mean scores on the dependent variable on students' learning.

Table 2. Paired samples test.

No.	Paired samples test	Paired differences					t	df	Sig. (2-tailed)
		Mean	Std. deviation	Std. error mean	95% confidence interval of the difference				
					Lower	Upper			
1.	**Pair 1** Pre-— post-tests	-7.40	7.95	1.45	-10.3	-4.42	-5.09	29	0.00

     The effect size for the paired-sample t-test must be calculated from the following formula: =0.47 to understand the magnitude of the intervention's effect.

     According to Cohen (1988) the effect size for this construct is small. From the eta squared value of 0.47, it can be concluded that there has been a small effect with a substantial difference in GAI usage on perceived learning.

5. Discussion

     The present study was designed to examine the impact of integrating GAI tools into coursework on students' learning experiences compared to using traditional tools. As noted in the literature review, GAI tools help simplify complex and stressful tasks allowing users to complete difficult tasks more quickly than humans (Khanzode & Sarode, 2020). The results of this study showed that some participants chose to use GAI tools to complete their assignments due to the significant effort required to complete tasks with conventional tools. However, most participants preferred a combination of GAI tools and traditional tools (see Figure 1). This preference for using GAI tools alongside traditional tools is further supported by Maphoto et al. (2024).
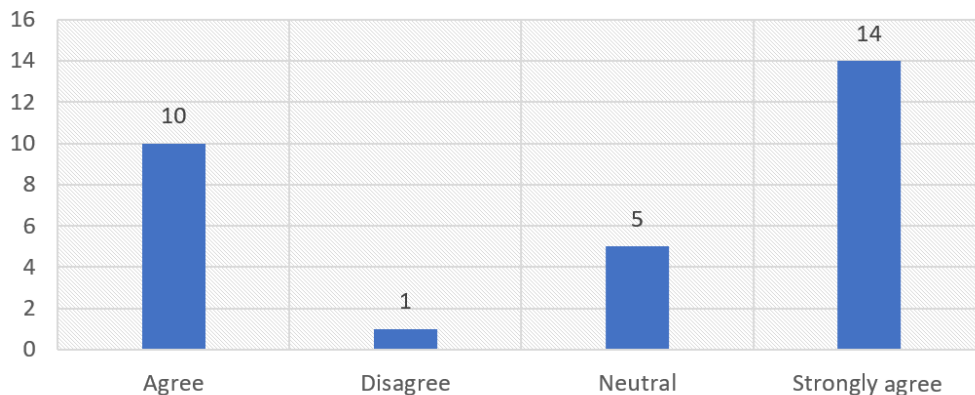
Figure 1. Students' perspectives on the benefits of GAI tools.

     In addition, previous studies associated the benefits of GAI tools with enhancing personalized learning in which students select the preferred tools to complete their assignments (Pratama et al., 2023). Students learnt about both traditional tools and GAI tools through their search to get their work done. In this study, students completed their assignments through both traditional tools and GAI tools based on the topic of their interest and their search. In addition, it was reported that GAI tools offer collaborative space among students to learn from each other and to complete their work simultaneously.

     Regarding the challenges of GAI tools, the current study found that there is a need for preparation for teacher to enhance their creativity in innovating new pedagogy of teaching with the use of GAI tools to prevent the encountered challenges such as the cost of the tools, restricted features, and complex interface. This is consistent with the findings reported by Hwang et al. (2020) which asserted that integrating AI in Education (AIED) has unveiled new possibilities for teachers and students to design better learning experiences. Similarly, it aligns with UNESCO's report that GAI leads to innovating new ways of teaching (UNESCO, 2021). In addition, this study asserted the need for policies and guidelines at the level of institutions to regulate the use of these emerging technologies for teachers and students alike. These findings align with those of previous studies (Amado et al., 2024; Dignum, 2019; Pedro et al., 2019; UNESCO, 2021). Surprisingly, this study showed that GAI tools limited students' creativity because they made students dependent on these smart tools to create content. In addition, the free version of these tools did not include advanced features of editing needed to use their creativity to improve the videos. As a result, a suggestion that emerged in this study is to create new teaching methods to integrate GAI tools effectively in a course's curriculum to make students more creative and innovative by using these emerging technologies. This finding aligns with the findings of Maphoto et al. (2024) that GAI tools can be effective when they are used purposefully to create innovative teaching methods. Finally, this study's results indicate that students preferred using the free feature of GAI tools aligning with the findings of Chergarova et al. (2023). Consequently, participants showed a preference for the limited available features.

6. Conclusion

This study aims to explore the impact of GAI tools on teaching and learning practices focusing on students' learning experiences and performance compared to traditional tools. This study found that most students in the intended course selected GAI tools besides traditional tools to complete their assignments because of their curiosity to explore the affordances of these GAI tools in education. As a result, the current investigation found that the impact of GAI tools resides in their benefits: time-saving, efficiency, and creativity in producing different types of digital content. It was suggested that GAI tools could be used as a starting point for generating content, and then students would add their creativity to it. Furthermore, the most striking result observed is that GAI tools offer real-time collaboration for group work and easy accessibility to content since these tools are cloud-based.

In addition, two of the main challenges with using GAI tools in teaching and learning are the issues of quality and authenticity. For example, some content can't be humanized by GAI tools such as sound in videos which minimizes the quality of the produced content. Moreover, other challenges revealed are plagiarism and privacy issues regarding copyright and feeding AI tools with sensitive personal information and data. Cautions are needed, and policies and guidelines must be created by the institutions for both students and teachers.

There are additional challenges of GAI technologies. Research has shown that the cost of some GAI tools is a factor limiting their optimal use, there is concern about biases in GAI content and there is a need for better user interfaces to make GAI tools more accessible and user-friendly. Finally, another concern with using GAI tools in the teaching and learning process is that they may provide irrelevant or inaccurate information. Regarding the effect of GAI tools on students learning performance, this study's finding reported a significant difference among the mean scores on the dependent variable on students' learning. The findings reported in this study shed new light on the teacher's role in encouraging students to use GAI tools in their learning process in a way that will develop critical thinking skills. Greater efforts are needed to ensure the effective implementation of GAI tools in teaching and learning processes in terms of developing clear policies and guidelines for GAI use in higher education.

7. Recommendations and Implications

Future studies are recommended to repeat this study with other sections with a large sample size to validate its findings. Furthermore, a comparative study could be designed to assess the long-term effects of GAI tools on students' learning experiences and performance with a wide range of AI tools. For instance, a study will be designed for two years with multiple sections in the same course. As a result, best practices for using GAI tools will be provided and can be used as a roadmap for other faculty in the university. Moreover, the use of these tools in classroom settings will provide institutions with insights into the advantages and disadvantages of incorporating these emerging technologies in teaching and learning practices. This understanding will help institutions to establish policies, regulations, and guidelines for the use of GAI tools in academic settings as these smart technologies are rapidly evolving and transforming education.

8. Limitations of the Study

The major limitation of the current study is the small sample size which did not allow examining the effect of GAI tools on students' learning performance at a large scale. In addition, this study is limited to a short implementation time of only two semesters. Various GAI tools should be used to complete the course's assignments.

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