RESEARCH ARTICLE

Discourse analysis on experience-based position of science, mathematics, and Tech-Voc educators on generative AI and academic integrity

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ABSTRACT

Artificial Intelligence (AI) could encourage simulation of human intelligence in machines that are programmed to perform tasks that typically require human intelligence. These tasks include reasoning, learning, problem-solving, perception, understanding natural language, and even decision-making. Previous studies noted the importance of assessing the use of technology in education considering its potential implications in the student's learning and development processes. Hence, this study explored the potential implications of AI particularly in science, mathematics, and technical-vocational education. Educators (n=20) were purposively sampled to be interviewed about their experiences in using AI in their classrooms. The findings suggested a positive perception of generative AI among educators, with many acknowledging its potential to enhance educational practices and outcomes especially in aiding the understanding science concepts, facilitating analytical skills development, and personalizing learning experiences. However, alongside their positive perceptions, educators expressed concerns about potential drawbacks associated with AI use in education. These concerns included the risk of overreliance, plagiarism, and inaccuracies in AI-generated content. To mitigate these negative impacts, educators emphasized the importance of implementing effective policies and guidelines for AI use in classrooms such as guiding students on ethical use, ensuring transparency in AI tool usage, and establishing clear instructions for ethical AI utilization. Transparency emerged as a key theme, with educators emphasizing the need for transparency regarding students' outputs and the extent of AI use. This study calls for further analysis about the level of acceptance of educators in AI use and assess its impacts on students' short-term and long-term learning outcomes.

Keywords: science and mathematics educators; generative AI; academic integrity

1. Introduction

Generative AI has rapidly expanded its footprint of use in educational institutions. It has been embraced by students, faculty, and staff alike[1]. Chat models are programmed to respond to context-specific prompts from different fields and disciplines. AI chat models grow in popularity because of their accessibility and convenience[2]. However, some scrutinizes the logistical and ethical challenges such as the reliability of AI detectors that educators confront when attempting to assimilate this nascent technology into long-standing curricular structures[3].

In recent years, breakthroughs in AI technology have resulted in tremendous progress in its general adoption and utilization. The advancements in AI have brought forth advanced content-generation models that enable users to rapidly create a wide range of items, including digital video and writing samples, using straightforward text-based queries[4-6].

The purpose of this study was to explore the perceptions of mathematics, science, and technical-vocational (tech-voc) educators about the use of AI in education. This was a preliminary study that gathered data about how positive or negative were the educators in the use of generative AI in education.

To incorporate technology into education, it is crucial to address key factors like problem identification, selection of technology aligned with learning goals, and formulation of methods for optimal utilization of technology[7]. Furthermore, it is imperative to consider other factors, such as the presence of sufficient infrastructure and skilled personnel to oversee the integration of technology in education[8]. Teachers must possess a sufficient comprehension of the technology employed and possess the ability to effectively utilize it in the educational process[9]. Teachers must acquire new proficiencies and abilities in successfully managing the integration of technology in the learning process[4].

Generative AI, like the ChatGPT, is widely used in different fields. ChatGPT's capabilities have been praised as being remarkably impressive, while others have characterized it as highly productive, efficient, and continuously improving[10]. It is accessible to all users without any restrictions, unlike other AI-driven content generators[11]. ChatGPT has showcased its competence by successfully passing a Law school test[12] and a Master of Business Administration (MBA) exam[13]. Stokel-Walker[14] noted that some responses exhibit exceptional clarity, thorough study, and proper referencing. Despite its limits and ethical concerns, like previous language models, this tool has significant consequences for academic integrity[11].

Artificial intelligence in education (AIEd) is a developing field that combines AI technologies with education to revolutionize and enhance instructional methods, learning design, and assessment[15]. Furthermore, AIEd could help in enhancing student-centered learning such as facilitating adaptive tutoring[16,17], recommending individualized learning resources[18,19], and detecting students' learning gaps[20].

However, science and mathematics education are composed of complex educational structures of interrelated elements such as the instructor, student, information, media, and environment[21]. To have high level of science and mathematics education, it is necessary to thoroughly contemplate the many social, pedagogical, and environmental elements, rather than merely integrating AI technology in education[21,22]. On the other hand, technical-vocational education trains vocational skilled personnel to execute tasks using digital tools, operate facility production utilizing interface machine people, improve professionalism with digital media and system aid, and develop cooperative work structures[23,24]. The development of AI in vocational education is still in its early stages, making it challenging to sufficiently evaluate opportunities and threats[25].

With the rapid adoption of Generative AI technologies, there is significant interest in understanding how these tools are being received and utilized within educational settings. The focus is on academic integrity,

examining both the positive and negative views held by educators. Key areas of concern include the reliability of AI detectors and the ethical implications of incorporating AI into established curricular structures. The study highlighted the importance of addressing logistical challenges, ensuring adequate infrastructure, and equipping teachers with the necessary skills to effectively integrate AI technology into their teaching practices.

1.1. Literature review

AI is rapidly transforming various aspects of society, including education. Understanding teachers' perspectives on this disruptive technology is essential, given its potential to revolutionize the teaching and learning process[26]. Generative AI has revolutionized the field of higher education, and sparked debates on the potential of tools such as ChatGPT, Humata.ai or Sudowrite in teaching, learning and assessment processes[27]. The ChatGPT tool has led to an exponential expansion in the use of artificial intelligence in different fields, not only in education[13,14,28].

AI could be used as an educational tool to facilitate teaching and develop students' performance by including AI systems and applications in the curricula[29]. However, the successful implementation of new instructional technologies can be attributed to the attitudes of the teachers who lead the lesson[30]. Examples of AI approaches in education include generating personalized student learning recommendations, autograding essays, and improving educational resources[31]. AI-based educational tools focus on assessing the effectiveness of these technologies, identifying the hurdles faced in incorporating AI into teaching methods, and determining the support and development needed to leverage AI effectively[32].

The acceptability of AI use in the classroom by science teachers showed positive correlations with self-efficacy, ease of use, expected benefits, attitudes, and behavioral intentions[33]. New technologies, such as AI and machine learning, have the power to revolutionize science, as has been demonstrated in the past and is occurring again with these emerging computational tools[34].

Moreover, the teachers' perceptions of integrating AI into science lessons reflects the connection between AI and science, the challenges encountered when implementing the AI lesson package, and recommendations for improvements[35]. Learning math is considered a great challenge for many students[36]. The integration of AI in mathematics education offers personalized instruction, fosters critical thinking skills, and prepares Generation Alpha students for the demands of the digital age[37].

AI poses a challenge for HEIs and faculty members, highlighting the importance of improving and disseminating integrity policies across academia[38]. COVID-19 has also increased the risk of academic integrity violations using remote and virtual rooms[39,40]. Academic integrity depends on honesty, responsibility, transparency, and trust, and dishonesty undermines these values. Academic dishonesty can take various forms, such as plagiarism, inappropriate partnership, cheating on tests, copyright breaches, complicity, data fabrication, and bibliographic reference falsification[41-48].

The implementation of orientation and ethics programs, along with seminars on academic integrity, academic writing, and reference styles, has been proposed to discourage plagiarism in academic writing between learners and the academic community[49-51]. Similarly, the proposal to establish and enforce an academic integrity code, which includes articulation of the consequences for academic misconduct, was recommended as an intervention and has been linked to reduced occurrences of academic dishonesty[52-53].

Academic dishonesty has been studied from various aspects, including the prevalence[54-56] and advancements in technology to detect it[46,50,57,58]. Despite the extensive literature on academic integrity and the use of AI tools, some gaps remain. For instance, Gamage et al.[59] called for more research on ethical issues related to AI tools while Abd-Elaal et al.[60] argued that more research on AI can increase academic confidence.

Blau and Eshet-Alkalai[61] emphasized the necessity of investigating what drives young people to engage in ethical misconduct in HEIs.

It becomes all too perceptible that students call academic integrity into question with the use of AI tools, which justifies the motivation for conducting the study presented here. The widespread availability and ease of use of AI tools, such as generative AI for writing assistance, introduce new challenges to maintaining academic honesty. Students may perceive AI-assisted writing as their own work, blurring the lines between original thought and AI-generated content. This perception can lead to increased instances of academic misconduct, as students might rely on AI to produce work that they submit as their own, which undermines the principles of academic integrity.

2. Research questions

This study analyzed the perceptions of science, mathematics, and tech-voc educators about the use of generative AI in classrooms. Below were the questions sought to be answered in this study.

- How educators use generative AI in education?
- What were the perceptions of educators about the concept of academic integrity?
- What were the negative perceptions of educators in the use of generative AI?
- For educators, how to maximize the use of generative AI in classrooms considering their concerns?

3. Methods

The study aimed to analyze the experience-based position of science, mathematics, and Tech-Voc educators on generative AI and academic integrity. The researchers conducted interviews and collected qualitative data to identify the experiences, opinions, and perspectives of the educators regarding the use of generative AI in their classrooms. Researchers aimed to explore how educators see and assess the connections these two areas by conducting interviews and evaluating qualitative data.

3.1. Research design

The current study followed an exploratory research design and used qualitative research methodologies, specifically one-on-one interviews. The primary data gathered for this study was used as supporting evidence for additional theoretical and developmental assessments.

Exploratory design is a type of research methodology used primarily when the subject or problem being studied is not well understood or lacks a substantial amount of prior research. The main goal of exploratory design is to explore and gain insights into a phenomenon, develop a deeper understanding, and identify key variables and relationships that can form the basis for further, more structured research[62-64].

3.2. Sampling and participants

The participants of this study were science, mathematics, and Tech-Voc educators. This study purposively sampled (n=20) educators from different HEIs in the Philippines. Purposive sampling is a non-probability sampling technique used in research. This method involves selecting participants based on specific characteristics or criteria, determined by the researcher's judgment, that are relevant to the study's objectives[65-67].

In this study, the educators were sampled based on several characteristics like their familiarity with generative AI, how they use them, length of teaching service (at least 5 years), the subjects they taught (either mathematics, science, or Tech-Voc). **Table 1** below presents the summary of their demographic profile.

Table 1. Basic information of the educators.

	Subject	Years in service	Age
Educator 1	Mathematics	7 years	28
Educator 2	Science	8 years	34
Educator 3	Science	5 years	27
Educator 4	Mathematics	4 years	28
Educator 5	Tech-Voc	4 years	30
Educator 6	Tech-Voc	10 years	35
Educator 7	Mathematics	12 years	39
Educator 8	Science	10 years	37
Educator 9	Mathematics	7 years	36
Educator 10	Science	9 years	35
Educator 11	Science	5 years	31
Educator 12	Science	4 years	30
Educator 13	Mathematics	5 years	35
Educator 14	Tech-Voc	5 years	28
Educator 15	Mathematics	6 years	31
Educator 16	Mathematics	7 years	35
Educator 17	Science	10 years	40
Educator 18	Science	15 years	47
Educator 19	Tech-Voc	12 years	49
Educator 20	Mathematics	13 years	52

3.3. Instrument

In this study, open-ended questions were used as the instrument for conducting one-on-one interviews with science, mathematics, and Tech-Voc educators. The use of open-ended questions in the interviews facilitated the collection of qualitative data that could be analyzed to analyze themes, patterns, and variations in the educators' perceptions on generative AI and academic integrity.

Table 2. Interview guide questions.

Objectives	Interview questions
How educators use generative AI in education?	Do you use generative AI in your science-oriented subjects? Enumerate and explain each reason in using or not using generative AI.
What were the perceptions of educators about the concept of academic integrity?	What do you understand about academic integrity? Explain your thoughts about this.
What were the perceptions of educators in the use of generative AI?	Should students taking science-based courses be allowed to use generative AI? Enumerate and explain each reason. What is your stand on the issue that generative AI can affect academic integrity of students? Explain your stand based on your experience. Do you think generative AI and academic Integrity co-exist? Justify your stand based on your experience.

Are there aspects of generative AI that can strengthen academic integrity? Explain how.

Are there features of AI that can be improved for it to co-exist better with academic

integrity. Explain which features do you want to suggest or improve.

3.4. Data gathering procedure

Initially, potential participants were identified and selected based on predefined criteria relevant to the study's objectives. Once selected, the participants were contacted through email and phone to explain the purpose of the study, ensure their willingness to participate, and schedule convenient interview times. Prior to the interview, informed consent was obtained from all participants, ensuring they understood the nature of the study and their rights.

The interviews were conducted using a semi-structured format, which allowed for both guided questioning and the flexibility to explore emergent themes. Each interview session was held in a quiet, comfortable setting to facilitate open and honest communication. During the interviews, an audio recorder was used to capture the conversations accurately, with participants' permission, to ensure no valuable information was lost. The interviewer followed a prepared guide, asking a series of open-ended questions designed to elicit responses about the participants' experiences and perceptions.

The transcriptions were then reviewed and coded for key themes and patterns. Throughout the process, the confidentiality of the participants was maintained, with all identifying information being anonymized in the final transcripts.

3.5. Data analysis

The primary data of this study were the narratives from science, mathematics, and Tech-Voc educators. The thematic analysis of the interview data followed a systematic and rigorous process to identify and interpret key themes[66-70]. The audio recordings of the interviews were transcribed verbatim. Each transcript was then carefully read and re-read. During this initial reading phase, preliminary notes and observations were recorded to determine initial thoughts and potential patterns.

Relevant segments of text were highlighted, and codes were assigned to these segments that succinctly captured the essence of the data. These codes were then collated into a comprehensive list. The initial codes were examined to identify connections and overlaps, which facilitated the grouping of similar codes together.

Once the themes were established, they were reviewed and refined in relation to the coded extracts and the entire data set. This iterative process ensured that the themes accurately represented the data and were relevant to the research questions. The final themes were then named and defined clearly, providing a detailed description and interpretation of each theme.

4. Results

4.1. Question 1

How educators use generative AI in education?

Theme 1: For learning and creativity

Some participants (n=8) mentioned they use generative AI in enhancing the learning and creativity of their students. Science teachers use generative AI to help students in learning and understanding the fundamental concepts of science and nature.

The educators' comments reflect a positive perspective on the use of generative AI in education, particularly in science and math subjects. They noted that generative AI enhances learning and fosters creativity by creating simulations and models that simplify complex scientific concepts. This use of AI encourages students to experiment with different hypotheses which they believe could enhance their problem-solving skills.

"I do use generative AI in my subjects for several reasons, including to enhance learning and foster creativity. It is used to create simulations and models that simplify complex scientific concepts, and it encourages students to experiment with various hypotheses, enhancing their problem-solving skills." – **Educator 3**

"Students in science-based courses should be allowed to use generative AI. It can aid in understanding complex scientific concepts and phenomena. Using generative AI encourages students to think creatively and innovatively in problem-solving." – **Educator 12**

"Exposure to AI prepares students for future careers, where AI is increasingly used in scientific research and analysis." – **Educator 18**

"As a science and math teacher, I use generative AI to help students learn better. It helps them explore, come up with ideas, simulate things, be creative, and learn in a way that suits them. This makes learning science and math more fun and useful for their future." – **Educator 10**

"AI has been a game-changer in my Tech-Voc classes. I was able to create detailed simulations of real-world scenarios. In automotive technology, I can use AI to simulate engine problems and repair procedures. This allows students to practice diagnosing and fixing issues before working on actual vehicles." – **Educator 6**

Theme 2: Analysis and interpretation

Some educators (n=4) mentioned generative AI could help in analysis and interpretation. AI aids students in effectively analyzing and interpreting datasets, identifying pertinent trends, and drawing well-informed conclusions. AI enabled students to focus on understanding scientific ideas and analyzing their findings by automating laborious and time-consuming processes. This change in emphasis results in a more profound understanding and more significant study results.

"As an educator, I integrate generative AI into science subjects because it streamlines data analysis and interpretation for students." – **Educator 11**

"It helps them process large datasets efficiently, extract relevant patterns, and make conclusions. By automating tedious tasks, students can focus on understanding scientific principles and interpreting results, leading to deeper comprehension and more meaningful research outcomes." – **Educator 8**

Theme 3: For innovation

Some educators (n=4) also highlighted innovation as their main purpose of integrating generative AI in their class. The capacity of generative AI to examine extensive culinary data enables it to propose innovative combinations of flavors and cooking methods. This utilization of AI not only stimulates ingenuity among students but also familiarizes them with cutting-edge technological progressions in the culinary arts, enhancing their abilities and equipping them for present-day culinary methods.

"As a teacher in the culinary arts, I use generative AI to help students innovate new recipes and optimize ingredient combinations. AI can analyze vast amounts of culinary data to suggest unique flavor pairings and

*cooking techniques that students might not think of on their own. This not only help them be creative but also exposes students to modern technological applications in the culinary field." – **Educator 19***

Theme 4: Practice problem

Some mathematics teachers (n=3) use generative AI in making their practice problem. AI aids the teacher in generating and distributing practice exercises that cater to the needs and skills of each student. Through the utilization of AI-generated tasks, the teacher ensures that every student is adequately stimulated, regardless of their math proficiency levels.

Similarly, one teacher noted that AI enables students to engage in interactive inquiry and experimentation by generating dynamic graphs and geometric objects that may be manipulated in real-time. This interactive engagement allows students to directly witness the instant implications of changing variables, rendering abstract concepts more tangible and facilitating understanding.

*"Generative AI helps me design and distribute practice problems to my students. This ensured that all students are challenged appropriately." – **Educator 13***

*"For example, AI can generate dynamic graphs and geometric figures that students can manipulate in real-time, allowing them to see the immediate effects of changing variables. This hands-on experience makes abstract concepts more tangible and easier to understand." – **Educator 1***

4.2. Question 2

What were the negative perceptions of educators about the concept of academic integrity?

Theme 1: Honesty and ethical principles

Most educators (n=15) believed that academic integrity emphasizes the importance and principles of academic integrity within the educational setting. For them, academic integrity involves values such as honesty, fairness, and trustworthiness, serving as the moral foundation of the academic community. Key elements of academic integrity include following rules of good academic behavior, properly citing sources, refraining from plagiarism, and adhering to school regulations. It is being honest, fair, and responsible in academic endeavors, which includes doing one's own work, giving credit to others for their ideas, and abiding by established rules.

*"Academic integrity includes values like honesty, fairness, and trustworthiness. It is the moral basis of the academic community. It means following the rules of good academic behavior, such as properly citing sources, not plagiarizing, and following the rules set by the school." – **Educator 6***

*"Academic integrity means being honest, fair, and responsible in school. It's about doing your own work, giving credit to others when you use their ideas, and following the rules. It helps keep learning fair and trustworthy for everyone." – **Educator 9***

*"Integrity refers to the ethical principles and values that govern the conduct of academic work. It involves honesty, fairness, and responsibility in all aspects of learning and research. As an instructor, I believe that academic integrity is crucial for the development of students' knowledge and skills. It promotes a culture of honesty, originality, and respect for intellectual property." – **Educator 20***

Theme 2: Respect

Some educators (n=7) highlighted the concept of respect within the context of academic integrity. They emphasized that being honest and ethical in academic work, which includes avoiding plagiarism and cheating, is crucial for maintaining the integrity of the educational process. By upholding these principles, students and

teachers contributed to a fair evaluation of their own knowledge and skills, which in turn fosters a culture of trust and respect within academia.

"Being honest and ethical in academic work, avoiding plagiarism and cheating. It's crucial because it ensures fair evaluation of students' knowledge and skills, fostering a culture of trust and respect in academia." – **Educator 3**

"I believe academic integrity is fundamental to the integrity and credibility of education. It lays the foundation for trust and respect within academic communities and ensures that the pursuit of knowledge is conducted ethically and honestly." – **Educator 7**

4.3. Question 3

What were the negative perceptions of educators in the use of generative AI?

Theme 1: Academic dishonesty

Most educators (n=16) expressed their concern about how generative AI encourages academic dishonesty. For example, allowing students to use generative AI may compromise their learning experience and critical thinking skills. Specifically, the use of generative AI may lead to plagiarism and the submission of unoriginal work, which contradicts principles of academic honesty. They highlighted the importance of students producing original work and the potential for generative AI to undermine this principle by providing pre-generated content.

"Students taking science-based courses should not be allowed to use generative AI. By relying on generative AI, students may miss out on the hands-on experience and critical thinking skills that are essential in these subjects. It may lead to plagiarism and the submission of unoriginal work, which goes against the principles of academic honesty." – **Educator 19**

"Generative AI can potentially affect academic integrity if students misuse it for plagiarism or cheating." – **Educator 3**

"I believe that generative AI can indeed affect the academic integrity of students. Based on my experience, generative AI can have a negative impact on academic integrity due to several reasons. Firstly, it can facilitate plagiarism by generating content without proper attribution, compromising the originality and authenticity of students' work." – **Educator 11**

"AI and academic integrity are not compatible due to their potential to compromise originality, facilitate plagiarism, and hinder critical thinking. Academic integrity requires students to produce original work, while generative AI may provide pre-generated content, undermining these principles." – **Educator 17**

Theme 2: Overreliance

Some educators (n=4) were concerned about how AI caused students to be over reliant to the contents it generates. The educator acknowledged that while generative AI can provide benefits such as aiding understanding and experimentation, there is a potential risk that students may become overly dependent on it. This overreliance can lead to plagiarism, where students may use generative AI to generate content without fully understanding the underlying concepts or contributing original ideas.

"As an educator, I recognize that generative AI can impact students' academic integrity. While it offers benefits like aiding understanding and experimentation, there's a risk of overreliance and plagiarism." – **Educator 14**

*"Relying on generative AI may discourage the development of critical thinking skills as students become dependent on AI-generated content instead of actively engaging with the subject matter." – **Educator 2***

*"From my experience, I've observed instances where students may become overly reliant on generative AI tools, potentially compromising their critical thinking skills and originality in their work." – **Educator 20***

Theme 3: Concerns for accuracy

Some educators (n=3) also believed that the generative AI sometimes give inaccurate and unreliable information. Generative AI models may not consistently generate accurate results, particularly in relation to complex scientific concepts. This raises concerns about the reliability of the information provided by AI-generated content and the potential implications for student learning.

*"Generative AI models may not always produce accurate results, especially when it comes to complex scientific concepts. It is important for students to have access to reliable and accurate information to develop a strong understanding of the subject." – **Educator 16***

4.4. Question 4

For educators, how to maximize the use of generative AI in classrooms considering their concerns?

Theme 1: Transparency

Most educators (n=14) highlighted the concept of transparency in using generative AI in education. They believed on the importance of academic integrity and how generative AI tools can both pose challenges to and strengthen it. They noted the role of transparency in promoting academic integrity, with generative AI tools being capable of enhancing transparency by providing clear process on data analysis, detecting accuracy and plagiarism, and honesty in content generation. Educators should educate students on AI ethics and the importance of academic integrity. In terms of transparency, schools should integrate AI ethics and academic integrity policies into their educational frameworks to ensure that ethical principles are upheld in the use of AI technologies.

*"Academic integrity through its capacity to promote transparency, enhance originality, and support ethical learning practices. Generative AI tools can assist in creating transparent and reproducible outputs by providing clear documentation of data generation processes and algorithmic methods." – **Educator 1***

*"AI systems should prioritize enhanced transparency by providing clear explanations of their processes and outputs. This will enable users to understand and verify the accuracy of the information provided." – **Educator 8***

*"While generative AI can pose challenges to academic integrity, there are aspects that can strengthen it. Generative AI can enhance academic integrity by detecting plagiarism, supporting research, and creating interactive learning aids." – **Educator 9***

*"To ensure academic integrity, its users should be transparent about their content generation while teachers should educate students on AI ethics, and schools should integrate with academic integrity policies." – **Educator 15***

Theme 2: Monitoring and guidelines

Some educators (n=8) also believed on the importance of monitoring and establishing guidelines to ensure the ethical use of generative AI in academic settings while upholding academic integrity. For example, the educators emphasized the necessity of guiding students on the ethical use of generative AI and ensuring that assessments accurately reflect their genuine efforts. This highlights the importance of providing clear

guidelines and expectations to students regarding the appropriate use of AI tools in their academic work. With proper guidance and monitoring, the potential negative impact of generative AI on academic integrity can be minimized. This implies the need for ongoing oversight and support from educators to ensure that students use AI tools responsibly and ethically, while still benefiting from their educational advantages.

"It's crucial to guide students on its ethical use and ensure assessments reflect their genuine efforts." – **Educator 13**

"With proper guidance and monitoring, its impact can be minimized, allowing students to benefit from its educational advantages while upholding academic integrity." – **Educator 18**

"Ethical guidelines must be established and enforced to ensure that AI applications in academia adhere to academic integrity principles. These guidelines will promote fair and responsible use of AI, maintaining the integrity of academic standards." – **Educator 2**

"Generative AI and academic integrity can coexist if proper measures are in place. Transparency in the use of AI tools, clear guidelines on ethical usage, and vigilant monitoring can ensure that AI enhances learning without compromising integrity." – **Educator 20**

5. Discussion

Because of the emergence of generative AI use in the education, there is a need to establish a concrete understanding about its implications in the education system. Studies on the reasons behind the failure of implementations of education technologies place significant emphasis on the influence of social, psychological, and cultural factors[71-73]. Consequently, more psychological study is needed to better understand how educators perceive, trust, and employ education technology in their teaching practice[74]. Similarly, more research is needed to understand how social, cultural, and environmental factors impact educators' acceptance of technology, particularly AI-powered systems that may raise concerns about employment and privacy[75,76].

The findings of this study revealed that the science, mathematics, and Tech-Voc educators were very positive about the use of generative AI in education. For example, in science learning, one educator said that *"[generative AI] can aid in understanding complex scientific concepts and phenomena. Using generative AI encourages students to think creatively and innovatively in problem-solving" [Educator 12].* Additionally, one educator explained that *"...it helps them process large datasets efficiently, extract relevant patterns, and make conclusions" [Educator 8].* The results of this study reflected several findings from the literatures and previous studies. Topal et al.[77] argued that chatbots can benefit science education by boosting student learning and performance. Teachers' usage of an AI-enhanced scaffolding system may improve science, technology, engineering, and mathematics (STEM) students' scientific writing[78].

The positive reception of generative AI among science, mathematics, and Tech-Voc educators highlights its potential to significantly enhance educational practices and outcomes. For them, generative AI not only facilitates the comprehension of complex information but also enhances students' analytical skills and their ability to conduct meaningful scientific inquiry. Educators' positive attitudes on the use of generative AI in developing practice problems and dynamic, interactive learning experiences support the idea that AI can personalize and enrich the learning process. This was consistent with previous research, which highlights the relevance of AI in creating adaptive learning environments that cater to individual student needs.

However, although the educators were positive about the application of generative AI in education, they also manifested apprehension and concerns. For example, one educator noted that *"...while it offers benefits like aiding understanding and experimentation, there's a risk of overreliance and plagiarism" [Educator 14].*

One educator also believed that *"generative AI models may not always produce accurate results, especially when it comes to complex scientific concepts" [Educator 16]*. These concerns were not new at all. In fact, the study of Sullivan et al.[79] revealed that there is *"potential threat of artificial intelligence as a tool to facilitate student cheating."* Venkataraman[80] also reported that students now have the option of outsourcing the writing of their essays to the chatbot. Research conducted on student rates of contract cheating, for instance, noted that the perception/belief that there are many opportunities to cheat in assessments increased the risk that students would engage in cheating behaviors[81]. The ease of access to generative AI tools, which can instantaneously generate essays, solve problems, or complete assignments, might create an environment where students feel more tempted to cheat. This potential misuse of AI undermines the integrity of educational assessments and devalues the hard work of students who adhere to academic standards.

To mitigate the negative impacts of extensive use of AI in education, the educators suggested effective policy and guidelines of AI use in the classrooms. One educator believed that *"it's crucial to guide students on its ethical use and ensure assessments reflect their genuine efforts" [Educator 13]*. One also believed that *"transparency in the use of AI tools, clear guidelines on ethical usage, and vigilant monitoring can ensure that AI enhances learning without compromising integrity" [Educator 20]*. Similarly, Sullivan et al. (2023) argued that using AI like the ChatGPT requires careful consideration of permissible and unacceptable actions due to its high level of sophistication and availability, and that it is necessary to establish clear instructions for university personnel and students on how to use ChatGPT ethically. Findings of this study noted that it is necessary to have transparency about the student's output and the extent of their AI use. The findings of this study emphasized the critical need for transparency regarding both the outputs produced by students and the extent of their use of generative AI tools. Transparency is essential to ensure that educators can accurately assess the authenticity and originality of students' work. By maintaining transparency, educators can differentiate between a student's own intellectual efforts and the contributions made by AI.

In terms of educators' acceptance of generative AI use in classrooms, this study found that their perceptions were overwhelmingly positive. Educators recognized the transformative potential of AI tools to enhance the educational experience. Many highlighted how generative AI could facilitate a more engaging and interactive learning environment, making complex concepts more accessible to students through simulations, models, and other dynamic resources.

Despite their positive outlook, educators also acknowledged the importance of addressing potential challenges associated with AI use. They emphasized the need for clear guidelines and ethical standards to ensure that AI tools are used responsibly and effectively. This includes providing training for both teachers and students on the ethical use of AI and developing robust monitoring systems to prevent misuse, such as plagiarism or overreliance on AI-generated content.

6. Conclusion

This study highlighted that science, mathematics, and Tech-Voc educators generally have a positive perception of generative AI, recognizing its potential to enhance learning, foster creativity, and improve the comprehension of complex concepts. Educators noted that AI aids in processing large datasets, extracting relevant patterns, and drawing well-informed conclusions, thereby facilitating more profound and significant research outcomes.

However, alongside these benefits, educators also expressed concerns regarding overreliance on AI, the risk of plagiarism, and the accuracy of AI-generated contents. There can be also that potential for AI to facilitate cheating and reduce the authenticity of student work. The ease of access to AI tools, capable of

instantaneously generating essays and solving problems, may tempt students to engage in dishonest practices undermining academic integrity.

To mitigate these negative impacts, educators emphasized the need for effective policies and guidelines on the ethical use of AI in classrooms. They stressed the importance of guiding students on ethical AI use and ensuring transparency in AI-generated outputs. Clear guidelines on ethical AI usage and monitoring are crucial to maintaining academic integrity while leveraging AI's educational advantages.

The study suggested that future research should focus on understanding the psychological, social, and cultural factors influencing educators' perceptions and acceptance of AI technology. There is a need to explore the development of institutional ethical guidelines and monitoring systems to prevent AI misuse in classrooms. Future studies could also examine the impact of AI on student learning outcomes and the effectiveness of AI-enhanced teaching methods in different educational contexts. By addressing these areas, research can provide a comprehensive framework for the responsible and effective integration of AI in education.

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Conflict of interest

The authors declare no conflict of interest.

References

1. Yeralan, S., & Lee, L. A. (2023). Generative AI: Challenges to higher education. Sustainable Engineering and Innovation, 5(2), 107-116.
2. Duhaylungsod, A. V., & Chavez, J. V. (2023). ChatGPT and other AI users: Innovative and creative utilitarian value and mindset shift. Journal of Namibian Studies, 33, 4367-4378.
3. Rasul, T., Nair, S., Kalendra, D., Robin, M., de Oliveira Santini, F., Ladeira, W. J., ... & Heathcote, L. (2023). The role of ChatGPT in higher education: Benefits, challenges, and future research directions. Journal of Applied Learning and Teaching, 6(1).
4. Ausat, A. M. A., Massang, B., Efendi, M., Nofirman, N., & Riady, Y. (2023). Can Chat GPT replace the role of the teacher in the classroom: A fundamental analysis. Journal on Education, 5(4), 16100-16106.
5. Castillo, A. G. R., Rivera, H. V. H., Teves, R. M. V., Lopez, H. R. P., Reyes, G. Y., Rodriguez, M. A. M., ... & Arias-Gonzáles, J. L. (2023). Effect of Chat GPT on the digitized learning process of university students. Journal of Namibian Studies: History Politics Culture, 33, 1-15.
6. Whalen, J., & Mouza, C. (2023). ChatGPT: Challenges, opportunities, and implications for teacher education. Contemporary Issues in Technology and Teacher Education, 23(1), 1-23.
7. Ausat, A. M. A. (2023). The Application of Technology in the Age of Covid-19 and Its Effects on Performance. Apollo: Journal of Tourism and Business, 1(1), 14-22.

8. Kamar, K., Lewaherilla, N. C., Ausat, A. M. A., Ukar, K., & Gadzali, S. S. (2022). The Influence of Information Technology and Human Resource Management Capabilities on SMEs Performance. International Journal of Artificial Intelligence Research, 6(1.2), 1.

9. Ausat, A. M. A. (2022). Positive Impact of the Covid-19 Pandemic on The World of Education. Jurnal Pendidikan, 23(2), 107-117.

10. Gleason, N. (2022). ChatGPT and the rise of AI writers: How should higher education respond. Times Higher Education.

11. Eke, D. O. (2023). ChatGPT and the rise of generative AI: Threat to academic integrity?. Journal of Responsible Technology, 13, 100060.

12. Choi, J. H., Hickman, K. E., Monahan, A. B., & Schwarcz, D. (2021). ChatGPT goes to law school. J. Legal Educ., 71, 387.

13. Terwiesch, C. (2023). Would chat GPT3 get a Wharton MBA. A prediction based on its performance in the operations management course.

14. Stokel-Walker, C. (2022). AI bot ChatGPT writes smart essays-should academics worry?. Nature.

15. Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. Ieee Access, 8, 75264-75278.

16. Kose, U., & Arslan, A. (2017). Optimization of self‐learning in Computer Engineering courses: An intelligent software system supported by Artificial Neural Network and Vortex Optimization Algorithm. Computer Applications in Engineering Education, 25(1), 142-156.

17. Myneni, L. S., Narayanan, N. H., Rebello, S., Rouinfar, A., & Pumtambekar, S. (2013). An interactive and intelligent learning system for physics education. IEEE Transactions on learning technologies, 6(3), 228-239.

18. Ledesma, E. F. R., & García, J. J. G. (2017). Selection of mathematical problems in accordance with student's learning style. International Journal of Advanced Computer Science and Applications, 8(3).

19. Zhang, Z., Liu, H., Shu, J., Nie, H., & Xiong, N. (2020). On automatic recommender algorithm with regularized convolutional neural network and IR technology in the self-regulated learning process. Infrared Physics & Technology, 105, 103211.

20. Liu, M., Li, Y., Xu, W., & Liu, L. (2016). Automated essay feedback generation and its impact on revision. IEEE Transactions on Learning Technologies, 10(4), 502-513.

21. Xu, W., & Ouyang, F. (2022). The application of AI technologies in STEM education: a systematic review from 2011 to 2021. International Journal of STEM Education, 9(1), 59.

22. Krasovskiy, D. (2020). The challenges and benefts of adopting AI in STEM education. https://upjourney.com/the-challenges-and-benefits-of-adopt ing-ai-in-stem-education

23. Daleon, J. D., & Namoco, S. O. (2023). Determinants of Instructional Technology of Tech-Voc Educators in A State University in Northern Mindanao, Philippines. Sci.Int. (Lahore), 35(2),131-136.

24. Yusro, M., Misin, R., & Mauludin, M. A. (2024). Vocational Education Development Strategy in the Use of Artificial Intelligence in the Digital Era. In 5th Vocational Education International Conference (VEIC-5 2023) (pp. 734-741). Atlantis Press.

25. Windelband, L. (2023). Artificial Intelligence and Assistance Systems for Technical Vocational Education and Training–Opportunities and Risks. In New Digital Work: Digital Sovereignty at the Workplace (pp. 195-213). Cham: Springer International Publishing.

26. Uygun, D. (2024). Teachers' perspectives on artificial intelligence in education. Advances in Mobile Learning Educational Research, 4(1), 931-939.

27. Gallent Torres, C., Zapata-González, A., & Ortego-Hernando, J. L. (2023). The impact of Generative Artificial Intelligence in higher education: a focus on ethics and academic integrity. RELIEVE. Revista ELectrónica de Investigación y EValuación Educativa, 2023, vol. 29, num. 2, p. 1-19.

28. García-Peñalvo, F. J., Llorens Largo, F., & Vidal, J. (2023). The new reality of education in the face of advances in generative artificial intelligence.

29. Wardat, Y., Tashtoush, M., AlAli, R., & Saleh, S. (2024). Artificial Intelligence in Education: Mathematics Teachers' Perspectives, Practices and Challenges. Iraqi Journal for Computer Science and Mathematics, 5(1), 60-77.

30. Kim, N. J., & Kim, M. K. (2022, March). Teacher's perceptions of using an artificial intelligence-based educational tool for scientific writing. In Frontiers in Education (Vol. 7, p. 755914). Frontiers.

31. Nguyen, N. D. (2023). Exploring the role of AI in education. London Journal of Social Sciences, (6), 84-95.

32. Arvin, N., Hoseinabady, M., Bayat, B., & Zahmatkesh, E. (2023). Teacher Experiences with AI-based Educational Tools. AI and Tech in Behavioral and Social Sciences, 1(2), 26-32.

33. Al Darayseh, A. (2023). Acceptance of artificial intelligence in teaching science: Science teachers' perspective. Computers and Education: Artificial Intelligence, 4, 100132.

34. Bianchini, S., Müller, M., & Pelletier, P. (2023). Integrating New Technologies into Science: The case of AI. arXiv preprint arXiv:2312.09843.

35. Park, J., Teo, T. W., Teo, A., Chang, J., Huang, J. S., & Koo, S. (2023). Integrating artificial intelligence into science lessons: teachers' experiences and views. International Journal of STEM Education, 10(1), 61.

36. Orhani, S. (2021). Artificial intelligence in teaching and learning mathematics. Kosovo Educational Research Journal, 2(3), 29-38.

37. Melchor, P. J. M., Lomibao, L. S., & Parcutilo, J. O. (2023). Exploring the Potential of AI Integration in Mathematics Education for Generation Alpha—Approaches, Challenges, and Readiness of Philippine Tertiary Classrooms: A Literature Review. Journal of Innovations in Teaching and Learning, 3(1), 39-44.

38. Möller, A. (2023). An analysis of university academic integrity policies in New Zealand. Journal of Further and Higher Education, 47(3), 338-350.

39. Chavez, J., & Lamorinas, D. D. (2023). Reconfiguring assessment practices and strategies in online education during the pandemic. *International Journal of Assessment Tools in Education*, *10*(1), 160-174.

40. Maryon, T., Dubre, V., Elliott, K., Escareno, J., Fagan, M. H., Standridge, E., & Lieneck, C. (2022). COVID-19 Academic integrity violations and trends: A rapid review. Education Sciences, 12(12), 901.

41. Awasthi, S. (2019). Plagiarism and academic misconduct: A systematic review. DESIDOC Journal of Library & Information Technology, 39(2).

42. Cardina, Y., & Kristiani, K. B. S. (2022). Qualitative Survey of Academic Dishonesty on Higher Education: Identify the Factors and Solutions. Journal of Positive School Psychology, 6(3), 8705-8719.

43. Chiang, F. K., Zhu, D., & Yu, W. (2022). A systematic review of academic dishonesty in online learning environments. Journal of Computer Assisted Learning, 38(4), 907-928.

44. Kampa, R. K., Padhan, D. K., & Ahmad, F. (2020). Perceptions of Students and Researchers of Food Technology towards Plagiarism: A Case Study. DESIDOC Journal of Library & Information Technology, 40(6).

45. Kaščáková, E., & Kožaríková, H. (2022). Academic misconduct in the project work of tertiary esp students: causes, relationships and solutions. *Journal of Teaching English for Specific and Academic Purposes*, 201-215.

46. Surahman, E., & Wang, T. H. (2022). Academic dishonesty and trustworthy assessment in online learning: A systematic literature review. Journal of Computer Assisted Learning, 38(6), 1535-1553.

47. Tabsh, S. W., Abdelfatah, A. S., & El Kadi, H. A. (2017). Engineering students and faculty perceptions of academic dishonesty. Quality Assurance in Education, 25(4), 378-393.

48. Zhao, L., Mao, H., Compton, B. J., Peng, J., Fu, G., Fang, F., ... & Lee, K. (2022). Academic dishonesty and its relations to peer cheating and culture: A meta-analysis of the perceived peer cheating effect. Educational Research Review, 36, 100455.

49. Awasthi, S. (2019). Plagiarism and academic misconduct: A systematic review. DESIDOC Journal of Library & Information Technology, 39(2).

50. Cantiello, J., & Geschke, R. H. (2024). Preventing Academic Dishonesty in Online Courses: Best Practices to Discourage Cheating. Journal of Health Administration Education, 40(2), 205-230.

51. Cutri, J., Abraham, A., Karlina, Y., Patel, S. V., Moharami, M., Zeng, S., ... & Pretorius, L. (2021). Academic integrity at doctoral level: the influence of the imposter phenomenon and cultural differences on academic writing. International Journal for Educational Integrity, 17(1), 8.

52. Keener, T. A., Galvez Peralta, M., Smith, M., Swager, L., Ingles, J., Wen, S., & Barbier, M. (2019). Student and faculty perceptions: appropriate consequences of lapses in academic integrity in health sciences education. BMC medical education, 19, 1-9.

53. Tabsh, S. W., El-Kadi, H. A., & Abdelfatah, A. (2015). Past and present engineering students' views on academic dishonesty at a middle-eastern university. International Journal of Engineering Education, 31(5), 1334-1342.

54. Akbar Qaderi, L. A., & Thomson, D. (2016). Academic Integrity: The Fool's Dilemma. International Journal of Digital Society (IJDS), 7(5), 1165-1170.

55. Garcia, L. A. (2023). Examining the Increasing Prevalence of Academic Dishonesty: An Investigation of Students' Perceptions of Academic Integrity in Higher Education.

56. Hilliger, I., Ruipérez‐Valiente, J. A., Alexandron, G., & Gašević, D. (2022). Trustworthy remote assessments: A typology of pedagogical and technological strategies. Journal of computer assisted learning, 38(6), 1507-1520.

57. Alsabhan, W. (2023). Student cheating detection in higher education by implementing machine learning and LSTM techniques. Sensors, 23(8), 4149.

58. Johnson, C., Davies, R., & Reddy, M. (2022). Using digital forensics in higher education to detect academic misconduct. International Journal for Educational Integrity, 18(1), 12.

59. Gamage, S. H., Ayres, J. R., & Behrend, M. B. (2022). A systematic review on trends in using Moodle for teaching and learning. International journal of STEM education, 9(1), 9.

60. Abd-Elaal, E. S., Gamage, S. H., & Mills, J. E. (2022). Assisting academics to identify computer generated writing. European Journal of Engineering Education, 47(5), 725-745.

61. Blau, I., & Eshet-Alkalai, Y. (2017). The ethical dissonance in digital and non-digital learning environments: Does technology promotes cheating among middle school students?. Computers in Human Behavior, 73, 629-637.

62. Calaro, M. F., Vicente, M. B., Chavez, J. V., Reyes, M. J. D., Delantar, S., Jorolan, A., ... & Torres, J. (2023). Marketing campaigns leading to the purchase of accommodation products: A content analysis. Journal of Namibian Studies: History Politics Culture, 33, 4221-4236.
63. Chavez, J. (2022). Narratives of bilingual parents on the real-life use of English language: Materials for English language teaching curriculum. Arab World English Journals, 13(3).
64. Chavez, J. V., Libre, J. M., Gregorio, M. W., & Cabral, N. P. (2023). Human resource profiling for post-pandemic curriculum reconfiguration in higher education. Journal of Infrastructure, Policy and Development, 7(2), 1975.
65. Ceneciro, C. C., Estoque, M. R., & Chavez, J. V. (2023). Analysis of debate skills to the learners' confidence and anxiety in the use of the English language in academic engagements. Journal of Namibian Studies: History Politics Culture, 33, 4544-4569.
66. Chavez, J. V., Del Prado, R., & Estoque, M. (2023). Disrupted income of women educators during pandemic: Economic effects, adaptive strategies, and government recovery initiatives. Journal of Infrastructure, Policy and Development, 7(2), 1973.
67. Chavez, J. V., Cuilan, J. T., & Adalia, H. G. (2024). Message patterns through discourse analysis on the concept of apology and forgiveness during Ramadan among college students practicing Islam. Environment and Social Psychology, 9(3).
68. Chavez, J. V., & Del Prado, R. T. (2023). Discourse analysis on online gender-based humor: Markers of normalization, tolerance, and lens of inequality. In Forum for Linguistic Studies, 5(1), 55-71.
69. Inoferio, H. V., Espartero, M., Asiri, M., Damin, M., & Chavez, J. V. (2024). Coping with math anxiety and lack of confidence through AI-assisted Learning. Environment and Social Psychology, 9(5).
70. Sabdani-Asiri, M. L., Chavez, J. V., & Kaiser Isham Sabdani Savellon, D. P. A. (2024). Analysis of Public Speaking Resources And Alternative Improvement Strategies Among Academic Leaders With Public Speaking Woes. Migration Letters, 21(S6), 817-831.
71. Ames, M. G. (2019). The charisma machine: The life, death, and legacy of One Laptop per Child. Mit Press.
72. Cuban, L. (2013). Why so many structural changes in schools and so little reform in teaching practice?. Journal of Educational Administration, 51(2), 109-125.
73. Reich, J. (2020). Failure to disrupt: Why technology alone can't transform education. Harvard University Press.
74. Kizilcec, R. F. (2024). To advance AI use in education, focus on understanding educators. International Journal of Artificial Intelligence in Education, 34(1), 12-19.
75. Nazaretsky, T., Ariely, M., Cukurova, M., & Alexandron, G. (2022). Teachers' trust in AI‐powered educational technology and a professional development program to improve it. British journal of educational technology, 53(4), 914-931.
76. Nazaretsky, T., Cukurova, M., & Alexandron, G. (2022). An instrument for measuring teachers' trust in AI-based educational technology. In LAK22: 12th international learning analytics and knowledge conference (pp. 56-66).
77. Topal, A. D., Dilek Eren, C., & Kolburan Geçer, A. (2021). Chatbot application in a 5th grade science course. Education and Information Technologies, 26(5), 6241-6265.
78. Kim, N. J., & Kim, M. K. (2022, March). Teacher's perceptions of using an artificial intelligence-based educational tool for scientific writing. In Frontiers in Education (Vol. 7, p. 755914). Frontiers.
79. Sullivan, M., Kelly, A., & McLaughlan, P. (2023). ChatGPT in higher education: Considerations for academic integrity and student learning.
80. Venkataraman, B. (2023). Are you for real? The most urgent question with artificial intelligence as a new interlocutor. Boston Globe (Online). https://www.proquest. com/newspapers/are-you-real-most-urgent-question-withartificial/docview/2770576156/se-2?accountid=10675
81. Bretag, T., Harper, R., Burton, M., Ellis, C., Newton, P., Rozenberg, P., ... & van Haeringen, K. (2019). Contract cheating: A survey of Australian university students. Studies in higher education, 44(11), 1837-1856.