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PAIGE: A generative AI-based framework for promoting assignment integrity in higher education

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Abstract: The integration of Generative Artificial Intelligence (GAI) tools like ChatGPT, Google Bard, and Bing Chat in higher education shows excellent potential for transformation. However, this integration also raises issues in maintaining academic integrity and preventing plagiarism. In this study, we investigate and analyze practical approaches for efficiently harnessing the potential of GAI while simultaneously ensuring the preservation of assignment integrity. Despite the potential to expedite the learning process and improve accessibility, concerns regarding academic misconduct highlight the necessity for the implementation of novel GAI frameworks for higher education. To effectively tackle these challenges, we propose a conceptual framework, PAIGE (Promoting Assignment Integrity using Generative AI in Education). This framework emphasizes the ethical integration of GAI, promotes active student interaction, and cultivates opportunities for peer learning experiences. Higher education institutions can effectively utilize the PAIGE framework to leverage the promise of GAI while ensuring the preservation of assignment integrity. This approach paves the way for a responsible and thriving future in Generative AI-driven education.

Keywords: generative AI, ChatGPT, Google Bard, Bing Chat, higher education, assignment integrity

1. Introduction

Generative AI, including revolutionary models like ChatGPT, Google Bard, and Bing Chat, represents an impressive breakthrough in artificial intelligence [1,2]. Leveraging advanced deep learning architectures like GPT-3.5 (Generative Pre-trained Transformer), these systems have undergone extensive training on a vast array of internet data [3]. By assimilating patterns, language structures, and contextual information from enormous volumes of text, they can generate remarkably

human-like responses to the input they receive, making them powerful conversational agents. It is crucial to comprehend that the responses provided by these generative AI models are grounded solely in the data patterns they were trained on and lack genuine understanding or consciousness. Despite this, they excel at myriad tasks, such as virtual assistance, customer support, and creative writing support, making them invaluable tools for human interaction. As generative AI advances, we can anticipate even more significant technological improvements, paving the way for exciting new possibilities in human-machine interactions across diverse domains.

Emerging as a new technology, GAI has the potential to revolutionize several industries, including higher education. GAI tools in higher education have generated significant interest and debate among educators, policymakers, and researchers [4,5]. Although the adoption of GAI presents opportunities and challenges, it is necessary to develop research agendas to facilitate the effective use of these technologies in higher education settings.

The ChatGPT example demonstrates the extraordinary ability of GAI algorithms to generate human-like responses and engage in complex conversations [6]. Concerns regarding academic integrity have been expressed regarding using such tools in higher education, as students can create artifacts using GAI without actively engaging in the learning process [7]. Academic misconduct and plagiarism are a growing concern in higher education due to the misuse of AI-based technologies. Concern has been expressed by policymakers regarding this situation. These factors highlight the need for research reform and a re-evaluation of conventional research techniques.

The paper is structured into a total of nine primary sections. The Introduction presents an overview of the incorporation of GAI in the context of higher education, along with the accompanying difficulties about upholding academic integrity. The Literature Review provides a comprehensive overview of relevant prior studies on the use of AI technologies, such as ChatGPT, within the field of education. The section under "Research Objectives and Outcomes" explores the precise aims and research questions that are examined in the study. The Methodology section discusses the procedures employed for gathering responses from ChatGPT, Google Bard, and Bing Chat in response to a query related to the preservation of academic and assignment integrity in the context of AI. The section on the PAIGE Framework presents a conceptual framework that includes goals such as the ethical adoption of AI and the detection of plagiarism, with the aim of responsibly integrating AI while upholding academic integrity. The section on the Benefits of the framework explores the several advantages associated with the utilization of the framework. The survey sub-section demonstrates the responses of five instructors about their viewpoints of the framework. The limitations and challenges section provides a comprehensive analysis of the potential barriers that may arise during the implementation of the framework. Finally, the Conclusion section summarizes the primary findings, future study directions, and contributions made throughout the study.

2. Literature review

LLMs (Large Language Models) are machine learning algorithms that use extensive data and information to make predictions. As generative AI tools become more prevalent in a variety of domains, the emergence of DALL-E, GPT-3, and Stable Diffusion models raises significant ethical concerns regarding their potential benefits and harms [8]. The potential for GAI to spread

misinformation through the creation of convincing yet inaccurate or deceptive content is a fundamental concern. Researchers contend that platforms must identify, and designate content generated by AI, in addition to developing forensic techniques to detect manipulations. As with any application of machine learning, generative AI is susceptible to the perpetuation of detrimental stereotypes due to biases in training data and algorithms [9]. Also manifesting as biases are the failure of image generators to represent diversity and the production of objectionable content. Academics argue for damage reduction through the utilization of diverse data, pre-release evaluation of systems, monitoring of real-world usage, and public auditing of models. A similar situation could occur during the integration of GAI tools into the field of education.

There are pros and cons to using GAI technologies such as ChatGPT in higher education [10]. Researchers have discovered that generative AI tools can accelerate the acquisition of fundamental ideas [11]. GAI tools enable students to better understand complex topics by providing customized support. Additionally, these tools can translate educational materials into multiple languages, increasing the availability and inclusion of education [12].

However, integrating GAI tools into higher education takes a lot of work. The potential for students to misuse these tools for cheating and other deceptive purposes is a significant concern raised by education policymakers [13]. This factor has prompted discussions regarding academic integrity and the role of human learning and insight in the assessment process [14]. GAI tools such as ChatGPT were found to generate false references in academic writing, threatening the credibility of students' work [15]. As a result, some local education authorities have banned the use of ChatGPT and other AI-powered tools in schools [16].

Despite these obstacles, researchers have explored the feasibility of applying reproductive AI in various educational contexts. The use of AI-enabled tools for personalized learning, automated essay grades, and interactive learning experiences has been the subject of research [15,17]. In addition, there is a growing desire to comprehend how different generations of educators perceive and adopt GAI in education [18].

Moreover, Su & Yang proposed a theoretical framework, "IDEE" which integrates GAI tools in education [16]. To implement their proposed framework in practical educational environments, one need only adhere to its four phases. Educators must initially ascertain the intended results of implementing educational AI within their setting. Additionally, it is crucial to determine the optimal degree of automation following the intended goals. Thirdly, they should ensure that ethical considerations, such as the impact of prospective biases on teachers and students, are considered. Finally, an assessment of the efficacy of educational AI in attaining the intended results should be conducted. However, the approach proposed by the authors lacks measures for addressing the potential misconduct of GAI technologies within the context of educational integration.

So, further research is needed to identify practical measures to prevent such misuse and promote academic integrity. Moreover, alternative assessment methods that can appropriately evaluate students' learning and comprehension are yet to be explored while considering the integration of GAI tools. These factors involve understanding how to balance AI tools with traditional assessment methods that rely on human learning and insight.

3. Research objectives and outcomes

In this paper, we have formulated two research questions to address the issue of ensuring

assignment integrity in higher education while using GAI tools. Answering these two research questions we have developed our proposed framework.

- How can GAI be effectively utilized in higher education to preserve assignment integrity?
- What are the essential strategies to be implemented to ensure and maintain assignment integrity while integrating GAI in higher education?

To answer these research questions, we generate responses from popular generative AI tools, and with those findings, we propose a comprehensive conceptual framework that intertwines principles of responsible AI usage, academic integrity, and innovative pedagogical approaches.

Combining the research findings, we demonstrate how the conceptual framework facilitates a symbiotic relationship between GAI and higher education. Our paper emphasizes the importance of ethical AI integration, safeguarding academic integrity, and encouraging collaborative learning experiences in AI-driven education.

Overall, our research contributes to the existing body of knowledge by offering valuable insights into the responsible use of GAI in higher education and innovative strategies to foster student engagement, setting a foundation for future advancements in this field.

4. Methodology

The present study that we conduct is a theoretical study. We propose a conceptual framework in this study. To develop the framework, we follow some sequential methodological steps. The first stage in this research is to conduct a literature review to identify the knowledge gap. This phase is essential for ensuring that the case study is well-researched, and the research question is relevant. After identifying the knowledge gap, a case study is proposed to cover the gap that exists. The following stage is to formulate research questions that will serve as the basis for the case study. After the research questions have been formulated, a prompt question for the GAI tools is developed. The prompt query is kept concise and specific enough to elicit meaningful responses from GAI tools. The prompt query is posed to the GAI tools (ChatGPT, Bing Chat, and BARD) to generate responses. The GAI tool responses are then evaluated to generate a framework. The framework is a crucial outcome of the research. It is maintained clean and concise, and it is based on the essential ideas from the responses. The diagram in figure 1 outlines the method employed during the study.

4.1. Assignment as a case study

We selected assignments as the focal point of our case study, aiming to enhance academic integrity within the realm of higher education through the utilization of GAI. The utilization of GAI in higher education presents promising opportunities along with challenges of preserving academic integrity by misusing these tools, and assignment design serves as an exemplary case study for this purpose. Various strong justifications support this assertion. Primarily, assignments are integral elements within the educational assessment framework, assuming a pivotal function in evaluating students' knowledge, comprehension, and capacity for critical analysis [19]. Consequently, these factors hold considerable importance in influencing the trajectory of students' educational endeavors and safeguarding the legitimacy of their acquired knowledge and skills. Assignments exhibit a broad spectrum of formats, including but not limited to essays, reports, presentations, and projects [20]. The presence of diverse perspectives facilitates a thorough examination of the integration of GAI

tools into various assignment formats while upholding the principles of academic integrity. In addition, assignments allow students to showcase their ingenuity, innovation, and expertise in the subject matter.

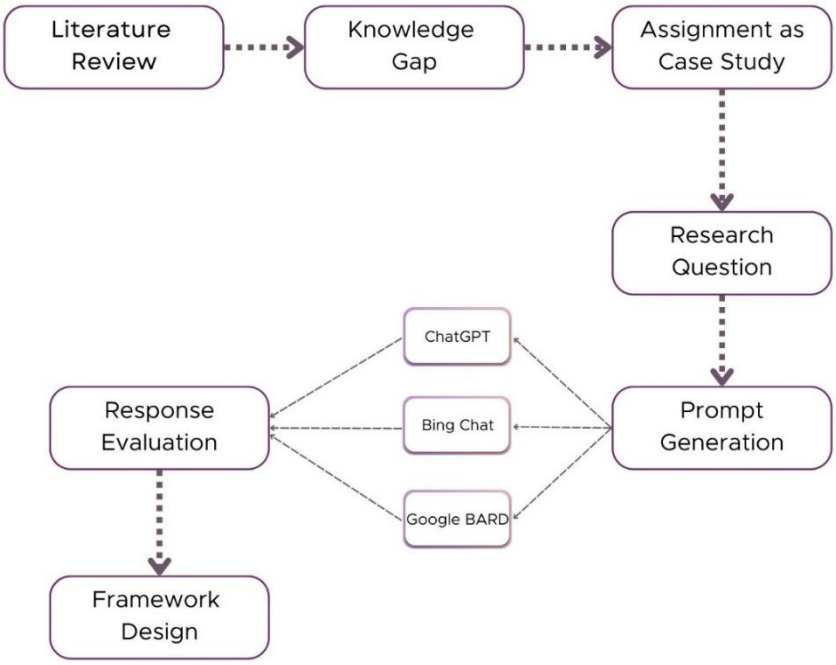


Figure 1. Methodology diagram.

4.2. Popular generative AI tools

AI has witnessed significant advancements in recent years, leading to various popular AI tools that have transformed human-machine interactions [21]. These AI tools, such as ChatGPT, Google Bard, and Bing chat, have revolutionized natural language processing and generative AI, showcasing remarkable progress in this domain. These tools are built upon sophisticated deep learning architectures, allowing them to understand and generate human-like text responses, making them powerful conversational agents.

This section explores three prominent AI tools—ChatGPT, Google Bard, and Bing Chat—shedding light on their architecture, training process, and capabilities [22]. By delving into their respective working principles, we gain valuable insights into how these popular AI models have become invaluable assets for various applications.

- ChatGPT

ChatGPT is an advanced language model based on the GPT-3.5 architecture, representing a remarkable milestone in artificial intelligence [23]. Developed by OpenAI, it is designed to understand and generate human-like text responses, making it a powerful conversational agent. The working principle of ChatGPT lies in its deep learning framework. During its training phase, ChatGPT was exposed to an extensive and diverse dataset from the internet, learning patterns, language structures, and contextual information [24]. This process enables the model to grasp the nuances of human language and respond coherently to a wide range of inputs.

ChatGPT utilizes its learned knowledge to generate contextually relevant and appropriate responses when given a prompt or input. It considers the words and phrases in the input and leverages its understanding of grammar, semantics, and context to craft its reply.

- Bing Chat

Bing chat is a generative AI system that can communicate with users in natural language and perform various tasks such as web search, content creation, and content improvement. Bing chat uses a large-scale neural network model to generate fluent and engaging responses based on the user's input language, mode, and intent [2]. Bing Chat also leverages web search results to provide factual and relevant information to the user. Bing Chat can handle different types of user requests, such as questions, chat messages, search queries, and creative prompts. Bing chat aims to be informative, visual, logical, actionable, positive, polite, interesting, entertaining, and engaging.

- Google BARD

Google Bard is a cutting-edge generative AI developed by Google, contributing to the growing landscape of popular generative AI models [25]. Built upon state-of-the-art deep learning techniques, Google Bard represents a significant advancement in artificial intelligence, particularly in natural language processing. At its core, Google Bard operates on a robust neural network architecture, including the latest language modeling innovations. The model has been extensively trained on a diverse and extensive dataset obtained from various sources on the internet. This training process allows Google Bard to learn complex patterns, language structures, and contextual information from vast text data. The functionality of Google Bard revolves around its capacity to receive textual input or prompts and generate human-like responses accordingly. By leveraging its understanding of grammar, semantics, and context, the model crafts coherent and contextually appropriate text, making it an impressive conversational agent.

Given the widespread popularity and extensive global usage of these three AI platforms, we have selected them as the preferred means to create responses to the posed question. While their responses are generally satisfactory, it is important to keep in mind the potential presence of prejudice or inaccuracy in their answers.

4.3. Determining the prompt questions and getting responses

We asked the AI tools the specific question, "How can higher education institutions effectively use GAI to preserve assignment integrity and academic honesty while applying crucial academic integrity criteria and strategies?".

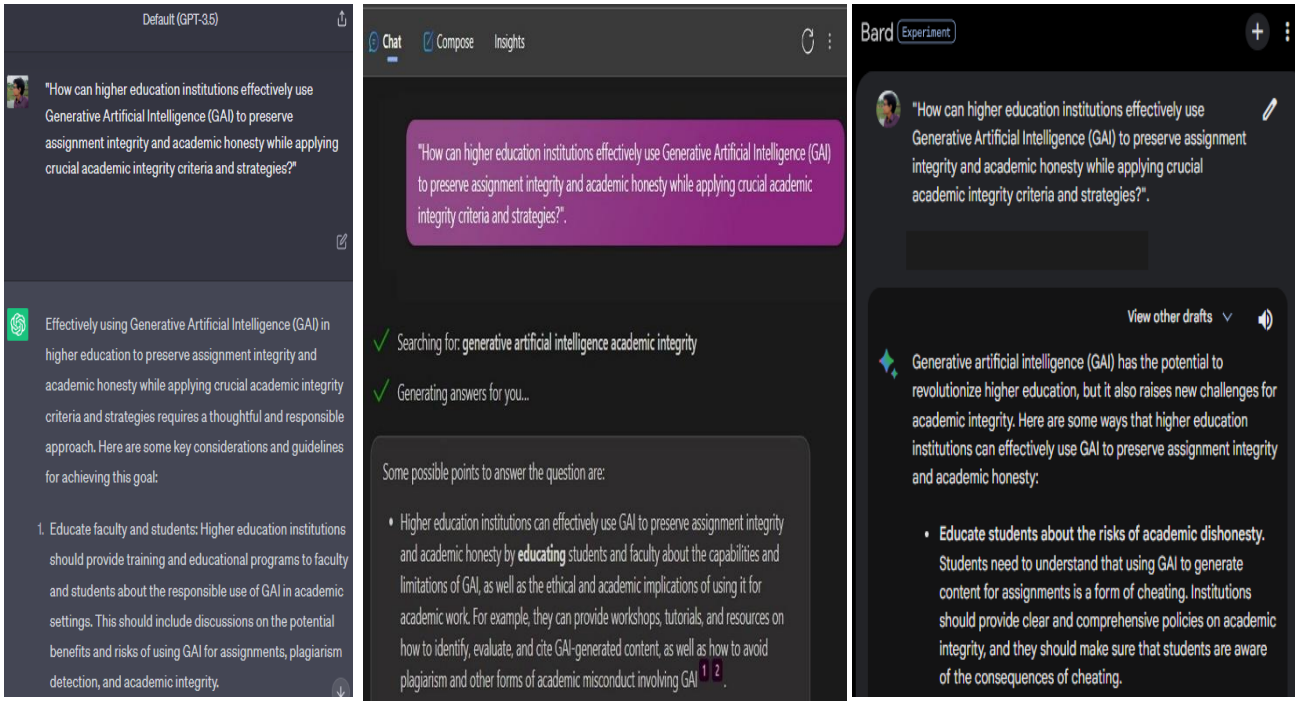
The question clearly addresses the two research objectives, which is to avoid generative AI misuse while also promoting academic integrity. The issue explores how GAI can be utilized to maintain assignment integrity.

Furthermore, the query is distinct and concise, with a clear connection to the research objective and questions. The question is also pertinent to the current status of GAI and academic integrity research, as it asks how GAI can be utilized to solve the challenges of preserving academic integrity in the face of generative AI misuse.

By gathering comments from popular AI tools, we plan to capitalize on the variety of

perspectives and approaches these AI systems may provide. Each AI tool may have distinct strengths and insights, and their responses may clarify various elements of GAI's implementation in academic environments, such as potential problems, rewards, and ethical concerns.

We posed the question to the leading AI tools (ChatGPT, Google Bard, and Bing Chat). Each of them responded with their unique perspective.



(a) ChatGPT (b) Bing Chat (c) Google BARD

Figure 2. Sample responses from the 3 popular GAI tools.

Figure 2 presents a set of sample screenshots showcasing the responses generated by three distinct GAI tools.

The findings produced by the three different AI technologies reveal similarities when compared side by side. Consequently, we focused our attention on the specific domains to identify the primary significant activities that may be carried out to guarantee the authenticity of assignments when generative AI approaches are applied within the framework of higher education.

Table 1 presents a comprehensive overview of the similar objectives found in the responses generated by various AI tools, along with the matching statements made by each tool for each specific objective.

Table 1. AI tools' objectives and matching statements (*note: content generated by AI*).

Common Objective	ChatGPT	Bing Chat	Google BARD
Educating students and faculties about	Higher education institutions should provide training and educational	Educating students and faculty about the capabilities and	Educate students about the risks of academic dishonesty. Students

how to use GAI in a reasonable way	programs to faculty and students about the responsible use of GAI in academic settings. This should include discussing the potential benefits and risks of using GAI for assignments, plagiarism detection, and academic integrity.	limitations of GAI and the ethical and academic implications of using it for academic work. For example, they can provide workshops, tutorials, and resources on how to identify, evaluate, and cite GAI-generated content and avoid plagiarism and other forms of academic misconduct involving GAI.	need to understand that using GAI to generate content for assignments is a form of cheating. Institutions should provide clear and comprehensive policies on academic integrity and ensure students are aware of the consequences of cheating.
Designing assignments that require innovative thinking	Promote assignments that require critical thinking, creativity, and problem-solving skills, making it challenging for students to rely solely on GAI-generated content. Focus on tasks that encourage unique perspectives and original contributions.	Designing assessments that are authentic, meaningful, and aligned with learning outcomes, rather than relying on standardized or generic tasks that GAI can easily complete or manipulate. For example, they can use open-ended questions, case studies, portfolios, reflections, or creative projects that require students to demonstrate their understanding, analysis, synthesis, and application of knowledge, skills, and values.	Design assignments that are not easily completed using GAI. Institutions can design assignments requiring students to use their knowledge and skills rather than simply generating text from a GAI tool. For example, assignments could require students to analyze data, write persuasive essays, or solve problems.
Establishing a conducive environment for fostering academic integrity	Create a culture that values academic integrity and honesty. Encourage academic integrity pledges, honor codes, and peer accountability mechanisms.	Fostering a nurturing environment that places high importance on academic integrity and upholds the principles of honesty. Promote the adoption of academic integrity pledges, honor codes, and mechanisms for peer accountability, reinforcing the commitment to ethical conduct and responsible academic practices among all educational community members.	Create a culture of academic integrity in the institution. This means promoting an environment where students feel comfortable reporting academic dishonesty and where they understand the importance of academic integrity.

Utilizing GAI tools for learning support	Utilize GAI not as a replacement for human assessment but as a tool to support and provide feedback to students. AI can be employed to assist in generating examples, providing practice questions, or offering constructive feedback on writing style and grammar.	Encouraging students and faculty to use GAI as a tool for learning, research, and innovation rather than as a shortcut or a substitute for academic work. For example, they can promote a culture of academic integrity, curiosity, and creativity among students and faculty and provide opportunities for them to explore, experiment, and collaborate with GAI in ethical and responsible ways.	Use GAI in a responsible and ethical way. GAI can be a powerful tool for learning, but it is important to use it in a way that does not compromise academic integrity. Students should be taught how to use GAI responsibly and ethically, and instructors should be aware of the potential for academic dishonesty when using GAI.
Using GAI detection tools	Invest in robust plagiarism detection systems that can identify content generated by GAI tools and cross-check it against known sources. This helps in identifying potential instances of academic misconduct.	They can use plagiarism detection software to check for signs of GAI-generated content, such as inconsistencies, errors, or anomalies in style, tone, vocabulary, or logic.	Develop plagiarism detection tools that can identify GAI-generated content. There are a number of plagiarism detection tools available that can identify GAI-generated content. These tools can be used to scan student assignments for plagiarism, and they can also be used to educate students about the risks of using GAI to cheat.

5. The PAIGE framework

The development of the theoretical framework is facilitated by the required detailed analysis of responses obtained from leading GAI tools such as ChatGPT, Google Bard, and Bing Chat. The overall objective of this theoretical framework is to provide a comprehensive and systematic approach to the effective generative use of GAI in higher education. The system attempts to address the important issues of maintaining assignment integrity and academic integrity.

As each stage of the framework incorporates and utilizes GAI, it possesses the potential to benefit GAI's capability to improve student learning experiences and ensure assignment integrity. The proposed framework (named PAIGE, in figure 3) is based on the objectives shown in Table 1. The framework's main goal is to promote assignment integrity using generative AI for higher

education. The goal is achieved by addressing five common objectives from the response of the three GAI tools.

The five objectives are further supported by theoretical discussion.

AI solutions are extensively utilized and trusted in various industries, including education [26,27]. A solid theoretical foundation for assessing generative AI in education can be established by including objectives from popular AI tools. While generative AI tools may exhibit potential biases on occasion, the framework was developed through a combination of AI tool input and human involvement in the meticulous evaluation of responses backed with relevant studies. The primary cause is that the goals of widely used AI tools are based on sound theory and research. Their objectives mirror important aspects of the actual operation of GAI. This indicates that both educators and students will receive helpful and reliable direction from the framework.

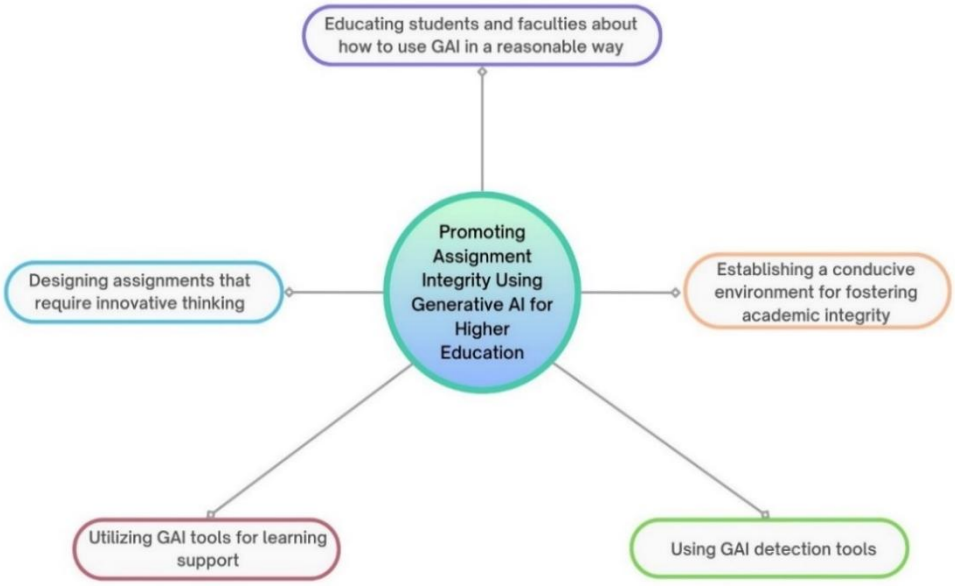


Figure 3. The PAIGE framework.

Major AI technologies also have realistic goals that align with industry requirements. For real-world applications in higher education, the framework will be increasingly relevant. Overall, a reasonable strategy to construct a theoretical framework is to take the goals of well-performing AI tools and modify them. The most recent AI technologies are balanced with the tried-and-true techniques needed for high-quality instruction. The framework will be sound theoretical and useful in actual learning environments.

The PAIGE framework encompasses a set of objectives that have the potential to significantly enhance the utilization of GAI in the field of higher education, with a particular focus on upholding assignment integrity. The set of objectives are briefly defined in the following part:

- Educating students and faculties about how to use GAI in a reasonable way: The imperative to instruct faculty and students on the sensible utilization of GAI has intensified in together with its ongoing integration within the education sector [28]. The objective of this is to provide knowledge to users on the responsible utilization of GAI. Specifically, it aims to offer guidance to students and staff members on the ethical and conscientious use of GAI, thereby assuring its suitable implementation in academic endeavors.

- Designing assignments that require innovative thinking: Study shows promoting critical thinking can enhance the quality of students, and this helps to produce skilled graduates [29]. This objective of the framework aims to develop tasks that motivate students to employ GAI in order to cultivate innovative thinking and problem-solving abilities, hence stimulating the production of unique and original work.
- Utilizing GAI tools for learning support: This objective focuses on integrating GAI for Learning Support [30]. It centers on utilizing GAI tools to optimize student learning experiences by offering tailored assistance and valuable resources that facilitate academic development and comprehension.
- Establishing a conducive environment for fostering academic integrity: Creating an atmosphere that supports academic integrity, which refers to the conduct, conduct, and values of academics and students in every aspect of their profession [31]. This includes implementing policies, providing support systems, and implementing educational programs that encourage honesty and ethical behavior in educational settings that utilize GAI technology.
- Using GAI detection tools: Researchers and businesses have collaborated to develop AI detection tools that can distinguish content produced by AI systems from that produced by humans [32]. The objective is to incorporate GAI detection techniques to identify occurrences of plagiarism or inappropriate usage, hence assisting in preserving assignment integrity and promoting academic honesty.

5.1. Benefits of the framework

Our proposed framework addressed the absence of measures for potential misconduct of GAI technologies in the context of educational integration, in contrast to the current paradigm that has been explored in the literature. Studies have been conducted to measure the effectiveness of plagiarism detection tools is assessed in the context of ChatGPT usage [33]. But existing frameworks does not prioritize preserving assignment integrity while integrating GAI in education setting [34,35].

There are many benefits associated with the framework, including goals for the application of GAI in higher education with the goal of maintaining assignment integrity. Faculty members and students receive training to ensure responsible use of GAI. As shown in the case study section, the framework may be used for a wide range of assignment types, demonstrating its generalizability. Furthermore, plagiarism is detected utilizing GAI detection techniques, which upholds assignment integrity. Additionally, assignments that inspire original thought are created to promote inventive thinking. Moreover, the system uses GAI to deliver personalized learning support, helping to create an ethically sound academic environment. In the end, this integration helps to foster positive learning environments and raise academic performance. Higher education can benefit from the use of GAI in a number of ways, including improved teacher empowerment, future-ready skill development, and institutional prestige [36].

The framework offers potential advantages to higher education students as it prioritizes the ethical integration of General Artificial Intelligence (GAI) into their education. As previously stated, the utilization of GAI in assignments has the potential to lead to incidents of academic misconduct. The PAIGE framework offers a comprehensive set of objectives that can serve as a guiding principle for students to effectively harness the capabilities of GAI in their pursuits of education and learning

outcomes, while still upholding the principles of academic integrity. Because of these advantages, the suggested framework is an essential manual for incorporating GAI into the system of higher education.

5.2. Survey on the effectiveness of the framework

Five instructors from a department of a university participated in the survey. They received information on the goals, procedures, and the proposed framework. After that, they had to respond to six questions to assess the effectiveness of the framework. Google Form was used for conducting the survey. No information regarding the participants' personal details was recorded or released to satisfy any ethical concerns.

The purpose of this survey is to evaluate the usefulness of the PAIGE framework in the field of higher education. The PAIGE framework is a visionary set of goals with a primary objective of protecting and expanding the use of GAI in academic settings. We hope to find out more about the framework's usefulness and potential uses in educational settings by collecting feedback from five experienced instructors. In addition, we aim to evaluate a framework built with generative AI tools and see if it matches the expectations of professional instructors.

Table 2. Survey questions and responses from the instructors.
(1 = Very Ineffective, 4 = Ineffective, 3 = Neutral, 4 = Effective, 5 = Very Effective)

Instructor No.	**Question 1:** To what extent do you believe that educating students and faculty about the responsible use of Generative Artificial Intelligence (GAI), as outlined in the PAIGE framework, is effective in upholding assignment integrity?	**Question 2:** How effective do you find the PAIGE framework's objective of designing assignments that require innovative thinking in promoting critical thinking and creative problem-solving skills among students?	**Question 3:** In your experience, to what extent has the utilization of GAI tools for learning support, as suggested by the framework, improved student learning experiences and academic development?	**Question 4:** To what degree do you believe that the PAIGE framework will be successful in establishing a conducive environment for fostering academic integrity in educational settings that use GAI technology?	**Question 5:** How effective have GAI detection tools, as advocated by the framework, been in identifying plagiarism and inappropriate usage, thus preserving assignment integrity and promoting academic honesty?	**Question 6:** Overall, how would you rate the effectiveness of the PAIGE framework in enhancing the utilization of generative artificial intelligence in higher education?
1	4	4	3	4	5	4
2	3	4	2	3	4	3
3	5	5	3	5	5	5
4	4	4	4	5	5	4
5	3	4	3	3	5	3

Six well-formulated questions (as presented in Table 2) are included in the survey to evaluate the usefulness of the PAIGE framework. In Question 1 we evaluate how effective participants believe education on appropriate GAI use will be in sustaining assignment integrity, and in Question 2 we focus on how effective innovative assignment design will be in encouraging critical thinking. Question 3 explores how GAI tools can be used to improve the educational experience for students, while Question 4 investigates whether the framework can be used to promote academic honesty. What effective GAI detection technologies are at protecting assignment integrity is the topic of Question 5. Finally, Question 6 offers an in-depth examination of the framework's overall efficacy, permitting a thorough evaluation of its educational, ethical, and practical contributions within the context of higher education.

Table 2 presents responses from five different instructors regarding the effectiveness of the PAIGE framework using Likert scale ratings (with 1 being the lowest and 5 being the highest). Instructors 1, 2, and 4 express confidences in the framework's capacity to promote innovative assignment design and establish a conducive environment for academic integrity, with ratings of 4. Instructors 3 and 5, on the other hand, hold stronger beliefs, with ratings of 5, particularly for academic integrity. However, there is more diversity in their perceptions of GAI tools for learning support, with ratings ranging from 2 to 3, suggesting room for improvement in this area. It is evident that all instructors unanimously support GAI detection tools' effectiveness in preserving assignment integrity. In summary, the responses from the instructors indicate a generally positive view of the PAIGE framework. While there is some variation in their perceptions, particularly regarding GAI tools for learning support, most instructors have confidence in the framework's potential to enhance various aspects of higher education, including academic integrity and innovative assignment design.

The positive responses regarding the GAI detection tools, along with favorable views on other aspects of the framework, suggest that integrating GAI tools can enhance the utilization of generative artificial intelligence in higher education.

5.3. Limitations and challenges of the framework

There are issues with the framework that need to be carefully thought through and fixed. For institutions with limited funding, the number of resources required to implement the framework—such as monetary contributions for teacher training and the purchase of GAI detection tools—may provide challenges. The guidelines of its framework may need to be updated on a regular basis to guarantee that it remains relevant and effective considering the continuously evolving field of GAI [37]. There are several different and complicated ethical issues related to the application of generative artificial intelligence (GAI) [38]. Formulating guidelines that are applicable to all situations may require assistance in establishing a framework for safe use of GAI.

Furthermore, assigning assignments that demand the use of GAI could unintentionally increase inequality among students who might need access to the necessary tools or training. The overall goal of encouraging diversity within the context of higher education may be compromised by this.

Moreover, user competency must be considered for the effective implementation of GAI in education, since not everyone has the necessary technical skills to utilize GAI appropriately. It's also critical to recognize that algorithms used in GAI may pick up biases from the training set [39].

This study suggests a conceptual framework, but more in-depth research is needed in the future

to make it work in real life. It is very important to do thorough empirical validation in several different educational settings to find out how the framework affects student engagement, learning results, and academic integrity. Improving the framework's value by adapting to different situations and thinking about inclusion can help it work better. In the field of GAI, it is very important to keep studying ethics and bias to make sure that only fair and clear content is produced.

6. Conclusions

This study addresses two key objectives - finding ways to prevent generative AI misuse and promote academic integrity and exploring innovative assignment criteria to ensure integrity when incorporating generative AI in higher education. To achieve these goals, we analyzed the perspectives of leading AI systems like ChatGPT, Google Bard, and Bing Chat on effectively leveraging generative AI while upholding academic honesty.

The analysis revealed common objectives like educating students, designing thoughtful assignments, establishing an integrity culture, using AI responsively, and implementing detection tools. These insights informed our proposed PAIGE framework encompassing these goals to guide the judicious integration of GAI. The framework emphasizes ethical AI adoption, assignment innovation, learning support, academic integrity policies, and misuse monitoring.

Our research makes important contributions by providing initial guidance on GAI integration while safeguarding academic principles. However, we recognize limitations like resource constraints, ethical complexities, and user proficiency challenges. Further empirical research is required to validate the framework, ensure inclusivity and accessibility, mitigate biases, assess long-term impacts, and address evolving generative AI systems. Nonetheless, this study sets the groundwork for developing responsible and engaging integrations of GAI in higher education.

The investigation of how to make the PAIGE framework inclusive and guarantee equal access to generative AI technologies will be among the study's future works. Factor in cultural differences, digital divide concerns, disabilities, and multilingual requirements. Constantly assessing the educational impacts and efficacy of newly developed generative AI models. Examining the framework's implementations in contexts other than higher education, including K–12 education, informal education, and professional development programs, can be a good future work.

Progressive, collaborative efforts between institutions, educators, researchers, and technologists will be pivotal in overcoming limitations. With a principled approach, as outlined in this paper, generative AI holds immense promise to transform pedagogical approaches, empower students, and uphold academic values. The insights from our analysis highlight that it is possible to derive the benefits of generative AI while fostering academic integrity through a synthesis of ethical AI adoption, assignment innovation, and detection mechanisms. More extensive research building on this foundation can pave the way for AI-enabled education that is creative, inclusive, and anchored in academic principles.

Use of AI tools declaration

The authors declare that they have not used AI tools in the writing of this article. However, several AI tools (ChatGPT, BingChat, BARD) were used to get responses for the purpose of the study. Such as, the content of Figure 2 and Table 1 are only generated by AI tools (ChatGPT, Bing Chat, and Google BARD).

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Conflict of interest

The authors declare that they have no conflict of interest.

Ethics declaration

The author declared that the ethics committee approval was waived for the study.

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