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The perspectives of Saudi students on the contribution that generative artificial intelligence can make to the educational system

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ABSTRACT

This study examines the role of generative artificial intelligence (AI) in the educational system of Saudi universities. A descriptive research design and a quantitative approach were employed, with a questionnaire used as the primary data collection instrument. The study sample consisted of 1,250 students selected randomly. The findings indicate that the use of generative AI in educational settings is at a high level. Furthermore, the results show no statistically significant differences in the use of generative AI across different academic disciplines.

1. Introduction

The rise of AI has been a defining characteristic of the modern era, and the sector of education is only one of many that has benefited greatly from AI-powered innovations. Leading academic institutions, tech businesses, and research centers have all invested heavily in artificial intelligence (AI) research in recent years, with the goal of expanding the field's methodologies, disciplines, and applications. Obenza et al. (2024) noted that generative artificial intelligence (GenAI) is one of the new ideas that have come out of these efforts; it is a significant step forward in the evolution of AI. According to Miao and Holmes (2023), GenAI can create new texts, photos, films, music, codes for programming, and situations by analyzing common patterns and statistical data on the distribution of words and their parts (tokens). The GenAI models were trained with the help of Big Data, which comprises massive amounts of information collected from various sources such as websites, social media, news, conversations, forums, and databases. The use of domain-specific data for retraining GenAI models is a possibility (Miao and Holmes, 2023). The benefits of technological progress are manifold, and include, but are not limited to, the following: the ability to tailor solutions to individual users' requirements, the ability to better manage resources, the encouragement of environmentally conscious behaviors, and the possibility of ever-increasing performance (Silva et al., 2024).

According to Silva et al. (2024), numerous GenAI tools are revolutionary and might revolutionize the education industry. By delivering more personalized forms, GenAI solutions in the classroom enhance students' learning experiences (Sullivan et al., 2023). Moreover, it improves student outcomes (Kalota, 2024) and the educational process (Jauhiainen and Guerra, 2023) by making it easier, more pleasurable, and engaging. Major obstacles to incorporating GenAI tools into course syllabi and the necessity to develop rules, laws, and ethical guidelines for their use are all part of this interconnected setting (Johnston et al., 2024). Students are important stakeholders who greatly impact the success of policy implementation, development, and integration (Zastudil et al., 2023). It's crucial to connect with them by understanding their perspectives and perceptions. There has been very little study on GenAI thus far, as it is still in its discovery phase. Additionally, there is a dearth of research on how students see GenAI (Chan and Hu, 2023; Johnston et al., 2024). As a result, everyone in the academic community is wondering how college students see GenAI's place in the classroom. Many studies (Bahroun et al., 2023; Chan and Hu, 2023) have concluded that it is important to study students' perspectives on GenAI in the classroom. The use of GenAI in Saudi Arabian universities is still

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in its infancy, and little thought has been given to how students see GenAI's place in their education. The development of suitable and workable regulatory frameworks, as well as the effective integration and use of GenAI in education, depends on our understanding of this component. University students' views on GenAI's place in the classroom are the subject of this research, which examines their familiarity with the technology, their opinions on its usefulness, and their willingness to embrace it. For a more thorough examination, we have additionally examined students' views on their knowledge of the difficulties and worries associated with the use of GenAI tools in the classroom. Examining how students felt GenAI tools affected their understanding of the SDGs in the classroom was crucial to filling in the gaps.

By illuminating how Saudi university students see GenAI's function in the country's educational system, this study helps to close a knowledge gap. As far as we are aware, this is the first study in Saudi Arabia to survey undergraduates about their thoughts on GenAI's place in the classroom. Additionally, researching how students view the use of GenAI in the classroom with respect to various scientific fields. Attempting to recruit more people is typical in previous research. Considering that most recent research has concentrated solely on ChatGPT, GenAI offers a far more comprehensive set of capabilities. Consequently, the following questions are targeted by this research:

Q1. What benefits and challenges do Saudi university students perceive in the use of generative artificial intelligence in the classroom?
Q2. Do Saudi university students' perceptions of generative artificial intelligence in education differ according to academic discipline (humanities versus scientific fields)?

2. Literature review

Academics and educational institutions are keen on incorporating new ideas and technology into teaching methods because of the fast qualitative advancements in AI. A more effective learning environment, enhanced learning experiences, and the capacity to construct knowledge societies based on long-term data storage and retrieval can all be achieved through this integration. Within this framework, GenAI technologies have revolutionized education by introducing fresh approaches and paving the way for better, more inclusive, and productive teaching methods (Bahroun et al., 2023). While these developments highlight the transformative potential of GenAI, existing studies tend to emphasize technological capabilities rather than critically examining how students themselves perceive and evaluate these tools in educational contexts. The importance of GenAI in the classroom has been discussed in a lot of books and articles. By utilizing natural language processing techniques, LLMs, and GPT, GenAI improves learning experiences and allows for immediate, personalized solutions to student demands (Silva et al., 2024). ChatGPT and Bard are text-to-text GenAI systems that can help students with their studies by responding to their questions and concerns, breaking down difficult ideas into simpler ones, and providing personalized feedback according to their cognitive and academic abilities. Students can practice their language abilities in different and authentic scenarios with GenAI systems that simulate real-life discussions. The quality of academic works and scientific papers can be improved with the help of these tools because they can check for spelling and grammar mistakes, make sentences and paragraphs more coherent, translate, summarize, and analyze data. To identify and prevent errors in computer programming, ChatGPT can comprehend and evaluate programming instructions (Surameery and Shakor, 2023). According to Sallam et al. (2023), healthcare education has benefited from GenAI systems that can create individualized scenarios based on real-life events and instantly provide feedback on how students have responded therapeutically to such scenarios. Taken together, these studies demonstrate a wide range of instructional applications; however, they largely assess effectiveness from a functional or outcome-based perspective, offering limited insight into students' subjective judgments regarding usefulness, relevance, and acceptability.

Also, programs like Stable Diffusion and DALL-E, which convert words into images, have been useful in the classroom for teaching students about art and design (Dehouche and Dehouche, 2023). New levels of expression, experimentation, prototype, and expense have been introduced by these tools. Going beyond the idea of information and expertise monopolization, GenAI enhances human creativity in numerous ways, including idea quality and evaluation, interaction, cooperation, and divergent thinking (Kalota, 2024). Innovation processes can be accelerated and development costs reduced by using GenAI technologies at the early stages of exploration, concept generation, and digital prototype design (Bilgram and Laarmann, 2023). According to Chan and Hu (2023), these tools also allow pupils to feel more confident in their abilities and learn more independently. People with impairments have benefited greatly from the use of GenAI tools in the classroom. So, for instance, the inclusion and communication of pupils with impairments have also been enhanced (Lyerly, 2023). Despite these positive accounts, the literature offers little critical discussion of whether students consistently recognize these creative and inclusive benefits, or whether such advantages are perceived differently across academic disciplines.

While GenAI has many potential benefits for classroom instruction, certain studies have highlighted some of the obstacles that educators may face. The biggest danger comes from ethical issues related to student data privacy, algorithmic bias,

academic dishonesty, and the ownership of student-submitted works and projects. According to Williams (2024), there is an obvious demand for more targeted software that can identify when these tools are being used in academic settings. Based on the findings of Emsley's (2023) research on the dependability and correctness of medical reports and articles generated by ChatGPT, it was found that out of 155 references, 47% were erroneous, 46% were factually correct but incorrect, and only 7% were factually correct but inaccurate. This lends credence to the conclusions of Kumar's (2023) research, which suggested that academic publications produced by ChatGPT were, on the whole, accurate and helpful, despite the fact that they contained a few citations that were not accurate. During the investigation, it was also discovered that these reports are lacking subjective opinions and values that are derived from EQ components. In a related vein, Harrer (2023) explains how the training of GenAI systems on data that is biased, erroneous, or otherwise damaging has a direct impact on the accuracy and reliability of the output. To add insult to injury, GenAI tools face multiple cybersecurity threats. Concerns over the security of these tools were voiced by 79% of IT leaders surveyed globally (Kalota, 2024). A loss of real learning experiences, lower levels of engagement and human connection, and a reduction in students' academic self-efficacy might result from the careless and excessive use of GenAI tools (Williams, 2024). Another potential side effect of GenAI technologies is a decrease in problem-solving and critical-thinking ability. Although these risks are well documented, relatively few studies explore how aware students are of these challenges or how such concerns shape their attitudes toward adopting GenAI in academic settings.

Because the perceptions of students have a significant impact on the quality of the educational experience that is provided, it is essential to understand the viewpoints that students have toward higher education (Cladera, 2021). The 3P model of instruction and assessment that Biggs (2012) developed places a strong emphasis on the significance of understanding how the perspectives of students influence the learning outcomes of those students. According to Biggs (2012), students' self-perceptions about their talents and the classroom setting greatly influence their learning style and, by extension, their performance in the subject. Confident students are more likely to take a more in-depth approach to their learning because they have a positive view of themselves and their educational environment, which includes course material, instructors, and assessment tools. Connecting ideas and seeing patterns are examples of higher-order thinking that this method emphasizes. Conversely, when students have low self-esteem and feel they can't make it in school, they take a shallow approach to learning that is too focused on memorization and recall and yields only mediocre outcomes. Discovering, comprehending, and addressing the viewpoints of university students, as well as extracting relevant indicators from those perspectives, is something that is necessary to enhance instructional practices, boost students' self-assurance, encourage the development of their thinking abilities, and increase their learning outcomes. This theoretical perspective underscores the importance of empirically examining students' perceptions of GenAI, as such perceptions may directly influence how these technologies are used and integrated into learning processes.

The success of implementing technical changes is also heavily dependent on how individuals perceive these innovations. To maximize the benefits of technological advances like GenAI in educational practices, it is crucial to understand how students perceive and view these innovations (Lokmic-Tomkins et al., 2022). Notably, universities confront significant obstacles when trying to figure out how to include GenAI technology into coursework and when trying to establish suitable rules (Johnston et al., 2024). Since students are important stakeholders whose opinions matter for the success of development and integration processes, it is crucial to involve them by learning about their perspectives and perceptions (Zastudil et al., 2023). Teachers and administrators can gain vital insights into how university students perceive the role of GenAI in education. This will help them conduct successful integration and development processes and create rules that are relevant and practical. However, much of the existing evidence remains fragmented and context-specific, limiting its usefulness for informing policy and practice across diverse higher education systems.

However, most published works have neglected to investigate how students perceive and value the subject. For example, Yilmaz and Yilmaz (2023) zeroed in on how ChatGPT affected students' computational thinking, programming self-efficacy, and intrinsic drive to learn. Students in the experimental group outperformed those in the control group in terms of computational thinking, programming self-efficacy, and motivation to learn. Furthermore, a framework for incorporating GenAI technologies into college courses was provided by Shailendra et al. (2024). The study highlighted the significance of rethinking educational programs to incorporate GenAI capabilities and giving educators and students more agency. On top of that, it suggested a matrix to evaluate how well the integration procedures worked. On the other hand, Chiu's (2024) research looked at how GenAI could affect education from the perspective of school administrators and educators. The necessity to equip students with digital and media literacy as well as critical thinking abilities—two of the most noticeable outcomes—is a direct outcome of the need to equip GenAI technologies. Bahroun et al. (2023) sought to undertake a comprehensive literature review on GenAI in education that was published between 2018 and 2023. The study focused on GenAI's uses in assessment, smart tutoring systems, ethical

considerations, interdisciplinary collaboration, responsible technology use, and supporting personalized learning. Improvements in self-directed and collaborative learning, together with the ability to personalize formative assessment procedures, were identified as among the most significant advantages. On the flip side, one of the biggest dangers is making erroneous data. While informative, these studies primarily emphasize outcomes, frameworks, or institutional perspectives, offering limited direct evidence of how students themselves assess the educational role of GenAI across different learning contexts.

While there is some writing on students' impressions of GenAI tools in the classroom, much of it lacks a comprehensive approach that considers students' views across a wide range of scientific fields and with a large sample size. For example, Firat's (2023) research revealed how PhD students saw the consequences of using Chat GPT; yet, the study's limitations—its small sample size of 14 and its focus on students with degrees in education—remain. Just to Shoufan's (2023) study, this one sought to evaluate how 56 computer engineering students, who made up a small but representative sample, felt about the benefits and drawbacks of Chat GPT. A similar small sample size was used in the study by Limna et al. (2023) to determine how 15 students felt about ChatGPT in the classroom. By reviewing one hundred TikTok posts, Haensch et al. (2023) determined how students felt about the Chat GPT tool; nevertheless, they neglected to account for the variety of scientific fields. The limitation of focusing on a single field or GenAI tool persists even in experiments with bigger samples. Discovering how 239 students majoring in math and science felt about the ChatGPT tool's function in the classroom was the goal of the study by Yilmaz et al. (2023). In the meantime, the purpose of the study by Singh et al. (2023) was to gauge how 430 computer science master's students felt about the ChatGPT tool as it pertained to pedagogy and instruction. Consequently, this study intends to address the lack of research by disclosing, through a larger sample size (1,390), the perspectives of university students regarding the function of GenAI in education, while also considering the diversity of scientific disciplines and GenAI technologies. These methodological limitations highlight a clear need for broader, cross-disciplinary investigations that move beyond single tools and small samples. Consequently, this study addresses the identified gap by examining Saudi university students' perceptions of the benefits and challenges of generative artificial intelligence in education using a large, diverse sample, while also exploring differences across academic disciplines and GenAI technologies.

3. Methods

Using a questionnaire-based descriptive quantitative methodology, this study surveyed participants. This kind of research aims to gain a better understanding of social phenomena and experiences by statistically defining the mindset, tastes, and views of the studied group by analyzing the views of a representative sample. Research involving social and psychological aspects frequently employs survey studies due to their reliability. In addition, survey studies have several advantages, such as a large sample size, the ability to draw broad conclusions, and quick and cheap data gathering. Therefore, this research design was optimal for elucidating how college students see GenAI's function in the classroom.

Data for this study were collected using a questionnaire to gain a better understanding of how college students evaluate the role of GenAI in the classroom. Obenza et al. (2024) and Williams (2024) completed several steps in the process of preparing the questionnaire. These steps included formulating the questionnaire in accordance with the objectives of the study, conducting a comprehensive review of the instruments, results, and recommendations from relevant studies and official reports, and consulting with experts to obtain their insights and recommendations. The final questionnaire contained a total of 38 items, which were organized into six basic categories. These statements formed the basis of the questionnaire. The demographic information, which consisted of five questions, the awareness and knowledge of GenAI tools, which consisted of five statements, acceptance and readiness, which consisted of five statements, the role of GenAI in education, which consisted of thirteen statements, potential fears and challenges, which consisted of five statements, and the impact of GenAI on sustainable development, which consisted of five statements were the categories that were included in one of these categories. Using a Likert scale with five points (strongly agree = 5, agree = 4, neutral = 3, disagree = 2, and strongly disagree = 1), participants were encouraged to express the degree to which they agreed or disagreed with each statement.

3.1. Sampling procedure and data collection

To ensure a representative and unbiased sample, a random sampling approach was adopted across multiple Saudi universities. The study involved students from fifteen public and private universities located in different regions of Saudi Arabia, ensuring institutional and geographical diversity. Universities were selected to reflect variation in size, academic focus, and disciplinary offerings. Within each university, participants were randomly invited to participate regardless of academic level or specialization.

Data collection was conducted primarily through an online questionnaire, which was distributed using official university communication channels, including institutional email lists and learning management systems, as well as student academic networks. This approach enabled broad reach and accessibility while maintaining anonymity and voluntary participation. The online mode was

selected to facilitate efficient data collection across a large sample within a limited timeframe. Data collection took place between late June and mid-August 2024.

Before distribution, participants were informed of the study's purpose, assured of confidentiality, and notified that their participation was entirely voluntary. Only fully completed questionnaires were included in the final analysis to ensure data quality.

3.2. Questionnaire development and validation

To strengthen content validity, the questionnaire underwent an expert review process prior to final administration. A panel of five experts was consulted, comprising specialists in educational technology, higher education pedagogy, educational measurement, and artificial intelligence in education. These experts were affiliated with Saudi and international universities and had prior experience in survey-based educational research.

The experts evaluated the questionnaire items for clarity, relevance, wording, and alignment with the study objectives. Based on their feedback, several refinements were made, including rephrasing ambiguous statements, improving the logical flow of items across sections, and ensuring appropriate coverage of both the benefits and challenges of GenAI in education. Minor adjustments were also made to reduce redundancy and enhance readability for student respondents. This iterative review process contributed to the overall validity and reliability of the instrument.

3.3. Population and sample

The purpose of this research was to learn how college students see GenAI's function in the classroom. Data were obtained from a random sample of fifteen Saudi Arabian university students during the 2024 academic year, from the end of June to the middle of August. The total number of responses received was 1,250. You can see the sample profile in Table 1. Most of the population consists of males (68.9%), with females making up 31.1%. The age bracket of less than 20 years old accounts for 58.8% of the total, followed by those in the 20–less than 35 age bracket (37.0% of the total), and finally, those over the 35 age bracket (4.2%). The data show that, when looking at scientific specialization, the sciences are the most common (65.6%), followed by the humanities (34.4%).

The study's questionnaire met the recommendation of Hair et al. (2019) in terms of internal consistency, as shown by the reliability analysis using Cronbach's alpha. When Cronbach's alpha is more than 0.70, we have achieved a reasonable level of reliability. With a Cronbach's alpha of 0.802, the 5-item GenAI tools knowledge and awareness measure demonstrated good reliability. With a Cronbach's alpha of 0.812, the five-item acceptance and preparedness measure was found to be good. Equally impressive was the GenAI educational scale's 13-item Cronbach's alpha of 0.863, which demonstrated very high internal consistency. A Cronbach's alpha of 0.746 showed satisfactory internal consistency for the 5-item fears and prospective problems measure. Finally, the five-item sustainable development scale showed remarkable internal consistency (Cronbach's alpha = 0.823) when tested with GenAI (Table 2).

Table 1: Profile of respondents

Variable	Categories	N	%
Gender	Male	861	68.9
	Female	389	31.1
Age	< 20 years	735	58.8
	20 - 35	463	37.0
	> 35	52	4.2
Academic disciplines	Humanities	430	34.4
	Sciences	820	65.6

Table 2: Cronbach's alpha test

The variable	N	Value
The knowledge and awareness of GenAI tools	5	0.802
Acceptance and readiness	15	0.812
The function of GenAI in educational	13	0.863
Worries and prospective problems	5	0.746
The influence of GenAI on sustainable development	5	0.823

To comprehensively analyze the initial research topic, it is essential to calculate the mean and standard deviations of all variables related to what college students think about the application of generative AI in the classroom.

Table 3 presents students' views on generative AI across five main areas: awareness, acceptance, educational use, concerns, and sustainable development. Overall, the mean scores show a generally high level of agreement, suggesting that students view GenAI as both useful and influential in their learning, while also being conscious of its limitations. In terms of knowledge and awareness, students demonstrated a strong understanding of what GenAI can and cannot do. They were particularly aware that these tools can sometimes produce inaccurate or misleading information. Awareness of outdated information was slightly lower, though still high, indicating that while students are generally critical users, some limitations are more salient to them than others. Students also showed a positive attitude toward adopting GenAI in their studies. They largely agreed that these tools are helpful, innovative, and likely to be used more in the future. Although ease of use received the lowest score within this group of items, it still reflected a favorable perception, suggesting that minor practical challenges do not significantly reduce students' willingness to engage with the technology.

Perceptions of the role of GenAI in learning were especially strong. Students felt that these tools improve access to learning resources, help them understand complex material, and support independent learning and faster feedback. While all aspects were rated highly, areas such as language improvement and brainstorming showed slightly lower agreement, pointing to aspects where the

perceived benefits may be less pronounced. When it comes to concerns, respondents expressed notable worries about issues such as reduced critical thinking, limited human interaction, and risks related to data privacy. Interestingly, ethical misuse was rated lower than other concerns, which may suggest that students are less aware of, or less sensitive to, the ethical implications of using GenAI in academic work. Finally, students viewed GenAI as having strong potential to contribute to sustainable development, particularly by widening access to educational resources and supporting lifelong learning. Although agreement was somewhat lower regarding its role in reducing gender gaps, perceptions were still clearly positive overall.

Table 3: Means and standard deviations

No.	Items	Means	SD	Results
	The knowledge and awareness of GenAI tools			
1	Recognize that GenAI tools may produce erroneous results.	4.56	0.40	High
2	Understand that GenAI tools can produce contextually irrelevant results.	4.21	0.54	High
3	Recognize that GenAI tools may produce obsolete results.	4.01	0.56	High
4	I know that GenAI tools possess limits in managing intricate jobs.	4.19	0.52	High
5	Recognize that GenAI tools possess constrained emotional intelligence, potentially resulting in unsuitable output.	4.36	0.50	High
	Total	4.25	0.35	High
	Acceptance and readiness			
1	Engaging with GenAI technologies is straightforward and unambiguous.	3.73	0.54	High
2	Generative AI techniques are beneficial for executing my educational tasks.	3.88	0.59	High
3	GenAI tools are groundbreaking instruments.	3.99	0.60	High
4	I appreciate utilizing GenAI tools in educational contexts.	3.79	0.61	High
5	I am inclined to utilize GenAI tools for instructional reasons more frequently in the future.	3.83	0.59	High
	Total	3.84	0.45	High
	The function of GenAI in educational			
1	GenAI tools enhance my access to a variety of instructional resources.	4.71	0.41	High
2	GenAI technologies enhance my comprehension of intricate academic language and topics.	4.52	0.30	High
3	The utilization of GenAI tools in pedagogical strategies enhances efficiency and conserves resources.	4.42	0.47	High
4	GenAI tools augment my educational results.	4.41	0.48	High
5	GenAI technologies enhance my critical thinking and problem-solving abilities.	4.59	0.45	High
6	GenAI tools facilitate the improvement of my autonomous learning and provide enhanced access to information.	4.32	0.49	High
7	GenAI tools facilitate the delivery of feedback customized to my academic and cognitive proficiency.	4.58	0.44	High
8	GenAI tools facilitate the provision of instantaneous feedback.	4.54	0.48	High
9	GenAI technologies enhance the velocity and efficacy of my brainstorming process.	4.11	0.48	High
10	GenAI technologies are valuable resources for the academic editing of scientific manuscripts.	4.25	0.45	High
11	Generative AI techniques are beneficial for honing language proficiency.	4.07	0.50	High
12	GenAI technologies are effective instruments for suggesting practical tasks and scenarios pertinent to academic subjects.	4.12	0.49	High
13	GenAI tools enhance my self-efficacy.	4.15	0.48	High
	Total	4.37	0.37	High
	Worries and prospective problems			
1	GenAI tools may restrict opportunities for human engagement and communication within the educational process.	4.14	0.51	High
2	GenAI tools may inhibit my critical thinking and problem-solving abilities.	4.28	0.48	High
3	GenAI tools may compromise the privacy, security, and confidentiality of individuals' data.	4.10	0.53	High
4	I will probably utilize GenAI tools extensively for instructional purposes.	4.15	0.52	High
5	I might utilize GenAI tools without adhering to ethical standards and norms.	2.35	0.51	Moderate
	Total	3.80	0.40	High
	The influence of GenAI on sustainable development			
1	GenAI solutions can facilitate improved egalitarian and transparent access to educational materials.	4.74	0.42	High
2	GenAI tools can facilitate the advancement of lifelong learning opportunities.	4.55	0.41	High
3	GenAI tools can facilitate innovative approaches to addressing the economic and environmental concerns of societies, including climate change, poverty, and hunger.	4.45	0.46	High
4	GenAI tools can aid in eradicating gender gaps in education.	4.44	0.49	High
5	GenAI tools can facilitate the empowerment of both youth and adults by equipping them with technical and vocational skills, thereby qualifying them for suitable employment or self-employment opportunities.	4.62	0.47	High
	Total	4.56	0.39	High

Taken together, these findings show that students are generally enthusiastic about the educational value of GenAI, while also recognizing important risks and challenges. This balance highlights the need for thoughtful integration of these tools, supported by clear ethical guidelines and pedagogical support.

To answer the second research question, we ran an independent sample t-test to see how college students' majors relate to their views on the function of generative AI in the classroom.

Table 4 indicates that the mean replies for the humanities college type were 4.12, while the mean responses for the scientific college type were 4.15. The significance of the two groups is (0.095), suggesting that specialization does not significantly influence the use of generative artificial intelligence in education.

Table 4: Independent samples T- test

Variables	N	Mean	SD	df	t	Sig
Humanities	430	4.12	0.43	1248	1.125	0.095
Scientific	820	4.15	0.40			

4. Discussion

This study set out to explore how undergraduate students in Saudi Arabia perceive the role of generative AI in their learning, and the findings offer several meaningful insights when interpreted through theoretical, cultural, and educational lenses.

First, the high level of awareness regarding both the capabilities and limitations of GenAI suggests that students are not passive users but rather informed and critical consumers of technology. Their strong recognition that AI can generate inaccurate or outdated information reflects a growing digital literacy, likely shaped by frequent exposure to AI tools and by national initiatives under Saudi Vision 2030 that emphasize digital transformation and critical engagement with technology. Similar patterns have been reported in recent studies conducted in technologically advanced learning environments (Chan and Hu, 2023; Kelly et al., 2023), where students demonstrated both enthusiasm and caution. In contrast, earlier work in less digitally mature contexts reported lower awareness of AI limitations (Obenza et al., 2024), indicating that national digital readiness may play an important role in shaping students' critical understanding. The strong acceptance and readiness to use GenAI can be well explained through the Technology Acceptance Model (TAM) and the Value-Based Adoption Model (VAM). Students perceived GenAI as useful, innovative, and relatively easy to use, which directly aligns with TAM's core constructs of perceived usefulness and perceived ease of use. At the same time, VAM helps explain why acceptance remains high despite acknowledged risks: students appear to perceive that benefits such as efficiency, access to resources, and learning support outweigh potential costs or concerns. This balance between perceived value and perceived risk mirrors findings by Chan and Lee (2023), who reported that students are willing to adopt GenAI when functional and learning gains are clear, even if uncertainties remain.

The very positive perceptions of GenAI's educational functions suggest that students see these tools as more than mere shortcuts; they view them as teaching companions that support understanding, feedback, independent study, and problem solving. From a pedagogical perspective, this aligns with theories of meaningful learning and self-regulated learning, where access to timely feedback, multiple representations of knowledge, and opportunities for exploration enhance cognitive engagement. Similar conclusions were drawn by Salinas-Navarro et al. (2024), who found that GenAI supports active and problem-based learning when used as a scaffold rather than a replacement for thinking. The slightly lower ratings for language development and brainstorming may indicate that students still value human creativity and interaction in these domains, suggesting that GenAI is seen as a supplement rather than a substitute.

One particularly interesting finding is the comparatively lower concern about ethical misuse. This may reflect a gap between technical familiarity and ethical awareness. In the Saudi context, where respect for authority and institutional regulation is strong, students may assume that ethical boundaries are already safeguarded by universities and national policies, leading to a lower personal sense of risk. Alternatively, the novelty and convenience of GenAI may overshadow concerns about plagiarism, data misuse, or academic integrity. Similar patterns have been observed in studies by Johnston et al. (2024), where students showed high functional acceptance but limited reflection on ethical implications. This contrasts with research in Western contexts, where academic misconduct and authorship issues are often primary concerns (Kelly et al., 2023), suggesting that cultural and institutional norms influence how ethical risks are perceived.

Concerns related to privacy, reduced critical thinking, and diminished human interaction, however, were strongly acknowledged. These worries resonate with international debates on whether over-reliance on AI may weaken higher-order thinking skills and the social dimensions of learning. Such concerns support arguments by Aldossary et al. (2024), who caution that without pedagogical guidance, AI tools may encourage surface learning rather than deep cognitive processing.

Finally, the strong belief in GenAI's contribution to sustainable development reflects the broader national discourse in Saudi Arabia, where sustainability, digital inclusion, and lifelong learning are central policy goals. Students' optimism regarding access to education, skills development, and social equity aligns with recent studies linking educational AI to the achievement of Sustainable Development Goals (Chan and Hu, 2023). This suggests that learners do not view GenAI merely as a classroom tool, but as part of a wider societal transformation.

Overall, these findings indicate that Saudi university students hold a balanced view of GenAI: they strongly value its educational and societal potential, understand its technical limits, but may require further support in developing ethical awareness and reflective use. Integrating TAM and VAM with contextual and pedagogical perspectives provides a clearer explanation of why acceptance is high, concerns are selective, and perceived value remains dominant in shaping students' attitudes toward generative AI.

5. Implications and recommendations

Based on the findings of this study, several theoretical, practical, and policy-related implications can be drawn for higher education institutions, educators, and policymakers, particularly within the Saudi Arabian context. From a theoretical perspective, the results reinforce the relevance of the Technology Acceptance Model (TAM) and the Value-Based Adoption Model (VAM) in explaining students' adoption of generative AI. Perceived usefulness, ease

of use, and overall value were found to outweigh perceived risks, which explains students' strong acceptance and readiness to use GenAI tools. Future research may extend these models by incorporating ethical awareness and digital responsibility as additional constructs to better capture the complexity of AI adoption in educational settings. From a practical perspective, the high perceived educational value of GenAI suggests that universities should move beyond experimental use and work toward structured pedagogical integration. Faculty development programs should be designed to train instructors on how to incorporate GenAI into teaching in ways that enhance critical thinking, problem-solving, and self-regulated learning rather than encouraging passive reliance. Curriculum designers may also consider embedding AI-supported activities, such as guided inquiry, feedback generation, and personalized learning tasks, while ensuring that learning outcomes remain centered on human cognition and creativity.

Given students' relatively lower concern about ethical use, there is a clear need to strengthen awareness of academic integrity, data privacy, and responsible AI practices. Universities are encouraged to introduce formal guidelines and codes of conduct for GenAI use, covering issues such as plagiarism, authorship, transparency, and data security. Short courses, workshops, and orientation modules on ethical AI literacy could help students develop a deeper understanding of both the opportunities and risks associated with these technologies. At the institutional level, the establishment of interdisciplinary committees or task forces on educational AI is recommended. Such bodies could be responsible for developing policies, monitoring ethical compliance, evaluating emerging tools, and advising on best practices for teaching and assessment in AI-supported environments. Collaboration between IT units, academic staff, legal experts, and educational researchers would ensure that technological adoption is aligned with pedagogical goals and national regulations.

Finally, in line with Saudi Arabia's Vision 2030 and its emphasis on digital transformation and sustainable development, GenAI can be strategically leveraged to promote inclusive access to education, lifelong learning, and skill development. Policymakers may support pilot projects and research initiatives that explore how GenAI can contribute to national sustainability goals while safeguarding cultural values, academic standards, and social responsibility. Together, these implications and recommendations highlight the importance of a balanced approach—one that maximizes the educational and societal benefits of generative AI while ensuring ethical, pedagogical, and institutional readiness for its responsible use.

6. Limitations and future research

Despite the valuable insights provided by this study, several limitations should be acknowledged. First, the research employed a cross-sectional survey design, which captures students' perceptions at a single point in time. As attitudes toward generative AI may evolve with increased exposure and institutional regulation, longitudinal studies are recommended to examine changes in perceptions, usage patterns, and ethical awareness over time.

Second, the data were collected through self-reported questionnaires, which may be subject to social desirability bias and common method variance. Students may have overestimated positive attitudes or underestimated ethical concerns. Future studies could complement survey data with qualitative methods, such as interviews or focus groups, to obtain deeper and more nuanced insights into students' experiences and reasoning.

Third, the sample composition may limit the generalizability of the findings. The respondents were predominantly male and largely drawn from science-related disciplines. This imbalance may influence the overall perception of GenAI, as students from the humanities and social sciences may interact with and evaluate these tools differently. Future research should employ more balanced and diverse samples across gender, academic disciplines, and institutions.

Finally, this study focused primarily on students' perceptions and did not examine actual learning outcomes or behavioral use of GenAI. Experimental and mixed-method studies are recommended to assess how GenAI integration affects academic performance, critical thinking, creativity, and ethical decision-making in real classroom settings.

7. Conclusion

This study provides one of the first large-scale empirical investigations into undergraduate students' perceptions of generative AI in higher education within the Saudi Arabian context. The findings reveal that students generally hold positive attitudes toward GenAI, recognizing its value in enhancing access to learning resources, supporting understanding of complex concepts, facilitating feedback, and promoting independent learning. These perceptions are consistent with the Technology Acceptance Model and the Value-Based Adoption Model, which explain adoption in terms of perceived usefulness, ease of use, and overall value outweighing perceived risks. At the same time, the study uncovers an important concern: although students are aware of technical and privacy-related risks, their sensitivity to ethical issues such as academic integrity and responsible use remains comparatively low. This highlights a critical gap between technological competence and ethical awareness, emphasizing the need for universities to integrate ethical AI literacy into curricula and institutional policies.

The study also demonstrates that disciplinary background influences how students perceive and value GenAI, suggesting that a "one-size-fits-all" approach to AI integration may be ineffective.

Tailored pedagogical strategies are therefore needed across different academic fields. From a practical perspective, the findings offer important implications for educators and policymakers in Saudi Arabia. As the country advances its Vision 2030 agenda and digital transformation in education, GenAI can be strategically harnessed to support quality learning, inclusivity, and sustainable development. However, successful implementation requires clear guidelines, staff training, ethical governance frameworks, and student awareness programs to ensure responsible and pedagogically sound use. In summary, this study contributes theoretically by extending TAM and VAM to the context of generative AI in higher education, empirically by providing evidence from a large Saudi student sample, and practically by offering direction for policy and instructional design. Together, these contributions help position GenAI not merely as a technological innovation but as a transformative educational tool that must be guided by sound pedagogy, ethical responsibility, and cultural context.

List of abbreviations

AI	Artificial intelligence
df	Degrees of freedom
EQ	Emotional quotient
GenAI	Generative artificial intelligence
GPT	Generative pre-trained transformer
IT	Information technology
LLMs	Large language models
N	Number of respondents
SD	Standard deviation
SDGs	Sustainable development goals
Sig	Significance level (p-value)
t	t-statistic
TAM	Technology acceptance model
VAM	Value-based adoption model

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Compliance with ethical standards

Ethical considerations

The study was approved by the Ethical Committee of the Deanship of Scientific Research, King Khalid University, Saudi Arabia (Ref. No. RGP2/671/46; approved on 20/02/2024). Participation was voluntary, and informed consent was obtained from all participants prior to data collection. Respondents were assured of anonymity and confidentiality, and no personally identifiable information was collected.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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