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RECEIVED 21 October 2023

ACCEPTED 15 April 2024

PUBLISHED 26 April 2024

## CITATION

Faisal E (2024) Unlock the potential for Saudi Arabian higher education: a systematic review of the benefits of ChatGPT. *Front. Educ.* 9:1325601. doi: 10.3389/educ.2024.1325601

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# Unlock the potential for Saudi Arabian higher education: a systematic review of the benefits of ChatGPT

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This systematic review investigates the potential benefits of integrating ChatGPT in higher education. Focusing on ChatGPT's impact, the study identifies themes such as ChatGPT's role in teaching and instruction, enhancing student learning and engagement, aiding language learning, and promoting inclusivity. The review underscores ChatGPT's ability to reshape the educational landscape, improve research and writing, bridge language gaps, and address specific challenges. ChatGPT emerges as a transformative tool empowering educators and students, aligning with Saudi Arabia's pursuit of academic excellence and future workforce readiness.

## KEYWORDS

ChatGPT, higher education, systematic review, Saudi Arabia, learning

## 1 Introduction

The Kingdom of Saudi Arabia has demonstrated an unwavering commitment to advancing higher education, acknowledging its crucial role in economic diversification and national development (Qahl and Sohaib, 2023). Under Vision 2030, the country has set ambitious goals to elevate its educational institutions to global standards, empowering its citizens with the knowledge and skills necessary to meet the challenges of the 21st century (Abdullateef et al., 2023). To achieve this transformative vision, embracing emerging technologies has become imperative, particularly in revolutionizing traditional teaching and learning methodologies.

In the context of this progress, Alotaibi and Alshehri (2023) discussed that integrating Artificial Intelligence (AI) technologies holds immense potential for transforming higher education in Saudi Arabia. In detail, the researchers conducted a study within Saudi Arabia's 2030 Vision for Higher Education, aiming to explore the opportunities and challenges of AI-based learning outcomes in the country's higher education institutes. Their analysis of 55 studies revealed that AI is emerging in Saudi higher education, with the potential to address educational challenges and accelerate progress toward the 2030 objectives. However, educators must acquire new technological skills for effective AI pedagogy. This study provides valuable insights for integrating ChatGPT and other AI tools in Saudi higher education, guiding policy and practice. With its capacity for processing vast amounts of data and generating intelligent insights, AI presents an opportunity to enhance teaching methodologies, personalize learning experiences, and optimize institutional operations (Chang et al., 2022). One such transformative AI technology at the forefront is ChatGPT (Generative Pre-trained Transformer), developed by OpenAI (Roumeliotis and Tselikas, 2023). ChatGPT exemplifies the potential of AI in understanding and generating human-like text (Katib et al., 2023),

making it a promising candidate for reshaping the educational landscape in Saudi Arabian universities and colleges.

As the digital age reshapes the global educational landscape, Saudi Arabian higher education has the opportunity to harness the power of AI technologies to provide innovative and personalized learning experiences for its students. Integrating AI tools like ChatGPT, universities and colleges would empower educators and students with novel teaching, learning, and research approaches (Alotaibi and Alshehri, 2023). The promise of AI in higher education lies in improving academic performance and fostering critical thinking, creativity, and adaptability—qualities essential for nurturing a future-ready workforce (Hwang and Chen, 2023; Perkins, 2023; Wang et al., 2023).

However, despite the potential benefits of AI technologies like ChatGPT, there remains a knowledge gap in understanding the specific advantages it can bring to Saudi Arabian higher education. Interested scholars in this area would benefit from a comprehensive overview of the existing literature and research in this new field. Thus, this paper will systematically investigate this gap by answering the research question:

What are the potential benefits of incorporating ChatGPT in Saudi Arabian higher education?

By systematically reviewing the relevant literature, this study aims to provide evidence-based insights into how ChatGPT can enhance teaching practices, improve student learning experiences, address language barriers, and promote inclusivity in higher education settings in Saudi Arabia.

## 2 Materials and methods

Employing a systematic literature review approach, this study addresses the research query and provides an all-encompassing perspective on the potential benefits of incorporating ChatGPT into Saudi Arabian higher education. This method adheres to a stringent, transparent, and reproducible process for data collection and analysis (Tranfield et al., 2003), ensuring dependable and synthesized outcomes. It facilitates in-depth exploration, amalgamation, and assessment of existing literature within the targeted research domain. This approach enhances the knowledge repository, draws robust conclusions, identifies research gaps, and outlines future investigative avenues. To ensure precision and transparency in reporting, the PRISMA 2020 technique, encompassing a 27-point checklist and a flow diagram, was adopted (Page et al., 2021). This systematic review adheres rigorously to PRISMA 2020 guidelines, streamlining the selection of pertinent studies systematically.

Table 1 provides a summary of the publication search string protocol used in the systematic review process. It includes the number of included results from various databases (Web of Science, EBSCO, ProQuest) based on the search field (Title, Abstract) and the date of the last update (June 05, 2023). The table helps track the effectiveness of the search strategy in identifying relevant publications for the review. The first search on the Web of Science had “ChatGPT,” only resulting in 209 studies. The second search on Web of Science used the combination “ChatGPT” AND “teaching” OR “instruction” OR

TABLE 1 Publication search string protocol.

Search field	Number of excluded results			
	Web of Science	EBSCO	ProQuest	Last updated
Title, Abstract	209	114	390	June 05, 2023
Title, Abstract	112	103	326	June 05, 2023
Title, Abstract	43	87	249	June 05, 2023

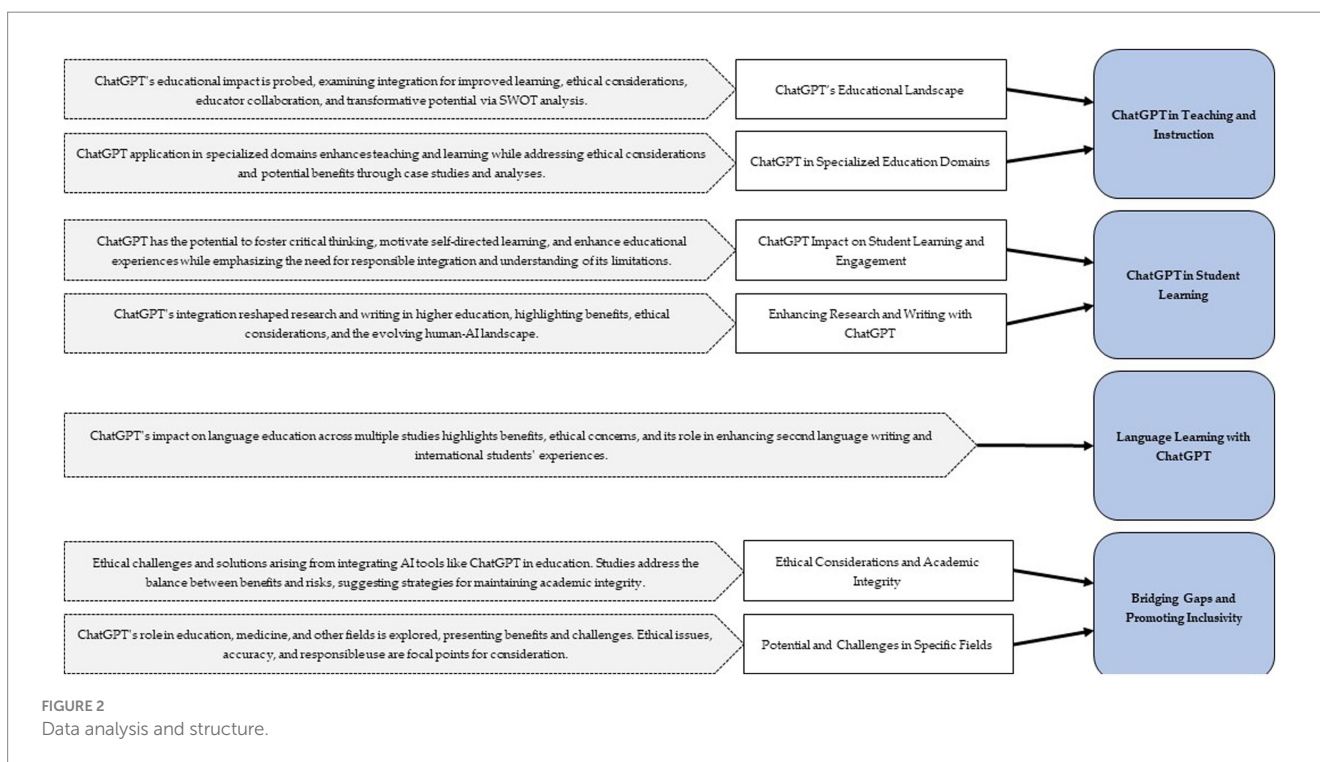
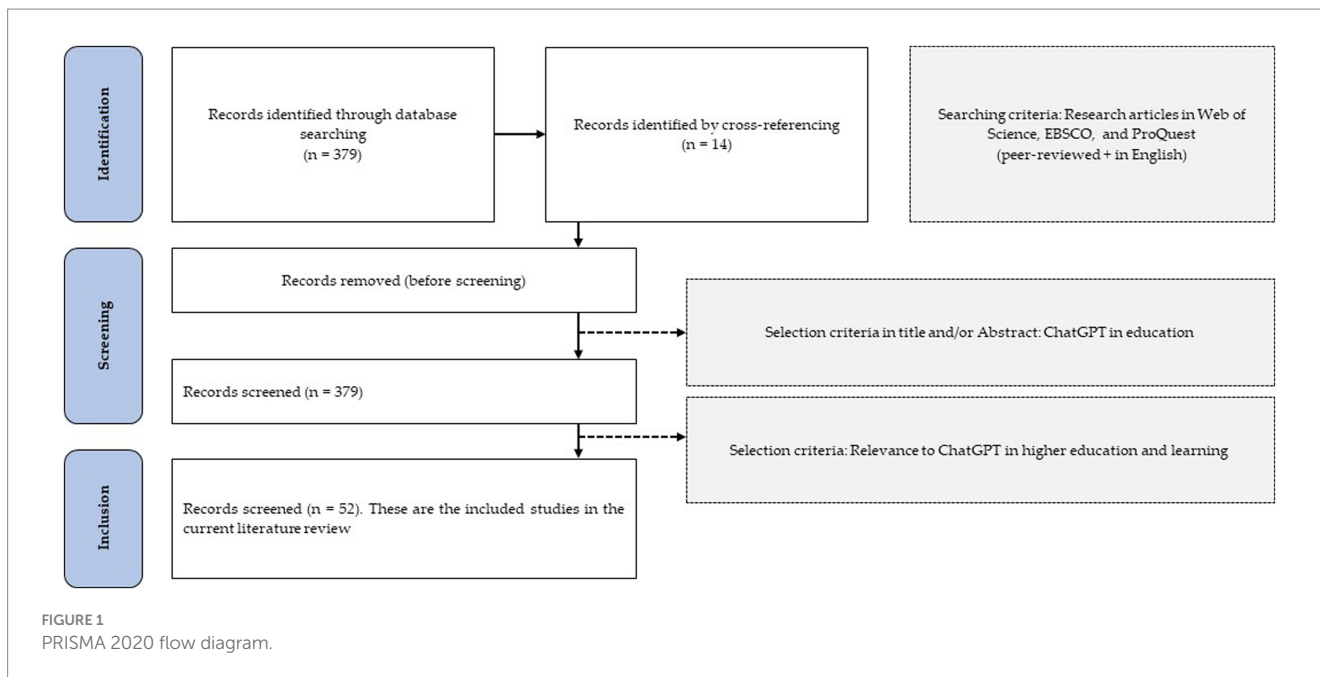
“education” OR “higher education” AND “learning” resulting in 43 studies. EBSCO and ProQuest also used the same last combination, resulting in 87 and 249, respectively. All the studies in the three databases were published in 2023.

Initially, a total of 379 publications were identified for detailed evaluation. Fourteen duplicate publications were eliminated, and an initial screening was performed. Then, an additional 244 were excluded because they were irrelevant to the current research question or topic. In the following screening step, 76 publications were eliminated, although they targeted ChatGPT in education, for education in general, and not for higher education specifically. A narrative literature search was conducted by using the keywords “ChatGPT in higher education” AND “literature review” OR “review” OR “studies review.” After this, seven relevant papers were added to the targeted literature. The final literature corpus, therefore, included 52 entries—all in English. Figure 1 illustrates the selection process of the studies included in the synthesis.

Qualitative content analysis was utilized for data examination (Mayring, 2002). Primary codes were formulated to capture data about ChatGPT’s role in higher education, establishing a groundwork for data arrangement. Commonalities, disparities, configurations, and tendencies were uncovered through a comparative examination of the coded information. Subsequently, secondary-level groupings were generated to categorize the data into overarching concepts, facilitating a more comprehensive perspective. These groupings were later streamlined into collective dimensions, shaping the impact of ChatGPT across various domains and its influence on student learning and research. This process is depicted in greater detail in Figure 2. This systematic approach facilitated data systematization, assessment, and amalgamation, ultimately yielding an exhaustive grasp of conceivable applications of ChatGPT within higher education. The outcomes provide a pivotal cornerstone for decision-making, presenting avenues for leveraging ChatGPT’s advantages in instructing undergraduate and postgraduate students and enhancing their learning endeavors and research undertakings. The following results section employs the second-order themes and the themes of the collective dimensions to convey these insights.

## 3 Results

In higher education, ChatGPT’s integration has ignited discussions about its potential and challenges. This review examines 52 research studies. Organized by themes, it explores how ChatGPT reshapes teaching, learning, research, language acquisition, and inclusivity efforts. Amidst this evolving landscape, the review offers



insights into ChatGPT’s transformative influence and ethical considerations, presenting a comprehensive outlook on its role in higher education. The following sections demonstrate these themes.

### 3.1 ChatGPT in teaching and instruction

Seventeen studies are categorized into the following subsections: ChatGPT’s educational escape in general and ChatGPT’s application in niche academic spheres.

#### 3.1.1 ChatGPT’s educational landscape

In higher education, researchers are delving into ChatGPT’s multifaceted impact, exploring its integration for enhanced learning while navigating ethical and practical challenges. The evolving role of ChatGPT in modern academia is a focal point of investigation.

For example, [Rahman and Watanobe \(2023\)](#) took a holistic view of ChatGPT’s potential to enhance personalized learning, content creation, and language translation. They also delved into the ethical challenges posed by potential plagiarism and overreliance. This research aimed to guide educators and researchers in effectively navigating the integration

of ChatGPT within academic contexts. Similarly, [Jeon and Lee \(2023\)](#) delved into the interplay between AI and human educators. The study identified the collaborative roles of ChatGPT and teachers through empirical research, highlighting their potential synergy in education. Their study emphasized the importance of leveraging AI capabilities and human pedagogical expertise. Meanwhile, [Sun and Hoelscher \(2023\)](#) addressed the rapid rise of ChatGPT and its ethical implications in academia. The study offered strategies for faculty to effectively navigate the integration of ChatGPT into educational practices, emphasizing the importance of promoting critical thinking and ethical decision-making among students.

Chaudhry examined how ChatGPT's emergence challenged traditional practices in universities and colleges. As AI-based tools like ChatGPT infiltrated the educational ecosystem, a need to reassess conventional methodologies for evaluating student performance and learning outcomes arose. The study emphasized the significance of reimagining existing practices considering this new technological era. Using a case study approach, the authors explored the implications of ChatGPT on student assignments and its alignment with academic integrity standards. The authors concluded with a clarion call for educational institutions to reevaluate their strategies for monitoring and enhancing student learning in the wake of AI integration.

Similarly, [Chan and Hu \(2023\)](#) highlighted university students' voices, gauging their perceptions of generative AI technologies like ChatGPT. Through a survey of undergraduate and postgraduate students, the research underscored the potential benefits and challenges of integrating AI tools in higher education. While the positive attributes of personalized learning support and assistance in various academic tasks were recognized, concerns regarding accuracy, privacy, and ethical considerations were also articulated. This study emphasized the importance of addressing student perceptions to guide effective integration strategies and ensure positive learning outcomes.

Other studies investigated ChatGPT using SWOT (strengths, weaknesses, opportunities, and threats) analysis, like [Zhu et al. \(2023\)](#), as they explored the transformative impact of ChatGPT on education through a SWOT analysis and acknowledged its capabilities and limitations. They provided educators with actionable insights into responsible integration strategies. [Farrokhnia et al. \(2023\)](#) examined ChatGPT's role in education along the same lines. The authors identified its potential to revolutionize educational practices while considering concerns like inaccuracies and biases. This study aimed to guide educators in harnessing ChatGPT's potential while navigating its complexities.

Together, these studies offered a comprehensive understanding of ChatGPT's multifaceted impact on education, ranging from its potential benefits to the responsible integration of AI tools in teaching and learning environments.

### 3.1.2 ChatGPT in specialized education domains

Incorporating ChatGPT into specialized education domains has unlocked fresh avenues for enriching teaching and learning experiences. A sequence of enlightening studies unveiled how ChatGPT was harnessed to bolster educational methods across varied fields. These inquiries illuminated the potential functionalities, benefits, and challenges of ChatGPT's employment in various specialized educational contexts.

[Smith et al. \(2023\)](#) centered on the potential functionalities of ChatGPT in social psychiatry education. They identified numerous

roles ChatGPT could fulfill in educational settings, such as serving as an information provider, facilitating debates and discussions, supporting self-directed learning, and crafting content for course materials. By preparing a hypothetical case vignette, ChatGPT showcased its capabilities in content creation for social psychiatry. The authors underscored that whilst ChatGPT presented innovative teaching opportunities, recognizing and prudently navigating its limitations, including misinformation and biases, was imperative.

[Cooper \(2023\)](#) explored the implications of generative artificial intelligence in science education, specifically focusing on ChatGPT. The study delved into how ChatGPT responded to queries related to science education and proposed methods through which educators could incorporate ChatGPT into science pedagogy. The research also contemplated the potential advantages and hurdles of employing ChatGPT as a research tool. Cooper emphasized the need for educators to exemplify judicious usage, prioritize critical thinking, and adapt AI-generated resources to specific teaching contexts, ensuring that students and educators could capitalize on the technology's benefits. Similarly, [Emenike and Emenike \(2023\)](#) delved into the considerations for AI text-generation software programs in chemistry education. The study discussed the broader impacts of generative artificial intelligence in the chemistry community, tackling academic integrity and student assessment concerns. The authors explored diverse ways students and faculty might harness AI systems, underlining the potential advantages, risks, and matters of equity and accessibility. The study called for constructive dialogues on harnessing AI technology's capabilities whilst remaining mindful of its limitations.

In another domain, [Ellis and Slade \(2023\)](#) examined the potential of ChatGPT as an educational tool for statistics and data science. The authors accentuated the importance of transcending plagiarism concerns and investigating AI tools' affirmative possibility. It encouraged educators to reflect upon the history of introducing novel technology in education and probed how ChatGPT could assist in developing course materials and student engagement. The study advocated for educators to guide the application of AI tools, leveraging their merits to enhance statistics and data science education.

While [Ajewski et al. \(2023\)](#) probed the implications of ChatGPT for legal education and practice, the study scrutinized how ChatGPT's advent might influence legal education, spotlighting strategies for assessments and integration into professional practice. The authors underscored the significance of apprehending AI's potential impact and thoughtfully incorporating AI technology into legal education.

[Pavlik \(2023\)](#) discussed the transformative potential of generative AI, focusing on ChatGPT's implications for journalism and media education. The essay explored ChatGPT's capacity and limitations and offered reflections on the broader impact of AI on journalism and media content creation. The study recognized generative AI's potential to reshape journalism and media practices, highlighting the collaborative potential between human educators and AI platforms like ChatGPT. The essay provided insights into how AI tools could influence journalism and media education.

In tourism education, [Ivanov and Soliman \(2023\)](#) dived into the transformative potential of ChatGPT in tourism education and research. The study pondered how ChatGPT's aptitude for generating text could reshape academic practices in the tourism domain. Due to AI technologies, the authors envisioned shifts in teaching, research, and publication processes within tourism education. Along the same lines, [Skavronskaya et al. \(2023\)](#) conducted a discerning analysis of the



role of ChatGPT in tourism education, focusing on its potential impact and constraints. The study heightened tourism educators' awareness of ChatGPT's potential for disruption and its ramifications for academic integrity and ethics. It underscored the necessity for pioneering pedagogies and ethical guidelines to ensure judicious AI usage in tourism education.

In engineering education, [Sánchez-Ruiz et al. \(2023\)](#) delved into the influence of ChatGPT on blended learning methodologies, with a particular emphasis on mathematics. The study gauged how AI tools like ChatGPT influenced critical thinking, problem-solving, and collaborative skills among students. The research analyzed students' perspectives on the reliability and utility of AI tools in academia, unveiling potential merits and hurdles in incorporating ChatGPT into engineering education.

In healthcare, [Friederichs et al. \(2023\)](#) explored the role of ChatGPT in medical education, specifically in assessing knowledge acquisition. The study juxtaposed ChatGPT's performance in addressing medical questions with that of medical students. It underscored ChatGPT's potential to respond accurately to queries and highlighted its utility as a tool for progress testing in medical education. Similarly, [Sallam \(2023\)](#) systematically reviewed ChatGPT's utility in healthcare education, research, and practice. The study explored the promising perspectives and valid concerns surrounding ChatGPT's integration into the healthcare sector. While ChatGPT's potential in scientific writing, drug discovery, and health literacy enhancement was evident, ethical and copyright issues, content inaccuracies, and cybersecurity concerns were significant concerns. The study highlighted the paradigm shifts that ChatGPT could induce in healthcare education, research, and practice. However, the authors emphasized that embracing ChatGPT and similar AI tools should occur with meticulous caution, ensuring responsible and ethical use within healthcare and academia. Along the same lines, [Huh \(2023\)](#) investigated the knowledge and interpretation prowess of ChatGPT. A parasitology examination was administered to both ChatGPT and medical students. The results unveiled a discrepancy between ChatGPT's performance and that of medical students. Despite ChatGPT's lower performance, intriguing insights emerged. The study revealed that while ChatGPT's correct answer rate did not correlate with item knowledge level, a link existed between acceptable explanations and accurate answers. The findings underlined the complexity of AI's cognitive abilities compared to human expertise. While ChatGPT's performance was subpar in this context, it illuminated AI's potential to enhance learning assessments and catalyze evaluation methodologies' evolution.

These studies revealed the potential and challenges of infusing ChatGPT into specialized education domains, from social psychiatry and science education to chemistry, statistics, law, tourism, engineering, and medical education. Each study provided a distinct outlook on how ChatGPT could augment teaching and learning experiences within its specific field while addressing the necessity for responsible and ethical usage.

## 3.2 ChatGPT in student learning

Fifteen studies are categorized in the following two subsections. The first is the effect of ChatGPT on student learning and involvement. The second is enhancing research and writing with ChatGPT.

### 3.2.1 ChatGPT impact on student learning and engagement

The influence of ChatGPT on student learning and engagement is a subject of significant exploration. The following studies assess its role in fostering critical thinking, motivating self-directed learning, and enhancing educational experiences.

For instance, [Shoufan \(2023\)](#) conducted a two-stage study to probe how students perceived ChatGPT's role in learning. The sample included senior students in a computer engineering program to evaluate ChatGPT's impact after using it for a learning activity. Thematic analysis revealed several themes, including students' admiration for ChatGPT's capabilities, motivation, help for study and work, and appreciation of its user-friendly interface. However, students acknowledged limitations, such as occasional inaccuracies and the requirement for background knowledge. The study emphasized that while ChatGPT could be a valuable learning tool, its constraints should be understood, educators should guide students on practical usage, and developers should strive to enhance its accuracy.

Similarly, [Rusandi et al. \(2023\)](#) stressed the crucial role of AI tools, particularly ChatGPT, in nurturing critical thinking skills within learning. The study focused on the intersection of AI, learning, and critical thinking, emphasizing the importance of ethical and responsible AI use. AI applications have the potential to complement educational processes, providing opportunities for students and researchers to develop robust critical thinking skills. The study underscored the need to cultivate critical thinking skills to harness AI's capabilities effectively, empowering individuals to discern accurate information and make informed decisions. In the conclusion, the authors showed that the collaboration between AI and human intellect, guided by the principles of academic integrity, held immense promise for shaping a knowledgeable and informed society.

[Strzelecki \(2023\)](#) examined ChatGPT adoption and usage predictors among higher education students at a Polish state university. Using technology adoption theory, the study found habit, performance expectancy, and hedonic motivation significantly influenced behavioral intention, while personal innovativeness impacted use behaviors. The research underscores the need to explore AI tool integration further in learning and teaching practices in higher education. Closely to this, [Lin \(2023\)](#) examined ChatGPT's potential as a facilitator for motivating self-directed learning (SDL) among adult learners in online contexts. The study highlighted ChatGPT's potential to assist learners in setting goals, locating resources, and personalizing learning plans while addressing concerns such as overreliance and needing proper guidance from instructors and institutions.

[Rospigliosi \(2023\)](#) provided an editorial perspective on the questions surrounding ChatGPT's integration into learning. The editorial emphasized the importance of scrutinizing and redefining the questions asked about AI in educational environments. Rospigliosi encouraged the exploration of various aspects beyond potential risks, fostering a more holistic understanding of AI's role in learning.

While most of these studies validate ChatGPT's significance in enhancing student learning, [Stojanov \(2023\)](#) adopts a more cautious stance toward its utilization. He studied ChatGPT's role as a more knowledgeable person in scaffolding learning experiences. This autoethnographic study showed ChatGPT's capacity to provide relevant content and highlight superficial answers but with inconsistent logic and contradictions. Considering its capabilities,

limitations, and human interaction dynamics, Stojanov emphasized the importance of caution when integrating ChatGPT as a learning aid.

These studies offered valuable insights into how ChatGPT influenced student perceptions, engagement, and learning experiences. They underscored the potential advantages of ChatGPT while highlighting the need for mindful integration, comprehensive guidance, and ongoing development to ensure optimal educational outcomes.

### 3.2.2 Enhancing research and writing with ChatGPT

As the landscape of higher education underwent a rapid transformation, the integration of artificial intelligence tools like ChatGPT redefined how research was conducted, how teaching was delivered, and how academic practices were shaped. This section delved into research and writing enhancement through the lens of several studies.

Regarding research, [Karakose \(2023\)](#) presented a comprehensive examination of the utility of ChatGPT in educational research. Leveraging advancements in natural language processing, ChatGPT's capacity to comprehend and generate human language positioned it as a potential tool for enhancing scientific work. The study highlighted the benefits and challenges of integrating ChatGPT into educational research. Educational researchers could leverage ChatGPT to identify gaps in the literature, generate hypotheses, devise surveys, conduct systematic reviews, and draft scientific manuscripts. However, the study also emphasized the limitations of ChatGPT, particularly its inability to ensure transparent content generation and accurate referencing. The paper called for a cautious and meticulous approach to leveraging ChatGPT's capabilities within educational research, all while considering ethical obligations and the evolving landscape of AI technologies.

[Peres et al. \(2023\)](#) investigated how the integration of generative AI might reshape the landscape of academic research and pedagogical strategies. By raising pertinent questions about the opportunities, threats, and avenues for future exploration, this editorial stimulated discourse on the transformative potential of AI in higher education. Similarly, [Cacciuttolo et al. \(2023\)](#) steered the discussion toward undergraduate programs, elucidating strategies for formulating research theses in the digitalization era. Emphasizing the role of information and communication technologies (ICTs), the study presented learning strategies for students while advocating for responsible research conduct. The authors underscored the importance of the ethical use of AI tools like ChatGPT to foster a comprehensive educational environment.

Concerning writing, [Vee \(2023\)](#) added a unique dimension to the discourse by advocating for a balanced approach to AI integration in composition and writing. The author underscored the value of engaging with the writing process and nurturing employed writing pedagogy, even as AI models like ChatGPT gained prominence. By delving into the model of first-year composition that prioritized critical inquiry and authentic interactions between students and teachers, Vee highlighted the limitations of solely relying on AI-generated content. This perspective served as a reminder that while AI tools could amplify efficiency, the essence of writing for productive uncertainty remained integral to the educational experience. Related to this, [Athaluri et al. \(2023\)](#) delved into the intriguing concept of AI hallucination within scientific writing, explicitly focusing on

ChatGPT's role in generating references. Through a meticulous analysis of references caused by ChatGPT, the study exposed the limitations of AI-generated references and highlighted potential pitfalls. This study provided insights into the responsible use of AI tools like ChatGPT in the research process by addressing accuracy, reliability, and ethical considerations.

While [Su et al. \(2023\)](#) suggested the infusion of ChatGPT into argumentative writing classrooms, the study envisioned ChatGPT as a tool to assist students in various facets of argumentative writing, from structuring to proofreading. It acknowledged the constraints of ChatGPT while proposing strategies for incorporating it responsibly into teaching and research. Similarly, [Mahyoob et al. \(2023\)](#) proposed a framework for analyzing ChatGPT's capabilities in generating effective academic writing. The study delved into the potential of ChatGPT as a language model for producing educational content. The proposed framework focused on relatedness, adequacy, limitation, authenticity, cognition, and redundancy, which collectively evaluated the accuracy and proficiency of algorithm-generated writing. The analysis of academic texts generated by ChatGPT within this framework unveiled its exceptional capabilities and inherent defects. Issues like information repetition, illogical reasoning, and lack of pragmatic interpretation underscored the necessity for a critical approach to AI-generated content in education and research.

In the [Dergaa et al. \(2023\)](#) study, writing and research were the two main elements. The authors dissected the potential benefits and threats of integrating AI-generated text into academic writing and research. The study highlighted the need for comprehensive discussions surrounding AI's role in enhancing educational efficiency while acknowledging concerns about authenticity and credibility. The authors reflected that integrating AI technologies into academic writing processes was a double-edged sword. On the one hand, AI models like ChatGPT offered efficiency gains, yet on the other, they raised questions about preserving the authenticity of scholarly work. The study called for ethical considerations, emphasizing human intelligence and critical thinking as cornerstones of the research process.

In the domain of scholarly inquiry, [Hwang and Chen \(2023\)](#) provided an editorial position paper that offered insights into the potential and challenges of using generative artificial intelligence (GAI) applications like ChatGPT in education. The authors delved into the balance between the promising perspectives and the potential misuse of GAI in educational settings. They provided illustrative examples of how GAI applications could be employed in academic contexts, shedding light on the potential for enhancing learning experiences and redefining search methodologies. The paper emphasized the importance of shifting from a "search" mindset to a "programming prompt" approach, urging educators and researchers to explore the potential of GAI to deepen understanding and prompt critical thinking. The authors called for research that unlocked GAI's potential while upholding the core educational values of in-depth comprehension and effective prompts.

Collectively, these studies shed light on how ChatGPT shaped research and writing. As the boundaries between human intellect and AI capabilities continued to blur, these insights served as guideposts for embracing technological advancements while upholding the core principles of education, ethics, and responsible conduct.

### 3.3 Language learning with ChatGPT

Integrating artificial intelligence tools, particularly ChatGPT, ushered in a new era of language learning. This section discusses seven studies investigating how ChatGPT transformed the language learning and teaching landscape.

Mohamed (2024) investigated the potential of ChatGPT in enhancing English as a Foreign Language (EFL) teaching. Engaging with ten EFL faculty members, the study examined their perceptions of ChatGPT's effectiveness in supporting students' English language learning. Through in-depth interviews, varying opinions emerged. While some faculty members acknowledged the tool's utility in providing rapid and accurate responses, others expressed reservations about its impact on critical thinking and the potential reinforcement of biases. The study highlighted ChatGPT's role as a complementary tool in traditional EFL teaching methods, acknowledging its value and the need for further research to assess its efficacy.

Young and Shishido (2023) directed their attention to the potential benefits that ChatGPT offers for EFL students as they practice language skills. The research explored the potential of ChatGPT in generating high-quality dialogue materials suitable for an EFL chatbot system. By assessing readability metrics and aligning the generated dialogues with the Common European Framework of Reference for Languages (CEFR) levels, the study highlighted the tool's capacity to produce understandable and stimulating dialogue materials. The findings illuminated the promise of ChatGPT in overcoming language education limitations and providing students with valuable resources.

Similarly, Liu and Ma (2023) explored the domain of EFL learners' interaction with ChatGPT for informal digital language learning. The study aimed to gauge learners' attitudes, intentions, and behaviors in utilizing ChatGPT beyond the classroom. This quantitative investigation encompassed 405 EFL learners and revealed intricate relationships between perceived ease of use, usefulness, attitude, behavioral intention, and actual use of ChatGPT. In conclusion, Liu and Ma underscored the importance of learners' positive attitudes toward the tool's effectiveness, which strongly influenced their engagement with ChatGPT in English learning beyond formal instruction.

Kohnke et al. (2023) studied ChatGPT as a potential for language teaching and learning. As a generative AI chatbot, ChatGPT opened doors for interactive language learning experiences. Kohnke navigated the potential benefits while engaging in debates and possible drawbacks of AI integration. To fully leverage ChatGPT in language classrooms, educators and learners had to develop digital competencies to engage with the technology responsibly and effectively. AI's integration was seen as an opportunity to enhance language learning, bridging the gap between formal instruction and real-world language use.

In second language writing, Barrot (2023) investigated using ChatGPT as a tool to write in a second language. As AI technology advanced, language learning landscapes transformed, and ChatGPT stood as a prime example. Its ability to emulate human-like interactions and support language input made it an enticing candidate for facilitating language learning. However, concerns loomed over its potential impact on writing pedagogy and academic integrity. While the potential benefits of ChatGPT for L2 writing were substantial, educators had to tread carefully. The study emphasized the importance of understanding AI's role as a supplement to, rather than a replacement for, traditional language instruction. Integrating AI tools

into L2 writing requires careful consideration of ethical implications and preserving the essence of authentic language learning experiences. Similarly, Salvagno et al. (2023) showed that ChatGPT extended to scientific writing, assisting in organizing material, generating drafts, and proofreading. However, ethical considerations abounded. The study cautioned against over-reliance on AI-generated content, highlighting the need for expert review before making critical decisions based on AI-generated outputs. In addition, the study underscored the dynamic ethical landscape AI technologies brought. While AI could expedite scientific writing processes, its potential pitfalls, including the risk of plagiarism and biases, warranted thoughtful regulation and ethical frameworks.

Related to language learning, Wang et al. (2023) discussed that AI applications could potentially reshape international students' learning experiences. AI's capacity for personalized learning experiences, predictive analytics, and chatbots for learning and research support stood to address international students' unique challenges in foreign educational settings. However, the paper acknowledged that harnessing AI's benefits required careful navigation of privacy, cultural, and ethical considerations. Implementing safeguards and regulations was vital to ensure that the integration of AI technologies in higher education maximized benefits while mitigating potential risks.

The studies in this section collectively highlighted the multifaceted impacts of AI, especially ChatGPT, on language learning and writing support. As educators and learners continued to navigate the ever-evolving landscape of language acquisition, ChatGPT's potential to enhance language proficiency remained a compelling avenue for exploration and innovation.

### 3.4 Bridging gaps and promoting inclusivity

This section discusses eleven studies to show how ChatGPT can contribute to bridging educational gaps and promoting inclusivity in higher education based on the included studies.

#### 3.4.1 Ethical considerations and academic integrity

Integrating artificial intelligence tools like ChatGPT into educational contexts prompted profound ethical considerations and challenges concerning academic integrity. The following studies discussed these vital concerns, exploring the potential impacts of ChatGPT on intellectual honesty and proposing strategies to maintain ethical standards.

Cotton et al. (2023) addressed the delicate balance between the benefits and challenges of incorporating ChatGPT into higher education. While ChatGPT offered advantages like enhanced engagement and accessibility, concerns surrounding academic honesty and plagiarism were palpable. The authors examined the opportunities and risks posed by AI tools in education and offered insights into detecting and preventing academic dishonesty. They highlighted universities' role in mitigating risks through proactive strategies, including formulating policies, training, support mechanisms, and robust methods for identifying and preventing cheating. The authors concluded that AI's integration, including ChatGPT, into higher education required a proactive and ethical approach to address benefits and challenges adequately.



Similarly, [Hung and Chen \(2023\)](#) delved into the benefits, risks, and regulations of ChatGPT's use in Chinese academia. The study aimed to understand how Chinese students used ChatGPT for academic activities and how regulation could maintain academic integrity. The research project employed content analysis of newspaper articles to capture perspectives on ChatGPT's role in Chinese academia. The authors revealed a polarized opinion regarding ChatGPT's academic role, with some educators advocating for its integration to enhance intellectual outputs and others expressing concerns about academic cheating. The authors recommended the establishment of regulations to guide students in fact-checking AI-generated content, adding citations, and utilizing AI tools systematically and creatively. [Perkins \(2023\)](#) also investigated academic integrity in the era of AI, such as ChatGPT. The study navigated the complexities of students' use of ChatGPT for formal assessments, particularly in digital writing contexts. While this way could offer benefits in education, including aiding writing and composition, automating writing evaluations, and supporting EFL learners, concerns about plagiarism and academic misconduct arose. The study highlighted that academic integrity was not solely defined using AI tools but by students' transparency in acknowledging their use. The ethical considerations of ChatGPT integration underscored the need for updated academic integrity policies within higher education institutions to navigate the evolving landscape of AI technologies.

Likewise, [Grassini \(2023\)](#) explored the implications of AI, particularly ChatGPT, on educational practices. The study acknowledged AI's transformative potential but raised concerns about its widespread use and opacity. ChatGPT's capabilities to generate human-like text and automate conversations had implications for various sectors, including education. Grassini discussed ChatGPT's impact on education, considering its progressive aspects and potential drawbacks. The author aimed to contribute to understanding how AI tools reshape educational norms in an era marked by technological advancements.

Together, these studies underscored the ethical complexities and academic integrity challenges of integrating AI tools like ChatGPT into educational settings. While these tools offered revolutionary potential, educators, institutions, and policymakers needed to address these concerns proactively and ethically to ensure responsible AI use while maintaining educational values.

### 3.4.2 Potential and challenges in specific fields

The integration of ChatGPT into various fields has ignited a discourse about its potential and challenges. Researchers have examined its impact on education, medical practice, and other domains, outlining scenarios that range from minimal influence to transformative competition. As ChatGPT's capabilities continue to evolve, careful consideration is required to harness its benefits while addressing ethical, educational, and technical concerns.

For example, [Van Slyke et al. \(2023\)](#) explored the potential impacts of ChatGPT on information systems education. The rapid adoption of AI tools had implications for various aspects of society, including education. This study aimed to understand the challenges AI posed for information systems education and discussed potential scenarios, ranging from AI having minimal impact to posing competition for educators. The paper assessed the challenges and consequences of each scenario, proposing responses ranging from inaction to embracing AI tools as legitimate learning aids. The authors provided recommendations for information systems educators to effectively navigate the evolving landscape and the impact of AI on education.

Along the same lines, [Gill and Kaur \(2023\)](#) studied the foundational aspects, vision, and research challenges associated with ChatGPT. They explored the technology's development, applications, and potential implications for various fields, including the Internet of Things. While discussing the potential benefits of integrating ChatGPT with the Internet of Things, the authors also addressed the ethical dimensions and prevailing trends within the ChatGPT landscape. They speculated on the technology's future trajectory, including advancements in energy efficiency, cybersecurity, and compatibility with other emerging technologies such as robotics and computer vision. In the conclusion, the authors recognized the opportunities and challenges posed by ChatGPT, providing valuable insights into the technology's evolving landscape.

In the medical context, [Khan et al. \(2023\)](#) emphasized the evolving role of ChatGPT in medical education. While it offered benefits, the study cautioned against the need for careful and responsible use. ChatGPT was integrated into medical practice and teaching, and ethical considerations and potential risks must be addressed to ensure effective and honest implementation. Similarly, [Sedaghat \(2023\)](#) discussed how ChatGPT's ability to generate text responses from internet sources had garnered attention, particularly in medical contexts. The author studied ChatGPT's performance in medical exams, demonstrating results comparable to third-year medical students. However, he also raised concerns about potential challenges, such as dealing with harmful content, misinformation, and plagiarism. While ChatGPT showed promise, its limitations in complex tasks like understanding human anatomy and generating radiological reports underscored the need for further improvements for regular use in the medical field.

[Seetharaman \(2023\)](#) was more optimistic, but the author highlights the potential of ChatGPT to enhance subjective learning and expression skills among medical students. The medical education landscape traditionally emphasized objective assessments, which might have yet to fully address the need for effective communication and subjective understanding in clinical practice. ChatGPT offered a solution by assisting non-English-speaking students in improving their language skills and communication abilities. This AI tool facilitated small group assessments, benchmarking students' responses against ChatGPT's outputs, thereby identifying knowledge gaps for improvement. Additionally, ChatGPT simulated patient encounters, enabling students to practice medical history-taking and symptom documentation. Continuing medical education (CME) programs could also leverage ChatGPT to access the latest research articles, clinical trials, and treatment guidelines, enhancing physicians' knowledge and patient care.

In another field, [Meyer et al. \(2023\)](#) discussed the implications of using ChatGPT for academic writing, education, and programming. The authors highlighted its potential benefits, including improved efficiency, while acknowledging the ethical implications and bias associated with its use. The authors also presented a comprehensive stance encouraging the responsible and cautious utilization of LLMs in academia while addressing potential challenges and limitations. In addition, [Kasneci et al. \(2023\)](#) explored the benefits and challenges of using large language models, like ChatGPT, in education. The authors discussed how these models could be employed to create educational content, enhance student engagement, and personalize learning. However, the authors stressed the need for competencies and literacies among teachers and learners to understand and navigate the technology's limitations and potential biases. In conclusion, the study



provided recommendations for integrating large language models responsibly and ethically in education.

In sum, the potential of ChatGPT in specific fields is undeniable, with promising applications in education, medicine, and more. However, these opportunities come hand in hand with challenges such as ethical implications, information accuracy, and the need for responsible usage. As stakeholders navigate this evolving landscape, thoughtful integration and ongoing refinement are essential to maximize the advantages of ChatGPT while mitigating its potential drawbacks.

## 4 Discussion

In recent years, education has witnessed a remarkable surge in innovation, primarily driven by advancements in artificial intelligence (AI). Among these breakthroughs, the emergence of ChatGPT, an AI-powered language model developed by OpenAI, stands as a significant stride. This cutting-edge technology harbors the potential to instigate a paradigm shift within higher education, redefining traditional teaching methodologies, amplifying student learning journeys, and fostering an environment of inclusivity. While ChatGPT's availability in Saudi Arabia is a novel development, its potential implications for the country's higher education landscape are profound.

Notably, the studies presented in the results section were conducted in contexts beyond Saudi Arabia, as ChatGPT's integration into the educational sphere is relatively nascent. However, these studies serve as foundational pillars for this research. They offer insights into the broader transformative capabilities of ChatGPT and its impact on language learning, writing support, ethical considerations, academic integrity, and bridging educational gaps. Although Saudi students were not directly targeted in those studies, their lessons lay the groundwork for envisioning the potential benefits ChatGPT could bring to Saudi higher education.

Against this backdrop, this study embarks on a journey to extrapolate the implications of integrating ChatGPT into Saudi Arabian higher education. While these implications are speculative, they are underpinned by the findings and analyses of the studies mentioned above. The intent is to harness the collective wisdom garnered from these studies and apply it to the unique educational context of Saudi Arabia. By doing so, we hypothesize that the integration of ChatGPT has the potential to catalyze a positive transformation within the Saudi higher education landscape, propelling it toward greater efficacy, inclusivity, and educational excellence. Through a systematic review of existing literature and a lens finely tuned to Saudi Arabia's distinct educational aspirations, this study endeavors to illuminate the uncharted pathways that ChatGPT's integration may illustrate within the Saudi higher education ecosystem.

This discussion will present the theoretical and practical implications, strengths, limitations, and future directions.

### 4.1 Theoretical implications (ChatGPT and educational paradigms)

The integration of ChatGPT into Saudi higher education carries theoretical implications that can reshape traditional educational

paradigms. In other words, ChatGPT challenges conventional notions of teaching, learning, and knowledge dissemination.

#### 4.1.1 Constructivist pedagogy enhanced

The availability of ChatGPT aligns with constructivist pedagogical approaches, emphasizing student-centered learning. ChatGPT's interactive nature encourages students to actively engage with content, prompting them to ask questions, seek explanations, and generate ideas. Instructors can shift from sole information providers to facilitators of meaningful interactions, fostering critical thinking and inquiry-based learning.

#### 4.1.2 Blurring boundaries of time and space

ChatGPT's asynchronous communication allows for continuous engagement beyond the confines of the classroom. This confuses the boundaries of time and space, enabling students to learn at their own pace and revisit discussions as needed. It challenges the traditional notion of learning as a fixed-time event and supports lifelong learning.

#### 4.1.3 Fostering multimodal learning

The incorporation of ChatGPT introduces opportunities for multimodal learning experiences. This technology enables the integration of various media formats, such as text, images, and even audiovisual content, into educational interactions. Instructors can design diverse learning materials that cater to different learning preferences and styles, enhancing engagement and comprehension. Furthermore, multimedia can facilitate a deeper understanding of complex topics, making learning more interactive and dynamic, especially when considering that this multimodal approach aligns with Saudi Arabia's commitment to modernizing its education system and catering to a digitally native generation. By leveraging ChatGPT's capabilities to generate and process diverse forms of content, educators can create a more immersive and engaging learning environment, fostering a deeper connection between students and the educational materials.

## 4.2 Practical implications (ChatGPT in Saudi higher education)

The practical implications of ChatGPT's availability in Saudi Arabia extend to various facets of higher education. By examining these practical implications, we can envision how ChatGPT can be integrated into educational practices to achieve tangible outcomes.

### 4.2.1 Customized learning resources

Educators can harness ChatGPT to develop tailored learning resources that cater to diverse learning styles and individual needs. Through personalized content creation, instructors can accommodate varying levels of understanding and address Saudi students' unique challenges that affect their learning experiences, e.g., language barriers, cultural differences, different levels of prior knowledge, or individual learning preferences. Instructors can use ChatGPT to create customized learning resources that consider these challenges and provide tailored support to help Saudi students overcome them. For instance, Saudi students might have varying English proficiency levels, and instructors

could use ChatGPT to create content that simplifies complex concepts, translates materials into Arabic, or provides explanations that resonate with Saudi students' cultural backgrounds. By addressing these specific challenges through personalized content creation, educators can enhance the effectiveness of the learning materials and improve the overall learning experience for Saudi students.

#### 4.2.2 Enhanced research and academic writing

ChatGPT can act as a virtual research assistant, aiding students and researchers in formulating research questions, generating ideas, and drafting academic papers. This practical application not only streamlines the research process but also enhances the quality and originality of written work.

#### 4.2.3 Interactive assessment and formative feedback

Integrating ChatGPT in Saudi higher education introduces innovative approaches to assessment and feedback. First, ChatGPT can create interactive assessments that engage students in problem-solving scenarios, case studies, or simulated real-world tasks. By generating dynamic questions and scenarios, educators can assess students' critical thinking, analytical skills, and application of knowledge. This approach moves beyond static assessments, fostering a more profound understanding and application of knowledge. Second, ChatGPT's ability to provide instant responses can be harnessed to offer real-time formative feedback to students. As students answer questions or submit assignments, ChatGPT can provide immediate insights, explanations, and suggestions for improvement. This continuous feedback loop empowers students to identify and address gaps in their understanding, promoting an iterative learning process. Third, through ChatGPT's interactions, educators can identify individual learning trajectories. Adaptive learning paths can be created based on students' interactions with ChatGPT, directing them toward resources, activities, or topics that align with their learning needs. This personalized approach optimizes students' learning experiences and supports their unique academic journeys. This shows that the integration of ChatGPT for interactive assessment and formative feedback aligns with Saudi Arabia's commitment to data-driven education and continuous improvement. Educators can guide students toward mastery and enhance learning outcomes by offering dynamic reviews and personalized feedback.

#### 4.2.4 Potential concerns or criticisms of integrating ChatGPT in Saudi higher education

Incorporating ChatGPT into Saudi higher education may raise concerns or criticisms from various stakeholders. Educators, students, policymakers, and other relevant parties may have reservations or objections regarding using ChatGPT in the educational context. Some common concerns could include privacy and data security issues, the potential for overreliance on AI technology, ethical considerations surrounding AI-generated content, cultural relevance and sensitivity, and the impact on traditional teaching methods and human interaction in the classroom. By acknowledging and addressing these potential concerns, educators and policymakers can develop strategies to mitigate risks and maximize the benefits of integrating ChatGPT in Saudi higher education.

### 4.3 Strengths, limitations, implications, and future directions

#### 4.3.1 Strengths

ChatGPT's ability to tailor responses to individual learning needs enhances personalized education, catering to diverse student profiles in Saudi Arabia with varying proficiency levels and learning styles. In addition, through language support and instant feedback, ChatGPT contributes to improved language proficiency, particularly for Saudi students enrolled in English-medium programs, creating an immersive language learning environment. Furthermore, employing ChatGPT as a virtual research assistant accelerates research endeavors, enabling students and researchers to brainstorm ideas, draft papers, and foster collaborative efforts, thereby boosting academic productivity.

#### 4.3.2 Limitations

While ChatGPT offers significant benefits, it is essential to recognize its limitations and potential biases. The potential for ChatGPT to perpetuate biases from training data raises concerns, particularly regarding cultural insensitivity or inaccurate responses. This aspect is essential in Saudi Arabia due to its cultural and religious context. Additionally, an overreliance on ChatGPT could diminish students' critical thinking and problem-solving skills if viewed as a substitute for traditional teaching methods. Ethical considerations, including AI-generated content, plagiarism, and academic integrity, must also be addressed, demanding clear guidelines for responsible usage. Ensuring ethical and transparent use of technology within institutions is paramount.

#### 4.3.3 Implications for applying findings to the Saudi context

Considering the unique context of Saudi higher education is crucial when applying the findings of studies on ChatGPT integration. Potential biases in the selected studies, such as those related to cultural norms or educational practices, may influence the relevance and generalizability of the findings to the Saudi context. For instance, if a study primarily focused on Western educational systems, its conclusions may only partially capture the nuances of the Saudi educational landscape. Furthermore, biases in the study design or data collection methods may limit how much the findings can be generalised to Saudi students or educators. By acknowledging these potential biases and considering their implications for applying findings to the Saudi context, we can ensure a more nuanced understanding of the role of ChatGPT in Saudi higher education and make informed decisions about its integration.

#### 4.3.4 Future directions

In this subsection, we propose specific areas for future research that can address the identified limitations or gaps in the existing literature on integrating ChatGPT in higher education.

##### 4.3.4.1 Addressing bias and ethical concerns

Future research should focus on developing methods to mitigate biases inherent in ChatGPT's training data and algorithms, particularly concerning cultural sensitivity and response accuracy. Additionally, exploring ethical considerations surrounding AI-generated content, plagiarism detection, and maintaining academic integrity in ChatGPT-integrated educational environments warrants further investigation. Studies could investigate the

development of transparent and ethical guidelines for the responsible use of ChatGPT in educational settings, ensuring that its integration aligns with ethical standards and promotes fair and equitable learning opportunities for all students.

#### 4.3.4.2 Exploring pedagogical strategies

Research is needed to explore innovative pedagogical strategies that effectively integrate ChatGPT into teaching and learning practices. Investigating how ChatGPT can complement existing instructional methods, such as flipped classrooms, project-based learning, or inquiry-based approaches, can provide valuable insights into enhancing student engagement, critical thinking, and learning outcomes. Additionally, exploring the effectiveness of ChatGPT in supporting collaborative learning environments and fostering peer interaction and feedback warrants further investigation.

#### 4.3.4.3 Understanding student perceptions and experiences

Research should aim to understand students' perceptions, attitudes, and experiences regarding integrating ChatGPT in higher education. Investigating how students interact with ChatGPT, their preferences for using AI technology in learning contexts, and its integration's perceived benefits and challenges can provide valuable insights into its impact on student learning experiences and outcomes. Additionally, exploring factors influencing students' acceptance and adoption of ChatGPT, such as perceived usefulness, ease of use, and trust in AI technology, can inform the design and implementation of ChatGPT-integrated educational interventions.

#### 4.3.4.4 Evaluating long-term effects and outcomes

Longitudinal studies are needed to evaluate the long-term effects and outcomes of integrating ChatGPT in higher education. Research should assess the sustained impact of ChatGPT on student learning, academic performance, and retention over extended periods. Additionally, investigating the effects of ChatGPT integration on educators' teaching practices, workload, and professional development needs can provide insights into its broader implications for instructional design and faculty support strategies.

By focusing on these specific areas for future research, scholars can advance our understanding of the integration of ChatGPT in higher education and contribute to developing evidence-based practices that optimize its use for improving teaching and learning outcomes.

## 5 Conclusion

The recent availability of ChatGPT in Saudi Arabia heralds a new era of transformative possibilities in higher education. By

incorporating theoretical implications that challenge traditional educational paradigms and practical implications that enhance various academic facets, Saudi higher education institutions can seize the opportunity to leverage ChatGPT's potential to its fullest. The technology's capacity to reshape teaching methods, foster language proficiency, promote inclusivity, and redefine research practices aligns seamlessly with Saudi Arabia's educational goals. If Saudi Higher Education institutions embrace ChatGPT, they assume a future of innovative and student-centered education that aligns with the country's vision for progress.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Author contributions

EF: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

## Funding

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

## Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## References

- Abdullateef, T., Alsheikh, R., and Khalifa, B. (2023). Making Saudi vision 2030 a reality through educational transformation at the university level. *Labour Ind.* 33, 225–240. doi: 10.1080/10301763.2023.2184166
- Ajevski, M., Barker, K., Gilbert, A., Hardie, L., and Ryan, F. (2023). ChatGPT and the future of legal education and practice. *Law Teacher* 57, 352–364. doi: 10.1080/03069400.2023.2207426
- Alotaibi, N. S., and Alshehri, A. H. (2023). Prosper and obstacles in using artificial intelligence in Saudi Arabia higher education institutions: the potential of AI-based learning outcomes. *Sustain. For.* 15:10723. doi: 10.3390/su151310723
- Athaluri, S. A., Varma, M. S., Kesapragada, V. S., Krishna, M., Vineel, Y., Tirth, D., et al. (2023). Exploring the boundaries of reality: investigating the phenomenon of artificial intelligence hallucination in scientific writing through ChatGPT references. *Cureus* 15:e37432. doi: 10.7759/cureus.37432
- Barrot, J. S. (2023). Using Chatgpt for second language writing: Pitfalls and potentials. *Assess. Writ.* 57. doi: 10.1016/j.asw.2023.100745
- Cacciuto, C., Vásquez, Y., Cano, D., and Valenzuela, F. (2023). Research thesis for undergraduate engineering programs in the digitalization era: learning strategies and



- responsible research conduct road to a university education 4.0 paradigm. *Sustain. For.* 15:11206. doi: 10.3390/su151411206
- Chan, C., and Hu, W. (2023). Students' voices on generative AI: perceptions, benefits, and challenges in higher education. *Int. J. Educ. Technol. High. Educ.* 20:43. doi: 10.1186/s41239-023-00411-8
- Chang, Q., Pan, X., Manikandan, N., and Ramesh, S. (2022). Artificial intelligence technologies for teaching and learning in higher education. *Int. J. Reliab. Qual. Saf. Eng.* 29:2240006. doi: 10.1142/S021853932240006X
- Cooper, G. (2023). Examining science education in ChatGPT: an exploratory study of generative artificial intelligence. *J. Sci. Educ. Technol.* 32, 444–452. doi: 10.1007/s10956-023-10039-y
- Cotton, D. R. E., Cotton, P. A., and Shipway, J. R. (2023). Chatting and cheating: ensuring academic integrity in the era of ChatGPT. *Innov. Educ. Teach. Int.* 61, 228–239. doi: 10.1080/14703297.2023.2190148
- Dergaa, I., Chamari, K., Zmijewski, P., and Ben Saad, H. (2023). From human writing to artificial intelligence generated text: Examining the prospects and potential threats of Chatgpt in academic writing. *Biol. Sport.* 40, 615–622. doi: 10.5114/biolSport.2023.125623
- Ellis, A. R., and Slade, E. (2023). A new era of learning: considerations for ChatGPT as a tool to enhance statistics and data science education. *J. Stat. Data Sci. Educ.* 31, 128–133. doi: 10.1080/26939169.2023.2223609
- Emenike, M. E., and Emenike, B. U. (2023). Was this title generated by ChatGPT? Considerations for artificial intelligence text-generation software programs for chemists and chemistry educators. *J. Chem. Educ.* 100, 1413–1418. doi: 10.1021/acs.jchemed.3c00063
- Farrokhnia, M., Banihashem, S. K., Noroozi, O., and Wals, A. (2023). A swot analysis of Chatgpt: Implications for educational practice and research. *Innov. Educ. Teach. Int.* 1–15. doi: 10.1080/14703297.2023.2195846
- Friederichs, H., Friederichs, W. J., and März, M. (2023). ChatGPT in medical school: how successful is AI in progress testing? *Med. Educ. Online* 28:2220920. doi: 10.1080/10872981.2023.2220920
- Gill, S., and Kaur, R. (2023). ChatGPT: vision and challenges. *arXiv.org*, 3, 262–271. doi: 10.1016/j.iotcps.2023.05.004
- Grassini, S. (2023). Shaping the future of education: exploring the potential and consequences of AI and ChatGPT in educational settings. *Educ. Sci.* 13:692. doi: 10.3390/educsci13070692
- Huh, S. (2023). Are ChatGPT's knowledge and interpretation ability comparable to those of medical students in Korea for taking a parasitology examination? A descriptive study. *J. Educ. Eval. Health Prof.* 20, 1–6. doi: 10.3352/jehp.2023.20.1
- Hung, J., and Chen, J. (2023). The benefits, risks and regulation of using ChatGPT in Chinese academia: a content analysis. *Soc. Sci.* 12:380. doi: 10.3390/socsci12070380
- Hwang, G., and Chen, N. (2023). Exploring the potential of generative artificial intelligence in education: applications, challenges, and future research directions. *J. Educ. Technol. Soc.* 26, 1–18. doi: 10.30191/ETS.202304\_26(2).0014
- Ivanov, S., and Soliman, M. (2023). Game of algorithms: ChatGPT implications for the future of tourism education and research. *J. Tour. Futures* 9, 214–221. doi: 10.1108/JTF-02-2023-0038
- Jeon, J., and Lee, S. (2023). Large language models in education: a focus on the complementary relationship between human teachers and ChatGPT. *Educ. Inf. Technol.* 28, 15873–15892. doi: 10.1007/s10639-023-11834-1
- Karakose, T. (2023). The utility of ChatGPT in educational research—potential opportunities and pitfalls. *Educ. Process Int. J.* 12, 7–13. doi: 10.22521/edupij.2023.122.1
- Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., et al. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learn. Individ. Differ.* 103:102274. doi: 10.1016/j.lindif.2023.102274
- Katib, I., Assiri, F. Y., Abdushkour, H. A., Hamed, D., and Ragab, M. (2023). Differentiating chat generative pretrained transformer from humans: detecting ChatGPT-generated text and human text using machine learning. *Mathematics* 11:3400. doi: 10.3390/math11153400
- Khan, R. A., Jawaid, M., Khan, A. R., and Sajjad, M. (2023). ChatGPT – reshaping medical education and clinical management. *Pak. J. Med. Sci.* 39, 605–607. doi: 10.12669/pjms.39.2.7653
- Kohnke, L., Moorhouse, B. L., and Zou, D. (2023). ChatGPT for language teaching and learning. *RELC J.* 54, 537–550. doi: 10.1177/00336882231162868
- Lin, X. (2023). Exploring the role of ChatGPT as a facilitator for motivating self-directed learning among adult learners. *Adult Learn.* doi: 10.1177/10451595231184928
- Liu, G., and Ma, C. (2023). Measuring EFL learners' use of ChatGPT in informal digital learning of English based on the technology acceptance model. *Innov. Lang. Learn. Teach.* 18, 125–138. doi: 10.1080/17501229.2023.2240316
- Mahyoub, M., Algaraady, J., and Alblwi, A. (2023). A proposed framework for human-like language processing of ChatGPT in academic writing. *Int. J. Emerg. Technol. Learn.* 18, 282–293. doi: 10.3991/ijet.v18i14.41725
- Mayring, P. (2002). "Qualitative content analysis," in *Qualitative research: A handbook*, eds. U. Flick, Kardorff, E. von and I. Steinke. (London: Sage Publications).
- Meyer, J. G., Urbanowicz, R. J., Martin, P., O'Connor, K., Li, R., Peng, P., et al. (2023). ChatGPT and large language models in academia: opportunities and challenges. *BioData Mining* 16, 20–11. doi: 10.1186/s13040-023-00339-9
- Mohamed, A. M. (2024). Exploring the potential of an AI-based Chatbot (ChatGPT) in enhancing English as a foreign language (EFL) teaching: perceptions of EFL faculty members. *Educ. Inf. Technol.* 29, 3195–3217. doi: 10.1007/s10639-023-11917-z
- Page, M., McKenzie, J., Bossuyt, P., Boutron, I., Hoffmann, I., Mulrow, C., et al. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *PLoS Med.* 18:e1003583. doi: 10.1371/journal.pmed.1003583
- Pavlik, J. V. (2023). Collaborating with ChatGPT: considering the implications of generative artificial intelligence for journalism and media education. *Journal. Mass Commun. Educ.* 78, 84–93. doi: 10.1177/10776958221149577
- Peres, R., Schreier, M., Schweidel, D., and Sorescu, A. (2023). On ChatGPT and beyond: how generative artificial intelligence may affect research, teaching, and practice. *Int. J. Res. Mark.* 40, 269–275. doi: 10.1016/j.ijresmar.2023.03.001
- Perkins, M. (2023). Academic integrity considerations of AI large language models in the post-pandemic era: ChatGPT and beyond. *J. Univ. Teach. Learn. Pract.* 20, 1–24. doi: 10.5376/1.20.02.07
- Qahl, M., and Sohaib, O. (2023). Key factors for a creative environment in Saudi Arabian higher education institutions. *Journal of information technology education. Innovations Pract.* 22, 001–048. doi: 10.28945/5105
- Rahman, M. M., and Watanobe, Y. (2023). ChatGPT for education and research: opportunities, threats, and strategies. *Appl. Sci.* 13:5783. doi: 10.3390/app13095783
- Rospigliosi, P. (2023). Artificial intelligence in teaching and learning: what questions should we ask of ChatGPT? *Interact. Learn. Environ.* 31, 1–3. doi: 10.1080/10494820.2023.2180191
- Roumeliotis, K., and Tselikas, N. (2023). ChatGPT and open-AI models: a preliminary review. *Future Internet* 15:192. doi: 10.3390/fi15060192
- Rusandi, M., Ahman, S., Khairun, D., and Mutmainnah, A. (2023). No worries with ChatGPT: building bridges between artificial intelligence and education with critical thinking soft skills. *J. Public Health* 45, e602–e603. doi: 10.1093/pubmed/fdad049
- Sallam, M. (2023). ChatGPT utility in healthcare education, research, and practice: systematic review on the promising perspectives and valid concerns. *Healthcare* 11, 1–20. doi: 10.3390/healthcare11060887
- Salvagno, M., Taccone, F. S., and Gerli, A. G. (2023). Can artificial intelligence help for scientific writing? *Crit. Care* 27:75. doi: 10.1186/s13054-023-04380-2
- Sánchez-Ruiz, L. M., Moll-López, S., Nuñez-Pérez, A., Moraño-Fernández, J. A., and Vega-Fleitas, E. (2023). ChatGPT challenges blended learning methodologies in engineering education: a case study in mathematics. *Appl. Sci.* 13:6039. doi: 10.3390/app13106039
- Sedaghat, S. (2023). Early applications of ChatGPT in medical practice, education and research. *Clin. Med.* 23, 278–279. doi: 10.7861/clinmed.2023-0078
- Seetharaman, R. (2023). Revolutionizing medical education: Can Chatgpt boost subjective learning and expression? *J. Med. Syst.* 47, 61–72. doi: 10.1007/s10916-023-01957-w
- Shoufan, A. (2023). Exploring students' perceptions of ChatGPT: thematic analysis and follow-up survey. *IEEE Access* 11, 38805–38818. doi: 10.1109/ACCESS.2023.3268224
- Skavronskaya, L., Hadinejad, A., and Cottrell, D. (2023). Reversing the threat of artificial intelligence to opportunity: a discussion of ChatGPT in tourism education. *J. Teach. Travel Tour.* 23, 253–258. doi: 10.1080/15313220.2023.2196658
- Smith, A., Hachen, S., Schleifer, R., Bhugra, D., Buadze, A., and Liebreiz, M. (2023). Old dog, new tricks? Exploring the potential functionalities of ChatGPT in supporting educational methods in social psychiatry. *Int. J. Soc. Psychiatry* 69, 1882–1889. doi: 10.1177/00207640231178451
- Stojanov, A. (2023). Learning with ChatGPT 3.5 as a more knowledgeable other: an autoethnographic study. *Int. J. Educ. Technol. High. Educ.* 20, 1–17. doi: 10.1186/s41239-023-00404-7
- Strzelecki, A. (2023). To use or not to use Chatgpt in higher education? A study of students' acceptance and use of technology. *Interact. Learn. Environ.* 1–14. doi: 10.1080/10494820.2023.2209881
- Su, Y., Lin, Y., and Lai, C. (2023). Collaborating with ChatGPT in argumentative writing classrooms. *Assess. Writ.* 57:100752. doi: 10.1016/j.asw.2023.100752
- Sun, G. H., and Hoelscher, S. H. (2023). The ChatGPT storm and what faculty can do. *Nurse Educ.* 48, 119–124. doi: 10.1097/NNE.0000000000001390
- Tranfield, D., Denyer, D., and Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *Br. J. Manag.* 14, 207–222. doi: 10.1111/1467-8551.00375
- Van Slyke, C., Johnson, R., and Sarabadani, J. (2023). Generative artificial intelligence in information systems education: challenges, consequences, and responses. *Commun. Assoc. Inf. Syst.* 53, 1–21. doi: 10.17705/1CAIS.05301
- Vee, A. (2023). Large language models write answers. *Compos. Stud.* 51, 176–181.
- Wang, T., Lund, B. D., Marengo, A., Pagano, A., Nishith, R. M., Teel, Z. A., et al. (2023). Exploring the potential impact of artificial intelligence (AI) on international students in higher education: generative AI, chatbots, analytics, and international student success. *Appl. Sci.* 13:6716. doi: 10.3390/app13116716
- Young, J. C., and Shishido, M. (2023). Investigating OpenAI's ChatGPT potentials in generating chatbot's dialogue for English as a foreign language learning. *Int. J. Adv. Comput. Sci. Appl.* 14, 65–72. doi: 10.14569/IJACSA.2023.0140607
- Zhu, C., Sun, M., Luo, J., Li, T., and Wang, M. (2023). How to harness the potential of ChatGPT in education? *Knowl. Manag. E-Learn.* 15, 133–152. doi: 10.34105/j.kmel.2023.15.008