

Research Article

Cite this article: Ekundayo, T., Khan, Z., & Chaudhry, S.A. (2024). ChatGPT's Integration in GCC Higher Education: Bibliometric Analysis of Trends. *Educational Process: International Journal*, 13(3): 69-84. <https://doi.org/10.22521/edupij.2024.133.4>

Received July 1, 2024

Accepted September 12, 2024

Published Online October 21, 2024

Keywords:

ChatGPT in higher education, artificial intelligence in education, GCC countries, bibliometric analysis, educational technology integration

Author for correspondence:

Tosin Ekundayo

 tosinekundayo@outlook.com

 Innovative Entrepreneurship

Department, Synergy University Dubai



OPEN ACCESS

© The Author(s), 2024. This is an Open Access article, distributed under the terms of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted re-use, distribution and reproduction, provided the original article is properly cited.

ChatGPT's Integration in GCC Higher Education: Bibliometric Analysis of Trends

Tosin Ekundayo , Zafarullah Khan , Shahid Ali Chaudhry 

Abstract

Background/Purpose. The integration of ChatGPT within higher education holds significant potential for enhancing learning through personalized, adaptive, and interactive educational experiences. This study's aims were to investigate how academic engagement with ChatGPT in higher education has evolved within the Gulf Cooperation Council (GCC) countries. The objective was to identify key trends, benefits, challenges, and implications of adopting this technology in higher education systems across the region.

Materials/Methods. This study employed a bibliometric analysis of publications indexed in the Scopus database, focusing on those related to ChatGPT and higher education. VOSviewer software was used to generate network and overlay visualizations of key research topics and their co-occurrence patterns over time. Constructivist learning theory was applied as the theoretical framework to contextualize the findings and explore how ChatGPT can be used to support personalized learning in higher education.

Results. The analysis revealed that ChatGPT and artificial intelligence are central to the academic discourse on AI in higher education, particularly in GCC countries, with notable increases seen in research output over recent years. Key findings include the positive impact of ChatGPT on personalized learning and student engagement, as well as the growing focus on ethical concerns such as data privacy and bias. The study also identified strong interdisciplinary connections, with AI research in education intersecting with fields such as computer science, linguistics, and cognitive science.

Conclusion. The findings suggest that ChatGPT is becoming increasingly relevant and influential in higher education, particularly in the GCC region, where its adoption aligns with ongoing educational reforms and technological advancements. However, addressing ethical challenges and ensuring equitable access to AI-driven tools are crucial in order to maximize the positive impact of ChatGPT on learning outcomes. The study provides valuable insights for educators, educational policymakers, and academic researchers on the effective integration of AI technologies within higher education.

1. Introduction

ChatGPT is a state-of-the-art AI language model developed by OpenAI that generates human-like text based on input prompts. The tool has the capability to enhance higher education students' performance through supporting them in their academic writing (Chen et al., 2020). The software leverages natural language processing in order to engage in interactive and contextually relevant conversations. It is argued that ChatGPT is able to provide tailored educational content and real-time feedback that addresses individual students' needs, thus fostering a more effective and engaging learning environment (Javaid et al., 2023). It can also assist educators in managing routine tasks, allowing them to focus more on student interaction and pedagogical strategies (Holmes et al., 2019). Despite its growing integration into education, the use of ChatGPT has also raised significant concerns over academic integrity (Bin-Nashwan et al., 2023). The potential for students to use ChatGPT to generate essays, solve assignments, or to conduct research without proper attribution can lead to issues of plagiarism that undermine the educational process (Ekundayo et al., 2024). There is also an inherent risk of misinformation being spread if the AI-generated return provides incorrect or biased information. Educators have shared concerns over the authenticity of student work and the potential for critical-thinking skills' erosion in cases where students rely excessively upon AI-generated content instead of engaging deeply with the material of their own accord (Zhai et al., 2024). In order to mitigate these issues, educational institutions have started to implement guidelines and tools that can detect plagiarism and AI-generated text as a means to monitoring and managing the use of AI by students and faculty alike. There has also been a push towards educating students and faculty about the appropriate and ethical use of AI, and emphasizing the importance of original thought and proper attribution in their academic work. However, the benefits of ChatGPT in enhancing learning, providing personalized support, and improving student engagement have driven its continued adoption in academia. By fostering a balanced approach that addresses ethical concerns whilst promoting educational support, institutions aim to harness the advantages of ChatGPT while also maintaining academic integrity (Holmes et al., 2019; Luckin et al., 2016).

Recent developments have indicated that the integration of ChatGPT needs to align with regulations from the Committee on Publication Ethics (COPE) in order to ensure its ethical usage and adequate protection of data privacy (Foo & Wilson, 2012). COPE has emphasized the importance of transparency, accountability, and integrity in research and publication practices. Ensuring that ChatGPT operates within these guidelines is crucial to maintaining trust and credibility in educational settings. Issues such as bias in AI algorithms, concerns over data privacy, and the potential misuse of AI-generated content must be carefully managed (Binns, 2018). By adhering to COPE regulations, higher education institutions within GCC countries can aim to promote responsible AI integration and enhancement of the overall educational experience while safeguarding ethical standards and data privacy.

Engagements with ChatGPT in the higher education context highlight its potential to revolutionize personalized learning and enhance student support (Adiguzel et al., 2023; Burger et al., 2023; Qasem, 2023; Sabzalieva & Valentini, 2023). Ongoing conversations in this area are considered crucial to address issues of academic integrity, AI's ethical usage, and concerns over data privacy. By continuing these discussions, stakeholders can develop effective strategies and guidelines aimed at maximizing ChatGPT's benefits, whilst maintaining high-level educational standards and trust by all concerned.

The integration of OpenAI's ChatGPT tool into higher education has garnered significant worldwide attention, including in countries of the Gulf Cooperation Council (GCC). The GCC, which is comprised of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates, has been proactive in adopting innovative educational technologies aimed at enhancing learning outcomes

and in fostering educational excellence (Alamri & Alsaleh, 2018). As these countries strive to modernize their educational systems, ChatGPT presents a transformative tool that can help address various educational challenges, and all with the aim to improve the overall teaching and learning experience. ChatGPT's ability to generate human-like text based on user prompts makes it a versatile tool when used within the education context. It can be used to facilitate personalized learning by providing tailored educational content and real-time feedback, thus catering to the individual needs of students (Chen et al., 2020). This personalized approach can significantly enhance student engagement and help to meet learning outcomes, since it allows for the adaptation of educational material to suit different learning paces and styles (Zawacki-Richter et al., 2019).

The countries of the GCC have been at the fore of integrating AI in education to bridge gaps in accessibility and inclusivity. For example, AI-powered tools like ChatGPT have been used to support students with disabilities by providing customized learning experiences that can accommodate their specific needs (Almogren et al., 2024). Inclusivity like this is crucial for ensuring that all students have equal opportunities to succeed, regardless of their individual challenges. AI-driven tools like ChatGPT have the capability to analyze vast amounts of data in order to tailor educational content to individual learners' needs, thereby enhancing the learning process (Das et al., 2023). One significant advantage of AI's usage in the education context is its capacity to facilitate personalized learning. AI systems can adapt to the unique learning pace and style of each student, providing customized resources and support (Akavova et al., 2023). This level of personalization is not easily achievable in traditional educational settings, where a one-size-fits-all approach often dominates. As such, AI tutors can offer additional exercises and explanations for students who struggle with specific concepts, ensuring that no student is left behind (Kulik & Fletcher, 2016). Moreover, AI tools like ChatGPT can provide real-time feedback, a crucial element in the learning process, that helps students to understand their mistakes and to help them learn from them, which can lead to significant improvement in learning outcomes (Darvishi et al., 2024).

Intelligent tutoring systems and automated grading tools are examples of AI applications that provide immediate feedback, helping students to continuously improve (Gligorea et al., 2023). AI also supports the creation of adaptive learning environments, which adjust the difficulty and type of content based on learner performance levels and the individual academic progress of students (Baek & Doleck, 2023). Adaptive learning technologies can help to identify when students are struggling and to modify the instructional approach accordingly so that it better suits their individual needs, thus facilitating a more effective and engaging learning experience (El-Sabagh, 2021). ChatGPT and other AI technologies are transforming the role of educators. These tools can now handle many administrative and routine tasks, freeing up educators to focus on more critical aspects of teaching, such as mentoring and developing innovative instructional strategies (Luckin et al., 2016). This shift allows educators to provide more personalized attention and support to their students (Holmes et al., 2019).

The growing body of research on the integration of ChatGPT within GCC higher education underscores its potential to revolutionize teaching and learning practices. As GCC countries continue to invest in educational innovation, the role of ChatGPT is likely to expand, offering new opportunities for the enhancement of educational quality in the region. While previous studies have underscored the transformative potential of ChatGPT and AI tools in education, specific investigations into the trajectory of their role within GCC's higher education sector remain limited or non-existent. The current study aims to address this gap by focusing on the following research question:

- *What are the evolving trends and key themes in academic research on ChatGPT's integration in higher education within GCC countries over time?*

The significance of this study lies in its thorough analysis of the academic engagement with ChatGPT in the higher education context of GCC countries. Specifically, the study seeks to explore how the integration of ChatGPT has been discussed and studied over time, providing a clearer picture of the region's academic landscape. This is deemed to be of particular relevance given the GCC's proactive efforts to embrace advanced educational technologies with the aim of improving learning outcomes (Shamsuddinova et al., 2024). Through the identification of trends, key themes, and research patterns, the study aims to offer valuable insights for educators, policymakers, and researchers into the current state of AI integration in the GCC region's educational systems. It also highlights future directions for the employment of AI technologies such as ChatGPT in education throughout the region. The study aims to contribute to the literature by addressing a critical gap; that being the lack of region-specific analysis on how AI is being implemented in education. It is expected that understanding these trends will enable stakeholders to develop more targeted, culturally and socioeconomically relevant strategies to more effectively incorporate AI-driven educational technologies in GCC countries, while providing a historical framework for future AI-driven educational reforms.

2. Literature Review

The integration of ChatGPT in higher education has generated substantial global interest and discussion. The following literature review synthesizes key findings from recent studies in GCC countries in relation to the rest of the world.

The ChatGPT AI tool offers several potential benefits for higher education, particularly in enhancing personalized learning and the provision of real-time feedback. Schönberger's (2023) study in the United States highlighted that ChatGPT can serve as a valuable tool in providing tailored educational content and support, catering to individual student needs, and enhancing their overall learning experience. This capability aligns with findings from research conducted by Alneyadi and Wardat (2023) in Oman, where ChatGPT's role in improving student engagement and academic performance is emphasized, particularly within complex subjects like electronic magnetism. Both their research and that of others has consistently shown that ChatGPT can significantly improve student engagement and learning outcomes. Leleparry et al. (2023) included data from various institutions worldwide to investigate how ChatGPT can serve as an interactive tutor, offering personalized support and addressing specific learning challenges faced by students. This personalized approach was further supported by the findings of Alneyadi and Wardat's (2023) study, in which it was indicated that students in Oman benefitted from the tailored feedback and explanations provided by ChatGPT, which in turn led to improved student motivation and better academic performance.

Here it should be stated that the integration of ChatGPT within higher education is not just about exploiting technological advantage, but also about the enhancement of pedagogical practices. Alhasan and Aljamaan (2023) explored how ChatGPT can be integrated into various educational settings, including those in Saudi Arabia and the United Arab Emirates, to support teaching and learning processes. Their findings suggested that ChatGPT can assist in automating routine academic tasks, allowing educators to focus more on student engagement and innovative teaching strategies. Similarly, Faisal (2024) discussed how ChatGPT can facilitate adaptive learning environments, where the content and difficulty level can be adjusted based on learners' performance and progress.

Despite its clear benefits, the integration of ChatGPT within higher education presents significant challenges and risks. One of the primary concerns, as highlighted by Leleparry et al. (2023), is the potential for reinforcing existing biases. The vast dataset used to train ChatGPT may contain inherent biases, which can then be reflected in its responses to users, potentially perpetuating stereotyped views and misinformation. Also, Schönberger (2023) raised concerns about data privacy

and the ethical use of AI-generated content, particularly in maintaining academic integrity. The ethical implications of using ChatGPT in education are critical. Faisal (2024) emphasized the importance of developing clear guidelines for the responsible use of ChatGPT in order to ensure that its usage enhances rather than undermines educational practices. Issues such as plagiarism, authorship, and the ethical use of AI-related tools in education must be carefully managed so as to maintain integrity of the educational process. Furthermore, Almogren et al. (2024) highlighted the need for transparency in how AI tools like ChatGPT are integrated into educational settings, which aligns with the aforementioned COPE regulations (Foo & Wilson, 2012).

The comparative analysis offered by the current study aims to provide valuable insights into the best practices and challenges associated with AI tools such as ChatGPT, and their integration within educational practices. Almogren et al. (2024) suggested that GCC countries, particularly Qatar and the UAE, are making significant strides forward in adopting innovative technologies in education. The literature highlights the proactive steps taken by GCC countries to integrate with AI-related tools such as ChatGPT as a means to improving educational outcomes. Interdisciplinary research that combines insights from education, computer science, and cognitive science is expected to lead to a more comprehensive understanding of AI's impact on education, as discussed in the study published by Alneyadi and Wardat (2023).

2.1. Theoretical Framework - Constructivist Learning Theory

Constructivist learning theory is primarily derived from the works of Jean Piaget and Lev Vygotsky, and provides a robust theoretical framework for the current study (Biggs, 1996). This theory posits that learners construct their own understanding and knowledge of the world through experiencing things and in their subsequent reflection on those experiences (Chen & Lertamornsak, 2023). When students encounter something new, they reconcile it with their previous ideas and experiences, which may subsequently change what they believe or the new information may be discarded as irrelevant (Smith et al., 1994). In the context of GCC countries, the integration of ChatGPT into higher education can support the region's goals of modernizing education and improving learning outcomes. The personalized and interactive nature of ChatGPT aligns with the educational reforms and technological advancements being pursued in GCC countries. By adopting a constructivist approach, the GCC's educational institutions can leverage the advantages of ChatGPT in order to create more engaging, effective, and student-centered learning environments.

The constructivist learning theory provides a solid foundation from which to understand the potential impact of ChatGPT in higher education. By emphasizing the roles and advantages of personalized learning, active engagement, collaboration, reflection, and contextual learning in higher education, this theoretical approach can be used to highlight ways in which ChatGPT could be used to transform educational practices and enhance student learning experiences. As GCC countries continue to embrace innovative educational technologies, the principles of constructivism can guide the effective integration of ChatGPT, ensuring that the move supports meaningful and impactful learning.

3. Methodology

3.1. Research Design

The design of this study follows the research onion concept established by Saunders et al. (2007). The research philosophy for this study is pragmatism, which is considered ideal in this case, as outlined in Saunders et al.'s (2007) research onion, since it prioritizes practical outcomes and real-world applications over abstract principles. Pragmatism allows for the integration of multiple research methods, particularly the combination of quantitative bibliometric analysis to identify trends and patterns in academic publications (Phair & Warren, 2021). As such, this approach is

deemed to be particularly suitable for exploring the evolving academic engagement with ChatGPT in higher education within GCC countries, where diverse educational contexts and technological advancements need to be considered. Pragmatism supports the use of bibliometric analysis to systematically analyze large datasets from the Scopus database, enabling the identification of significant trends, key themes, and influential contributors. By focusing on practical solutions and outcomes, pragmatism ensures that the research findings are actionable and relevant, providing valuable guidance for the effective integration of ChatGPT in educational settings.

The study employs a deductive approach, which is suitable because it allows the research to begin with a theory or hypothesis about the integration of ChatGPT in higher education, which can then be tested through empirical observation and analysis. The bibliometric analysis will help test the theory or hypothesis that academic engagement with ChatGPT is increasing and evolving in significant ways. A mono approach is adopted in the study, that being quantitative research, which is suited to comprehensive analysis of bibliometric data to quantify the occurrence and co-occurrence of keywords, to track publication trends, and for measuring the impact of research outputs.

The primary research strategy employed is a case study focusing on GCC countries. This allows for in-depth exploration of how ChatGPT is integrated into higher education within a specific regional context. The study adopts a longitudinal time horizon, analyzing data over a period to capture the trends and changes seen in academic engagement with ChatGPT over time. This approach is deemed crucial to understanding the evolution and future trajectory of AI integration in higher education.

This study uses bibliometric secondary data from the Scopus database, including title, keywords and the abstracts of published articles. The study's data were collected through a comprehensive search conducted on the Scopus database on June 26, 2024, to gather relevant publications on ChatGPT's integration in higher education in GCC countries. The search focused on identifying key academic literature by employing specific keywords related to "ChatGPT," "Artificial intelligence," "Higher education," and "GCC countries," ensuring the inclusion of studies that directly aligned with the study's research question.

The collected data were then subjected to bibliometric analysis, with VOSviewer used to visualize keyword networks and trends. By following Saunders et al.'s (2007) research onion framework, the current study follows a structured and comprehensive approach to explore the evolving academic engagement with ChatGPT in higher education within GCC countries.

3.2. Search Strategy

To systematically identify and analyze academic literature related to the integration of ChatGPT in higher education within GCC countries, a comprehensive search strategy was employed against the Scopus database. The search strategy was designed to capture relevant publications that discussed ChatGPT, chatbots, and their applications in higher education and university settings in Saudi Arabia, the United Arab Emirates, Oman, Qatar, Bahrain, and Kuwait (i.e., GCC countries).

The following search terms and filters were applied:

Search Query

(TITLE-ABS-KEY (chatgpt) OR TITLE-ABS-KEY (chatbots) AND TITLE-ABS-KEY (higher AND education) OR TITLE-ABS-KEY (universities) OR TITLE-ABS-KEY (university)) AND (LIMIT-TO (AFFILCOUNTRY, "Saudi Arabia") OR LIMIT-TO (AFFILCOUNTRY, "United Arab Emirates") OR LIMIT-TO (AFFILCOUNTRY, "Oman") OR LIMIT-TO (AFFILCOUNTRY, "Qatar") OR LIMIT-TO (AFFILCOUNTRY, "Bahrain") OR LIMIT-TO (AFFILCOUNTRY, "Kuwait"))

3.3. Inclusion and Exclusion Criteria

The study's inclusion criteria were published academic articles, reviews, conference papers, and book chapters that discussed the integration of ChatGPT or chatbots in higher education or university settings. Only publications from authors affiliated to the specified GCC countries, namely Saudi Arabia, the United Arab Emirates, Oman, Qatar, Bahrain, and Kuwait, were considered. In order to ensure accessibility and comprehension, only English language publications were included.

Conversely, the study's exclusion criteria was used to eliminate publications not related to higher education or university settings, studies that did not involve ChatGPT or chatbots, and publications from countries outside of the specified GCC region. This selective approach ensures that the study remains focused on relevant literature within the appropriate geographical and thematic scope. Figure 1 presents a PRISMA flowchart of the study's data collection process, illustrating the flow of information through the various stages of the systematic review (Kahale et al., 2021; Rethlefsen & Page, 2022).

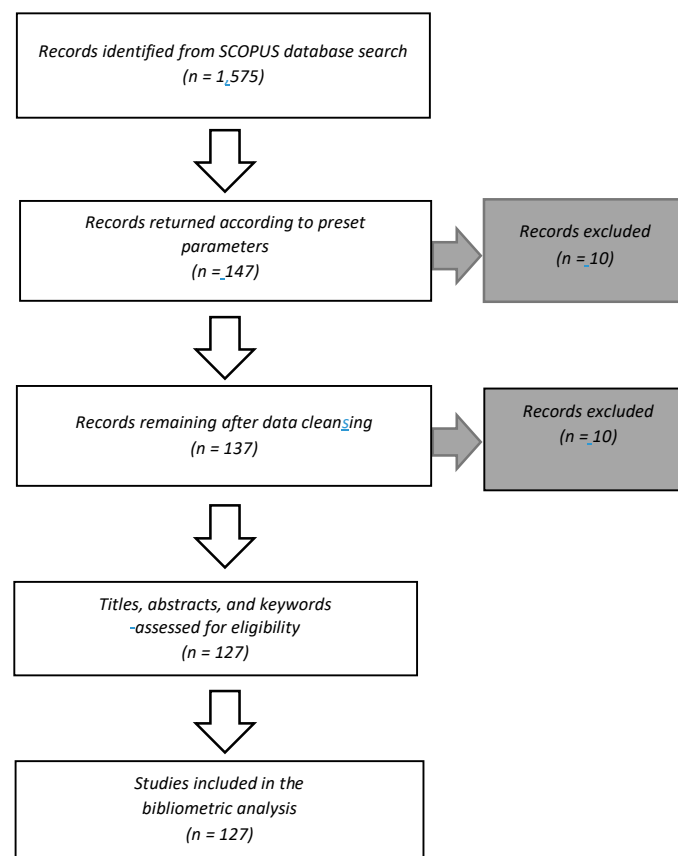


Figure 1. PRISMA Flowchart: Identification and Screening Process for Bibliometric Analysis

4. Results and Interpretation

This section provides a detailed analysis of the academic engagement with ChatGPT in higher education of GCC countries, employing VOSviewer for network and overlay visualizations. The bibliometric analysis of Scopus-indexed publications revealed keyword trends in this academic domain, with network visualizations used to illustrate the co-occurrence of frequently used keywords, uncovering central themes and research priorities. Overlay visualizations have been used to further highlight the temporal evolution of these themes, showing how the focus has shifted over

time. The discussion then interprets these findings, exploring the implications associated with integrating ChatGPT within the higher education context of GCC countries.

In order to answer the study's research question, VOS viewer was used for the co-occurrence analysis of the keywords used in the examined research studies. This identified the keywords used and provided visualization of the relationships and interactions between frequently occurring keywords, thereby highlighting central themes and the research focus of the studies. This analysis helped to reveal how the keywords used were linked, revealing patterns and trends in the academic literature.

For this dataset, keyword co-occurrence analysis was performed on all keywords with a threshold of five (i.e., those keywords with five or more occurrences), resulting in 34 significant instances out of the total keyword count of 835. For each of the 34 identified keywords, the total strength of their co-occurrence links with other keywords was calculated. Keywords with the highest total link strength were selected to highlight the most influential terms in this academic discourse, with Table 1 presenting the top 20 keywords.

Table 1. Top 20 Keywords and Link Strength

Keyword	Occurrences	Total Link Strength
ChatGPT	75	195
Artificial intelligence	58	197
Students	31	135
Chatbots	24	82
Chatbot	22	72
Education	18	68
Higher education	18	66
Education computing	15	77
Natural language processing	13	57
Human	12	54
Machine learning	11	50
AI	11	41
Humans	10	49
Learning systems	9	48
Language model	9	42
Article	8	36
High educations	8	33
E-learning	8	29
Natural language processing systems	7	35
Performance	6	32

4.1. Network visualization

The aim of using network visualization was to present the co-occurrence of the most frequently used keywords, uncovering central themes and research priorities.

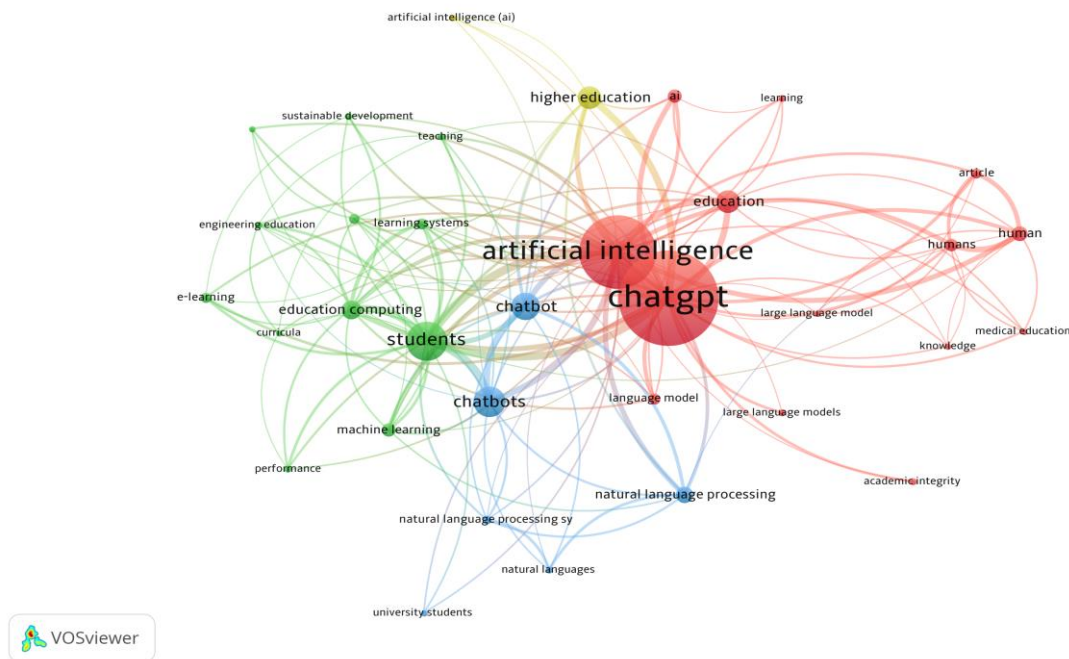


Figure 2. Network Visualization Showing Top 150 Network Co-Occurrences

According to the network visualization analysis presented in Figure 2, the keywords of “ChatGPT” and “Artificial intelligence” are integral to the network, as indicated by their high occurrence and link strength (75 occurrences, 195 link strength for “ChatGPT”; 58 occurrences, 197 link strength for “Artificial intelligence”). These keywords are at the core of academic discourse, connecting with various other terms and highlighting their pivotal role in research on AI in education.

Other significant themes identified include “Students” (31 occurrences, 135 link strength) and “Education” (18 occurrences, 68 link strength), emphasizing the focus on how ChatGPT and AI impact learners and educational processes. The keywords of “Higher education” (18 occurrences, 66 link strength), “Education computing” (15 occurrences, 77 link strength), and “Natural language processing” (13 occurrences, 57 link strength) suggest a strong interest in the technological and pedagogical aspects of integrating AI into higher education within the GCC region. Supporting technologies such as “Chatbots” (24 occurrences, 82 link strength), “Machine learning” (11 occurrences, 50 link strength), and “Language model” (nine occurrences, 42 link strength) indicate a broader technological context involving other AI tools and techniques relevant to ChatGPT’s application. The presence of keywords like “Human” (12 occurrences, 54 link strength) and “Humans” (10 occurrences, 49 link strength) underscores interest in the human-AI interaction aspect, highlighting ethical, psychological, and practical considerations in the adoption of AI in education. Keywords such as “Learning systems” (nine occurrences, 48 link strength), “E-learning” (eight occurrences, 29 link strength), and “Performance” (six occurrences, 32 link strength) point to the interest in how AI technologies can support learning environments and enhance educational outcomes.

The performed network visualization confirmed that ChatGPT and AI are central to current academic research in the context of higher education, indicating that the current study’s focus on

ChatGPT aligns well with prevailing academic interests. The network shows interdisciplinary connections, suggesting that research on ChatGPT in higher education is not confined just to educational technology, but also spans areas such as computer science, linguistics, and cognitive science. This broad scope can provide a richer understanding of how AI is transforming education.

The prominence of terms related to human interaction and educational systems highlights ongoing research interests, but also suggests areas where more in-depth studies could be beneficial. For instance, investigating the specific impacts of ChatGPT on student engagement, learning outcomes, and the effectiveness of adaptive learning systems could provide valuable insights. Understanding the strong co-occurrence of keywords related to education and AI in the GCC region can help policymakers and educational leaders recognize the key areas where AI can be integrated effectively. This can guide the development of targeted strategies and policies to support the adoption of AI in higher education. The significant linkage to human-related keywords underscores the importance of addressing ethical concerns, data privacy, and the responsible use of AI in education. This aspect is crucial for gaining acceptance and ensuring the positive impact of AI technologies.

4.2. Overlay visualization

The aim of an overlay visualization is to highlight the temporal evolution of these themes, showing how the focus may have shifted over time.

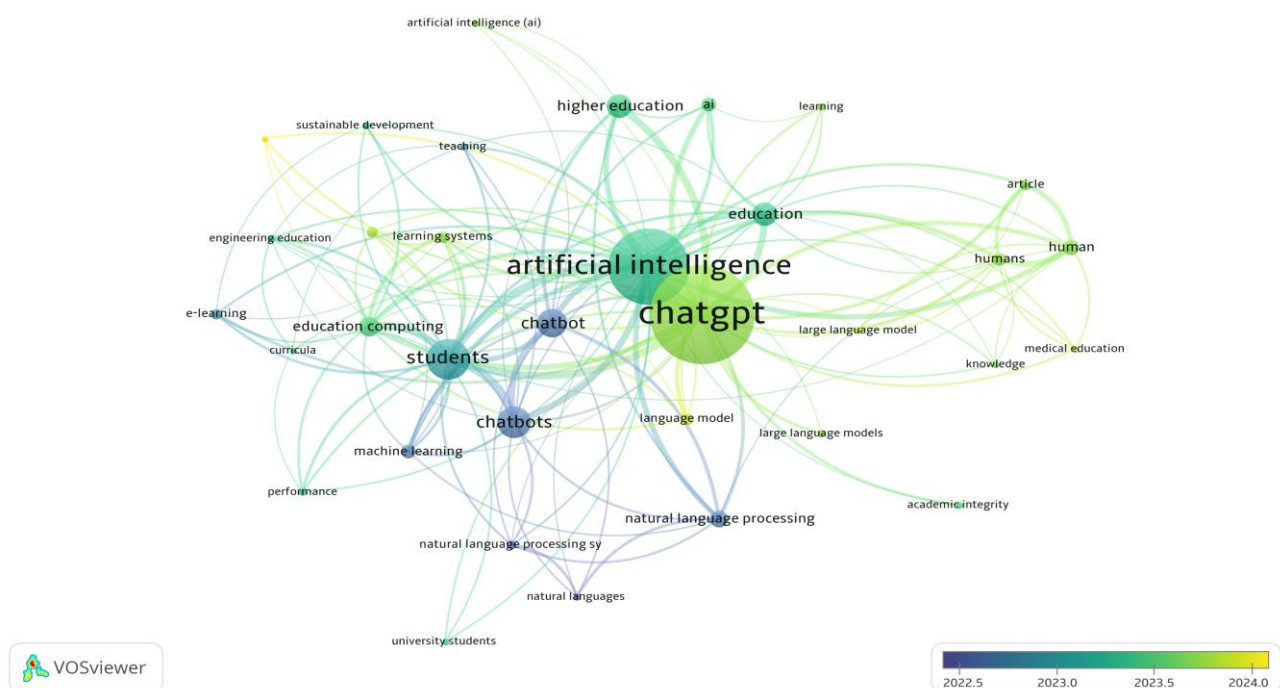


Figure 3. Overlay Visualization of Top 150 Co-Occurrences

According to the overlay visualization presented in Figure 3, the co-occurrence of keywords related to the integration of ChatGPT in higher education in the GCC region is illustrated according to the relationships between these keywords and through highlighting the temporal aspect of their co-occurrences. The color gradient used in Figure 3's visualization ranges from blue (signifying earlier years) to yellow (more recent years), indicating the average publication year of documents associated with each keyword.

As can be seen from Figure 3, the central keywords of “ChatGPT” and “Artificial intelligence” are the most prominent, with “ChatGPT” having 75 occurrences and a total link strength of 195, and “Artificial intelligence” having 58 occurrences and a total link strength of 197. These keywords are central to the network, signifying their importance in the academic discourse on AI in education around the GCC region. The color gradient indicates that research on artificial intelligence and ChatGPT spans multiple years, with more recent studies (presented as yellow) showing a growing focus on these technologies. Keywords such as “Education computing,” “Machine learning,” and “Learning systems” appear in green, suggesting that they were the focus of research in the middle of the period analyzed in the current study. More recent keywords, appearing in yellow, include “Higher education,” “Language model,” and “Large language models,” indicating a newer, more recent interest in these areas.

The overlay visualization shows that interest in ChatGPT and related technologies has increased over time, with a significant shift towards these topics in more recent years. This trend suggests that ChatGPT is becoming increasingly relevant in higher education research, reflecting its growing adoption and exploration in educational settings. The prominence of keywords such as “Students,” “Education,” and “Higher education” indicates that a major focus of the research undertaken has been on the impact of AI on learners and educational processes. This aligns with the study’s aim to understand how ChatGPT is being integrated into the GCC’s higher education and its effects on various stakeholders. The emergence of keywords like “Large language models” and “Language model” in more recent years highlights new areas of research interest, suggesting that the academic community is increasingly looking into the specific capabilities and applications of advanced AI models in education. The network visualization reveals connections between educational research and technological advancements in AI, suggesting an interdisciplinary approach. This intersection of fields can lead to more comprehensive and innovative studies, combining insights from education, computer science, and cognitive science.

By identifying the most frequently occurring and strongly linked keywords, key areas can be pinpointed that have been studied extensively, as well as those that may require further exploration. While areas such as artificial intelligence and ChatGPT have been well-researched, areas that include the ethical implications of AI’s usage in higher education, as represented by keywords such as “Human” and “Humans,” may benefit from deeper investigation. The visualization presented in Figure 3 offers valuable insight for educational policymakers and leaders by highlighting the central themes and emerging trends seen in the published literature on AI integration within GCC higher education. Understanding these patterns can help in the formulating of effective strategies and policies to support the adoption of AI technologies in educational institutions across GCC countries. The significant linkage to human-related keywords underscores the importance of addressing ethical considerations, data privacy, and the responsible use of AI in higher education. This aspect is considered crucial for gaining acceptance and to ensure a positive impact is realized from the use of AI technology in GCC higher education.

5. Discussion and Conclusion

The bibliometric analysis conducted in the current study provides a comprehensive overview of the evolving academic engagement with ChatGPT’s integration within higher education in GCC countries. The findings, derived from the Scopus database, revealed significant insights into the temporal trends that have shaped the academic landscape in the GCC region.

The central keywords identified in the analysis, “ChatGPT” and “Artificial intelligence,” underscore the pivotal role these technologies play in current academic discourse within the GCC region. The high occurrence and total link strength of these keywords indicate a sustained and growing interest in exploring the capabilities and implications of AI-driven tools like ChatGPT within educational settings. This aligns with global trends where AI’s potential to revolutionize education through personalized learning, real-time feedback, and adaptive learning environments has been widely acknowledged (Du Boulay, 2023; Hamal et al., 2022).

The temporal aspect of the overlay visualization (see Figure 3) highlighted a significant shift towards AI-related research in recent years. Keywords used in studies such as “Higher education,” “Language model,” and “Large language models,” which have appeared in more recent studies, suggest an increasing focus on the practical applications and specific functionalities of advanced AI model utilization in education. This trend is reflective of the rapid advancements seen in AI technology and its adoption within educational practices, particularly in the context of GCC countries, which have been proactively seeking to integrate cutting-edge educational technologies (Akiba & Fraboni, 2023; Bin-Nashwan et al., 2023; Hamal et al., 2022; Javaid et al., 2023).

Thematic analysis revealed that the impact of AI on students and educational processes has become a major area of academic interest. Keywords such as “Students,” “Education,” and “Higher education” are central to the network, indicating that much of the research has been focused on understanding how AI, and ChatGPT specifically, affects learner engagement, academic performance, and overall educational outcomes. This focus is crucial since it directly addresses the practical implications of integrating AI in education, which is a key concern for educators and policymakers aiming to enhance learning experiences and outcomes. The presence of keywords such as “Machine learning,” “Natural language processing,” and “Chatbots” highlights the technological context within which ChatGPT operates. The use of these keywords emphasize the interdisciplinary nature of the published research, combining insights from education, computer science, and cognitive science to explore the multifaceted applications of AI’s usage within educational contexts. This interdisciplinary approach is considered essential for the development of comprehensive and effective AI-driven educational tools.

The analysis also underscored the importance of ethical considerations of using AI in education, along with issues pertaining to data privacy and human-AI interaction (Kooli, 2023). Keywords related to human elements such as “Human” and “Humans” suggest a burgeoning academic awareness of the ethical and practical challenges associated with using AI in education. Addressing these challenges is therefore considered critical to ensuring the responsible and equitable use of AI technologies within educational settings.

In conclusion, the focus of academic engagement on ChatGPT’s integration within higher education in GCC countries has evolved significantly over time. This evolution can be said to reflect the broader global trends in AI research and its applications within educational contexts, with a particular emphasis seen on how it impacts both students and educational processes. The increasing prominence of advanced AI models, such as large language models, indicates a shift towards exploring the specific capabilities and benefits of these technologies in educational settings.

5.1. Limitations and suggestions for future research

The current study has several limitations. First, it relies solely upon publications listed on the Scopus academic database, potentially excluding other relevant studies indexed in alternative databases or regional journals, leading to a potentially limited representation of academic engagement on ChatGPT in the GCC region. Second, whilst the use of bibliometric analysis, including keyword co-occurrence and network visualization, offered considerable quantitative insights, the study lacked qualitative depth; although such methods may not capture how ChatGPT is practically implemented in educational settings or its specific impacts on student outcomes. Third, focusing exclusively on the GCC region limits the generalizability of the findings, as educational systems and cultural contexts vary in other regions of the world. These limitations suggest that further research is needed to expand the scope and depth of analysis in this area.

Future similar studies could expand data sources beyond just Scopus, incorporating alternative databases such as Web of Science and regional journals to capture a broader range of studies. Integrating qualitative methods, such as case study and interview, could elicit deeper insights into the practical application and outcomes of ChatGPT's usage within GCC higher educational settings. Cross-regional comparisons are also recommended in order to identify how ChatGPT is integrated differently based on cultural and educational contexts, with the aim of producing global best practices. Longitudinal studies are also needed so as to assess the long-term impact of ChatGPT on student learning outcomes and institutional practices over time. Lastly, future research could explore the ethical and practical issues associated with the use of AI in education, such as data privacy, bias, and academic integrity. By addressing these areas, it is hoped that future studies can offer more comprehensive insights into the evolving role of ChatGPT's usage in higher education.

6. Suggestions

Based on the findings of this bibliometric analysis, several recommendations can be made to enhance the integration of ChatGPT and other AI technologies in higher education within the GCC countries:

1. Collaborative research should be encouraged among universities, educational institutions, and AI developers to create tailored AI applications that address educational needs specific to the GCC region.
2. Interdisciplinary research centers should be established that focus on the use of AI in education as a means to fostering innovation and knowledge exchange.
3. Comprehensive guidelines and policies should be developed in order to ensure the ethical use of AI within educational contexts, addressing concerns related to data privacy, bias, and the impact on human-AI interaction.
4. Research should be prioritized that examines the practical applications and real-world impacts of using ChatGPT in educational settings, including pilot programs and case studies to demonstrate its effectiveness and to identify areas for potential improvement.
5. AI tools should be further integrated into existing educational frameworks and curricula with the aim of enhancing learning experiences and outcomes.

Declarations

Author Contributions. All authors contributed equally to the current study, and have read and approved publication of the final version of the article.

Conflicts of Interest. The authors declared no conflict of interest.

Data Availability Statement. The data that supports the findings of this study are available from the corresponding author upon reasonable request.

References

- Adiguzel, T., Kaya, M. H., & Cansu, F. K. (2023). Revolutionizing education with AI: Exploring the transformative potential of ChatGPT. *Contemporary Educational Technology, 15*(3), Article ep429. <https://doi.org/10.30935/cedtech/13152>
- Akavova, A., Temirkhanova, Z., & Lorsanova, Z. (2023). Adaptive learning and artificial intelligence in the educational space. *E3S Web of Conferences, 451*, Article 06011. <https://doi.org/10.1051/e3sconf/202345106011>
- Akiba, D., & Fraboni, M. C. (2023). AI-Supported Academic Advising: Exploring ChatGPT's Current State and Future Potential toward Student Empowerment. *Education Sciences, 13*(9), Article 885. <https://doi.org/10.3390/educsci13090885>
- Alamri, A. A., & Alsaleh, B. A. (2018). Transforming Education in the Gulf Region: Emerging Learning Technologies and Innovative Pedagogy for the 21st Century. *American Journal of Distance Education, 32*(1), 74-77. <https://doi.org/10.1080/08923647.2017.1323568>
- Alhasan, K. A., & Aljamaan, F. (2023). *Exploring Perceptions and Experiences of ChatGPT in Medical Education: A Qualitative Study Among Medical College Faculty and Students in Saudi Arabia* [preprint]. medRxiv. <https://doi.org/10.1101/2023.07.13.23292624>
- Almogren, A. S., Al-Rahmi, W. M., & Dahri, N. A. (2024). Exploring factors influencing the acceptance of ChatGPT in higher education: A smart education perspective. *Heliyon, 10*(11), Article e31887. <https://doi.org/10.1016/j.heliyon.2024.e31887>
- Alneyadi, S., & Wardat, Y. (2023). ChatGPT: Revolutionizing student achievement in the electronic magnetism unit for eleventh-grade students in Emirates schools. *Contemporary Educational Technology, 15*(4), Article ep448. <https://doi.org/10.30935/cedtech/13417>
- Baek, C., & Doleck, T. (2023). Educational Data Mining versus Learning Analytics: A Review of Publications From 2015 to 2019. *Interactive Learning Environments, 31*(6), 3828-3850. <https://doi.org/10.1080/10494820.2021.1943689>
- Biggs, J. (1996). Enhancing teaching through constructive alignment. *Higher Education, 32*(3), 347-364. <https://doi.org/10.1007/BF00138871>
- Bin-Nashwan, S. A., Sadallah, M., & Bouteraa, M. (2023). Use of ChatGPT in academia: Academic integrity hangs in the balance. *Technology in Society, 75*, Article 102370. <https://doi.org/10.1016/j.techsoc.2023.102370>
- Binns, R. (2018). Fairness in Machine Learning: Lessons from Political Philosophy. In S. A. Friedler & C. Wilson (Eds.), *Proceedings of Machine Learning Research* (Vol 81, pp. 149-159). PMLR.
- Burger, B., Kanbach, D. K., Kraus, S., Breier, M., & Corvello, V. (2023). On the use of AI-based tools like ChatGPT to support management research. *European Journal of Innovation Management, 26*(7), 233-241. <https://doi.org/10.1108/EJIM-02-2023-0156>
- Chen, L., Chen, P., & Lin, Z. (2020). Artificial Intelligence in Education: A Review. *IEEE Access, 8*, 75264-75278. <https://doi.org/10.1109/ACCESS.2020.2988510>
- Chen, L., & Lertamornsak, G. (2023). Internet of Things (IoT) based Investigation between Instructors' Insight of Constructivist Learning Theory and Learners Performance analysis in Higher Vocational Accounting Training. *International Journal on Recent and Innovation Trends in Computing and Communication, 11*(6s), 217-227. <https://doi.org/10.17762/ijritcc.v11i6s.6824>

- Darvishi, A., Khosravi, H., Sadiq, S., Gašević, D., & Siemens, G. (2024). Impact of AI assistance on student agency. *Computers and Education*, 210, Article 104967. <https://doi.org/10.1016/j.compedu.2023.104967>
- Das, A., Malaviya, S., & Singh, M. (2023). The Impact of AI-Driven Personalization on Learners' Performance. *Article in International Journal of Computer Sciences and Engineering*, 11(8), 15-22. https://www.ijcseonline.org/pdf_paper_view.php?paper_id=5603&3-IJCSE-09211.pdf
- Du Boulay, B. (2023). Artificial Intelligence in Education and Ethics. In O. Zawacki-Richter & I. Jung (Eds.), *Handbook of Open, Distance and Digital Education* (pp. 93-108). Springer. https://doi.org/10.1007/978-981-19-2080-6_6
- Ekundayo, T., Khan, Z., & Nuzhat, S. (2024). Evaluating the Influence of Artificial Intelligence on Scholarly Research: A Study Focused on Academics. *Human Behavior and Emerging Technologies* (Advance online publication). <https://doi.org/10.1155/2024/8713718>
- El-Sabagh, H. A. (2021). Adaptive e-learning environment based on learning styles and its impact on development students' engagement. *International Journal of Educational Technology in Higher Education*, 18(1), Article 53. <https://doi.org/10.1186/s41239-021-00289-4>
- Faisal, E. (2024). Unlock the potential for Saudi Arabian higher education: a systematic review of the benefits of ChatGPT. *Frontiers in Education*, 9, Article 1325601. <https://doi.org/10.3389/educ.2024.1325601>
- Foo, J. Y. A., & Wilson, S. J. (2012). An Analysis on the Research Ethics Cases Managed by the Committee on Publication Ethics (COPE) Between 1997 and 2010. *Science and Engineering Ethics*, 18(4), 621-631. <https://doi.org/10.1007/s11948-011-9273-3>
- Gligorea, I., Cioca, M., Oancea, R., Gorski, A. T., Gorski, H., & Tudorache, P. (2023). Adaptive Learning Using Artificial Intelligence in e-Learning: A Literature Review. *Education Sciences*, 13(12), Article 1216. <https://doi.org/10.3390/educsci13121216>
- Hamal, O., El Faddouli, N. E., Alaoui Harouni, M. H., & Lu, J. (2022). Artificial Intelligent in Education. *Sustainability*, 14(5), Article 2862. <https://doi.org/10.3390/su14052862>
- Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.
- Javaid, M., Haleem, A., Singh, R. P., Khan, S., & Khan, I. H. (2023). Unlocking the opportunities through ChatGPT Tool towards ameliorating the education system. *BenchCouncil Transactions on Benchmarks, Standards and Evaluations*, 3(2), Article 100115. <https://doi.org/10.1016/j.tbench.2023.100115>
- Kahale, L. A., Elkhoury, R., El Mikati, I., Pardo-Hernandez, H., Khamis, A. M., Schünemann, H. J., Haddaway, N. R., & Akl, E. A. (2021). PRISMA flow diagrams for living systematic reviews: a methodological survey and a proposal. *F1000Research*, 10, Article 192 <https://doi.org/10.12688/f1000research.51723.3>
- Kooli, C. (2023). Chatbots in Education and Research: A Critical Examination of Ethical Implications and Solutions. *Sustainability*, 15(7), Article 5614. <https://doi.org/10.3390/su15075614>
- Kulik, J. A., & Fletcher, J. D. (2016). Effectiveness of Intelligent Tutoring Systems: A Meta-Analytic Review. *Review of Educational Research*, 86(1), 42-78. <https://doi.org/10.3102/0034654315581420>
- Leleparry, H. L., Rachmawati, R., Zani, B. N., & Maharjan, K. (2023). GPT Chat: Opportunities and Challenges in the Learning Process of Arabic Language in Higher Education. *Journal International of Lingua and Technology*, 2(1), 10-22. <https://doi.org/10.55849/jiltech.v2i1.439>
- Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence Unleashed: An argument for AI in Education*. Pearson.
- Phair, D., & Warren, K. (2021). Saunders' Research Onion: Explained Simply. *Grad Coach*. <https://gradcoach.com/saunders-research-onion/>
- Qasem, F. (2023). ChatGPT in scientific and academic research: future fears and reassurances. *Library Hi Tech News*, 40(3), 30-32. <https://doi.org/10.1108/LHTN-03-2023-0043>

- Rethlefsen, M. L., & Page, M. J. (2022). PRISMA 2020 and PRISMA-S: common questions on tracking records and the flow diagram. *Journal of the Medical Library Association*, 110(2), 253-257. <https://doi.org/10.5195/jmla.2022.1449>
- Sabzalieva, E., & Valentini, A. (2023). *ChatGPT and Artificial Intelligence in higher education*. UNESCO International Institute for Higher Education in Latin America and the Caribbean. <https://educ.info/xmlui/handle/11515/38828>
- Saunders, M. N. K., Lewis, P., Thornhill, A., & Bristow, A. (2007). Understanding research philosophy and approaches to theory development. In M. N. K. Saunders, P. Lewis, & A. Thornhill (Eds.), *Research Methods for Business Students* (5th ed., pp. 160-204). Pearson.
- Schönberger, M. (2023). ChatGPT in higher education: the good, the bad, and the University. In J. Domenech, D. Menéndez Álvarez-Hevia, A. Martínez-Varea, R. M. Llácer-Iglesias, & D. Brunetto (Eds.), *International Conference on Higher Education Advances*, (pp. 331-338). Universitat Politècnica de València. <https://doi.org/10.4995/HEAd23.2023.16174>
- Shamsuddinova, S., Heryani, P., & Naval, M. A. (2024). Evolution to revolution: Critical exploration of educators' perceptions of the impact of Artificial Intelligence (AI) on the teaching and learning process in the GCC region. *International Journal of Educational Research*, 125, Article 102326. <https://doi.org/10.1016/j.ijer.2024.102326>
- Smith, J. P., III, DiSessa, A. A., & Roschelle, J. (1994). Misconceptions Reconceived: A Constructivist Analysis of Knowledge in Transition. *Journal of the Learning Sciences*, 3(2), 115-163. https://doi.org/10.1207/s15327809jls0302_1
- Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education*, 16(1), Article 39. <https://doi.org/10.1186/s41239-019-0171-0>
- Zhai, C., Wibowo, S., & Li, L. D. (2024). The effects of over-reliance on AI dialogue systems on students' cognitive abilities: a systematic review. *Smart Learning Environments*, 11(1), Article 28. <https://doi.org/10.1186/s40561-024-00316-7>

About the Contributor(s)

Dr. Tosin Ekundayo, Innovative Entrepreneurship Department, Synergy University Dubai
 Email: tosinekundayo@outlook.com
 ORCID ID: 0000-0002-8588-3783

Dr. Zafarullah Khan, Global Economy Department, Synergy University Dubai
 Email: zkhan_85@hotmail.com
 ORCID ID: 0000-0003-3438-8851

Shahid Ali Chaudhry, Information Technology Department, Synergy University Dubai
 Email: shahidali@synergydubai.ae
 ORCID: 0009-0005-2198-4648

Publisher's Note: Universitepark Limited remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.
