Systematic Review: AI's Impact on Higher Education - Learning, Teaching, and Career Opportunities

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Abstract – **AI is transforming many fields, including higher education. The pandemic has shown how AI can improve learning and teaching in higher education. This review examines how AI affects education quality, learning assessment, and higher education jobs (HE). The study employs a systematic qualitative method to review the academic literature on AI and higher education between 1900 and 2021. The data was gathered from various sources, including ERIC, Scopus, and the Web of Science, using specific exclusion and inclusion criteria centred on publication date, language, reported outcomes, setting, and publication type. From there on, the articles were analysed by Rayyan Software and categorised in Excel according to a scale that included aspects such as the quality of learning and teaching, assessment, and potential ethical future careers. The research also produced two bibliometric figures using VOSviewer to investigate co-authorship and the frequency of keyword occurrences in academic journals published in AI and HE. The analysis was done to ensure the study's validity in the scientific community.**

The study found that AI can improve education quality, provide practical learning and teaching methods, and improve assessments to better prepare students for careers. The study also emphasises the potential of AI to shape future employment opportunities and the need for higher education institutions to adopt AI to meet market demands. The study calls for more research on AI's effects on assessment, integrity, and higher education careers.

Keywords – **Artificial intelligence evaluation, future professions, higher education, influence.**

1. Introduction

Technology integration in education started with the first computers [41]. Since then, educators have utilised computers for various purposes, such as teaching, grading, and maintaining student databases, while students have used them for learning, research, and problem-solving. Artificial intelligence (AI) stands out as a noteworthy development among the various forms of technology integrated into education. Defined as a system in which machines mimic human behaviour and intelligence [52]. At the 1956 Dartmouth Artificial Intelligence Conference, leading scholars discussed abstracting content from sensory inputs, unpredictability, creative thinking, and "thinking machines". John McCarthy coined the term AI. Google Duplex, a phone chat assistant that makes reservations and appointments, and FaceApp, which uses AI to identify people in Facebook photos, make AI more common in our daily lives. Self-cleaning vacuum cleaners and educational apps like QuillBots, Grammarly, ChatGPT, and Word Tune also belong to AI. This systematic literature review examines AI's effects on higher education quality, learners' evaluation, teaching and learning ethics, and upcoming professions, which are crucial for development.

2. Literature review

This literature review examines the impact of artificial intelligence (AI) on higher education. It explores the potential benefits of integrating AI into education, such as improving education quality and introducing innovative teaching methods. However, it also highlights critical perspectives and ethical considerations. The review covers various aspects of AI's impact on education, including its effects on learning and teaching, assessment, future careers, and ethical implications. It emphasises the need for fair and ethical use of AI, evaluation of AI integration, and sustainable governance. The review acknowledges the challenges posed by AI in the fourth industrial revolution and calls for further research to fully understand and address the ethical implications of AI in education.

2.1. AI impacts on education quality

The AI amalgamation of learning and higher education has attracted growing interest and experimentation. While some argue that AI has the potential to improve education quality and provide 46critical perspectives should also be considered.

One concern is the potential for AI to reduce academic and teaching staff and the social implications of digitalisation in the economy [7]. Additionally, while some studies have found that AI can be used for proactive curriculum, student attention, and resource management [35], there are concerns about using AI for data processing and decision-making in education.

Furthermore, while using AI in e-learning through auto-grading via learning management system (LMS) platforms have been explored [35], it is essential to consider the ethical implications of relying on AI for grading and decision-making in education. There is also the risk that AI could perpetuate existing biases in the education system.

2.2. AI impacts learning and teaching in higher education

AI integration into education and higher education is gaining attention and experimentation. AI is believed to improve education and introduce new teaching and learning methods with other critical perspectives [23], [27].

Alyahyan [2] perceived student success as an institution's performance matrix. They investigated the role artificial intelligence plays in spotting students who are at risk and putting preventive measures in place to improve their academic standing. The findings demonstrated that AI effectively uses data mining and addresses students' concerns and requirements.

However, it is essential to note that using AI in this context raises ethical considerations, such as potential bias in identifying at-risk students and privacy concerns [2].

Vinichenko [50] used motivational AI to find the best ways to connect employee motivation and institutional incentives. Inspiration and stimulation differed, affecting innovation fulfilment. AI-based innovative systems were needed to meet 21st-century digital economy needs. However, it is essential to consider the potential repercussions of relying on AI for employee motivation and its ethical implications in this context [50].

Cox [14] highlights the long-term impact of AI and robotics on higher education, technically, pedagogically, and socially. Moridis [34] compiled several studies on online examination interference and found that algorithms and neural networks should complement one another for improved recognition mechanisms [14]. However, it is essential to consider the potential consequences of relying on AI for exams and the potential for AI-based systems to perpetuate existing biases.

Tashfeen [47] investigated how policymakers view the future of education, considering the ongoing disruption brought about by technological advancement. The research concluded that future scenarios that involve cooperative learning styles, such as active virtual learning, collaboration, and human-machine, produce more desirable outcomes for the education system's various stakeholders. However, considering the repercussions of relying on AI to deliver education and the possibility that AI will exacerbate existing educational disparities is of utmost importance [47].

While integrating AI into education is exciting, it is crucial to approach this topic critically and consider the potential consequences and ethical implications. It is essential to ensure that the educational use of artificial intelligence is fair and ethical and serves the best interests of students and teachers. Additionally, the studies discussed here did not include assessment as an integral component of education in their research, and it is vital to consider the role of evaluation in integrating AI into education.

2.3. AI impacts on assessment, future careers, and ethics in higher education

As online learning becomes more prevalent, there is a need for artificially intelligent (AI) teaching, deep learning, and teaching assistants. However, studies in the United States have yielded limited results due to a lack of comprehension of how students view AI assistants [28]. In addition, research has demonstrated that traditional teaching methods are insufficient for individualised education.

Hence, AI is the best data analysis and modelling alternative based on personalised education [55].

Using subjective and objective evaluations of Bolivian tutors and students, Sanjinis [43] created AI fuzzy logic evaluation approach and competencies. It found that the method was applicable across all educational levels. Similarly, Campos [10] used AI to validate the academic credits of higher education institutions, with the system meeting its objectives and effectively validating the academic credit analysis in 89.4% of cases. Additionally, Radović [40] emphasised the need for an effective curriculum and revised assessment procedures, highlighting the potential of AI-based automated assessment in medical education [40].

While the use of AI in education holds promise for innovative pedagogical practices, these studies could have been more comprehensive if they had evaluated AI in various qualitative and quantitative contexts. Furthermore, implementing AI in education requires a significant effort, a team of experts, and a time-consuming process for the generation of CIP assessment questions automatically.

As the global demand for artificial intelligence (AI) rises, sustainable, ethical governance must be implemented. Developed and developing nations have recognised the significance of implementing ethical AI usage guidelines and regulations. The General Data Protection Regulation was put into effect in 2018, for instance, by the European Union (GDPR). The United States of America issued an executive order concerning artificial intelligence, and The National Institute of Standards and Technology created trustworthy AI system technical regulations. The tech giants Google, Amazon, Microsoft, Alibaba, Baidu, and Tencent have all joined the community of tech companies that are concerned with AI ethics and governance [32].

The advancement of knowledge management, learning, teaching, and skill development are all areas that benefit tremendously from AI's applications. However, it is essential to note that as automation and the gig economy continue to shape the job market, the need for human and AI skills, adaptability, and resourcefulness will become increasingly important for success [23]. Studies such as those conducted by Gong [22] have examined the impact of AI on specific industries, in this case, radiology. This study found that 67.7% of respondents disagreed that AI would replace radiologists, while 29.3% agreed and 48.6% expressed concern about using AI in radiology [22].

The increasing prevalence of AI and digital technology can be considered part of the fourth industrial revolution, which poses significant challenges to social and labour structures.

This includes rising unemployment, an ageing population, and emerging industries in the employment market. Radical changes to educational systems, businesses, and work structures may be necessary to address these challenges. As automation continues to increase productivity and devalue salaries, employment may be replaced with career professionalism, and the economy of large corporations may replace the current one [32].

It is essential to acknowledge that the existing body of research on the ethical dimensions of AI remains limited, leaving significant gaps in our understanding of AI's broad educational and moral ramifications. Consequently, further scholarly investigations are imperative to comprehend AI's ethical implications better and formulate effective governance strategies accordingly.

3. Methodology

This systematic review seeks to synthesise and analyse the most recent academic literature published in the last few years on the influence of artificial intelligence (AI) on higher education. The research question was formulated using the PICOT framework, emphasising prognosis and forecasting: Will the deployment of AI in higher education affect the future of education? A systematic search strategy was employed using the Boolean AND operator and keyword combinations to ensure the inclusion of relevant literature. Conforming to the PRISMA criteria for a systematic review, the meta-analysis and systematic review were transparently and exhaustively reported [30]. In addition, a methodical qualitative approach was used to search for evidence from qualitative primary studies and conclusions [44]. The screening process for papers in the review followed a stringent protocol, including title processing, abstracts, and paper content. It was restricted to systematic research conducted following predefined criteria. The selected articles were exported to Rayyan Software for additional screening. Bibliometric analysis was performed using VOSviewer to generate co-authorship and keyword occurrence statistics for AI and higher education by country. The protocol was created to reduce bias, increase transparency and replicability, and demonstrate the study's viability [1].

3.1. Eligibility assessment

The researchers utilised Rayyan Software, a mobile and web application made available by Qatar University, to conduct a systematic literature review. This system allowed the researcher to maintain a torough screening.

The search resulted in the discovery of 509 articles, which were then imported into Endnote for evaluation against the inclusion and exclusion criteria established earlier. It was decided to look at fifty-six articles from Scopus, Web of Science, and ERIC. The researchers used thematic coding in Excel to identify the four primary areas of interest, which are as follows: the quality of education, learning and teaching, assessment, future careers, and the moral implications of AI in higher education. (Please refer to Figure 1 for any further information.)

3.2. Inclusion and exclusion criteria

The inclusion procedure constitutes the criteria for participation in this study: (1) during the first phase, 509 articles were located and imported into Endnote for screening according to the inclusion and exclusion criteria established beforehand. Articles must have been published between 1900 and 2021 in English-language academic journals; (2) the setting of the study must have been within higher education institutions and focused on artificial intelligence; and (3) the researchers must have determined that the results reported in the articles are consistent and appropriate. In addition, the limitations of the study's scope were connected to the humanities and other related disciplines, such as computer science. According to these criteria, the research did not include any sources that did not fall within the specified publication date range, did not report consistent results, were unrelated to higher education, or did not have an English translation. This paper has no interest conflict, does not involve any research linked with humans or animals, and adheres to the academic integrity protocol.
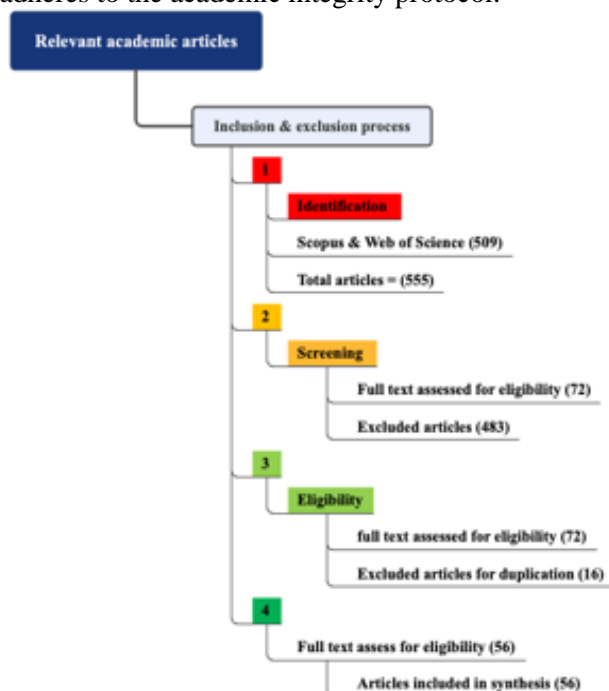

Figure 1. Inclusion and exclusion criteria

4. Findings

The final sample of 56 scientific articles used in this research offered evidence on various topics in higher education, such as the ethics of artificial intelligence (AI), learning and teaching, and potential future careers. The contents of the articles are summarised in Tables 1, 2, and 3, which include a list of references, country of origin, sample size, research design, and the most important findings. The findings of this study address four critical areas within the field of higher education: (1) AI impacts on educational quality, (2) AI impacts on the process of learning and teaching, (3) AI effects on assessment, and (4) AI effects on ethics and future careers in higher education.

The data analysed in this study were sourced from Scopus and visualised using VosViewer to investigate co-authorship patterns concerning AI and higher education country by country. This analysis revealed the presence of four main clusters, represented by the colours red, green, blue, and yellow, which comprise approximately 61 countries worldwide. This underscores AI's global significance in higher education, as depicted in Figure 2.
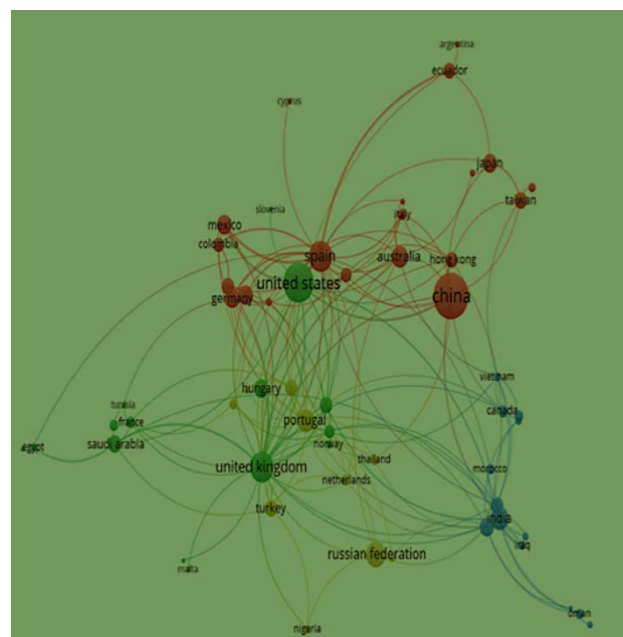
Figure 2. Co-authorship per country concerning AI & higher education (Source: VosViewer)

The significance of AI in higher education is further highlighted by Figure 3, which presents a network visualisation of keyword occurrences related to the topic. This analysis reveals the presence of eight main clusters of keywords associated with AI and higher education. These clusters demonstrate the breadth and depth of the field and its many interconnected subtopics.
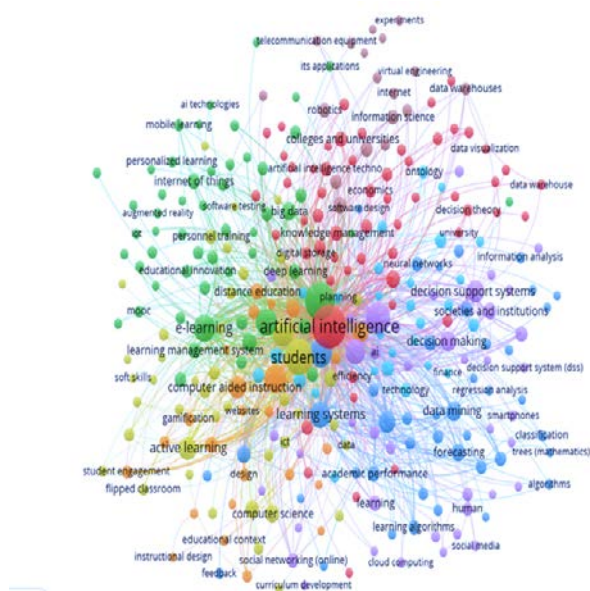
Figure 3. Network Visualisation of keywords occurrence concerning AI and higher education (Source: VosViewer)

The subsequent section provides an exhaustive examination of the notable findings derived from the study.

4.1. AI impact on education Quality

It has been discovered that artificial intelligence (AI) in education has a transformative effect on the quality of education. Studies have shown that AI can assist learners in better communication and connection to the world [9]. Integrating AI, IoT, and cloud technologies have been identified as advantageous for innovating and developing higher education curricula [31], [46]. Equally, using AI in education has reduced the need for academic personnel and the reinforcement of financially independent institutions.

It has also been discovered that AI can improve personalised education as well as the development of platforms for online learning [45]. In addition, it has been demonstrated that AI can improve learning management systems' functionality and anticipate learners' needs [57]. According to Bojorque [8], artificial intelligence can process structured and unstructured data, reducing the work management must do and accelerating the decision-making process.

In addition, artificial intelligence has improved creative problem-solving, effective time management, and interpersonal communication [29]. Furthermore, AI has been demonstrated to enhance the efficiency of strategic planning and learning and teaching [39]. Integrating AI into educational settings has also improved cognitive abilities, learning adaptability, and decision-making promptness [11].

According to Alyahyan [2], AI has improved the accuracy of predicting students at risk of failing and the speed with which data mining can occur.

In conclusion, studies have shown that AI has the potential to enhance education through advanced visualisation and early intervention [4; 18 and 49]. Integrating AI in creative instruction has positively impacted universities and colleges' academic reputation and citation index and prepared students for the future [50], as summarised below in Table 1.

Table 1. AI Impact on Education Quality

Findings	Research Design	Sample	Country	References
AI can be beneficial and efficient in higher education, potentially creating innovative educational guidance systems.	Systematic Review	Articles and conferences 2009-2019 (e-academic advising)	Saudi Arabia	[4]
AI can accurately identify at-risk students and alert stakeholders.	Experiment	Two undergraduate courses in 6 semesters	Spain	[5]
AI can improve the efficiency of e-learning systems and procedures and help learners become more self-sufficient.	Experiment	Latin American University: Information about the syllabus, grades, assessments, and online content	Latin America	[8]
AI can minimise academic workload, advance educational services, and ensure financial independence.	Forecasting Study	Academic years 2000/2001-2018/2019	Russia	[7]
AI can allow students to communicate more effectively and feel more connected to the rest of the world.	Foresight Study	Two scenarios	USA	[9]
AI can facilitate decision-making, resilience, intelligent process, automation, grading, feedback, and identifying at-risk students.	Systematic Review	30 articles	China	[12]

Findings	Research Design	Sample	Country	References
AI can generate broader questions related to higher skills instruction, staff job rethinking, and people agency, among other things.	Systematic Study	200 fictions	UK	[14]
AI can facilitate the quality control of educational planning, student support, and decision monitoring via advanced visualisation and early intervention.	Experiment	A large volume of data	Saudi Arabia	[18]
AI can monitor educational planning, academic counselling, and decision quality using advanced visualisation and early intervention.	Experiment	1600 respondents aged 18-54	Russia	[29]
AI can improve problem-solving, creativity, and time management. Cloud computing, big data, and the internet are digital transformation technologies for higher education institutions.	Qualitative Study	168 respondents	Kosovo	[31]
AI can improve innovation, problem-solving, and organisational skills. Internet, cloud, and big data are needed to digitise higher education.	Experiment	Black Box Society.	South Africa	[39]
AI can accurately predict student dropouts at 68-77%.	Experimental Study	3552 students	Taiwan	[49]
AI can enable accurate risk prediction for students and efficient data mining.	Systematic Review	Articles from 2015-2020	Turkey	[2]
AI can develop LMS systems and anticipate the needs of the learner.	Experiment	1116 students	Nigeria	[57]

4.2. AI influence on teaching and learning in higher education

Much research has been conducted on the application of AI in educational settings, and the findings continue to point to the significant role this technology plays in enhancing many facets of the teaching and studying process.

Several studies, such as those conducted by [3], [15], [19], [24], [25], [36], [47], [48], [49], [52], [53], [60], have highlighted the benefits of AI in areas such as recognition mechanisms, tutoring, emotional awareness, language teaching, personal and group skills development, and cognitive learning process measurement.

However, it is essential to note that while AI can significantly enhance the education and training process, there are concerns about its limitations and potential biases. Bhalla [6] highlights the importance of incorporating empathy through reasoning in AI to reduce bias and provide more comprehensive feedback input and solutions. Furthermore, [17], [37], [42], [56], [58] have highlighted the importance of ongoing research and development. They added that AI could continue to adapt and improve in response to the rapidly changing technology and digital landscape.

Table 2. AI influence on teaching and learning in higher education.

Findings	Research Design	Sample	Country	References
AI improves engaged and organisational learning, enhancing learning quality	Mixed methods	11 professors	Spain	[3]
AI incorporates empathy to reduce bias, provide feedback, and offer solutions	Case study	153 students	UK	[6]
AI enhances language teaching techniques and reveals teaching effectiveness	Experiment	Not given	Singapore	[15]
AI facilitates multiscale brain mapping and uncovers neural activity patterns such as cognition, feeling conception, and action	Experiment	Six projects	China	[17]

AI measures the cognitive learning process and provides timely, constructive feedback through neuro-lecturing	Experiment	200 students	UK	[19]	Integrating AI into higher education helps students prepare for future careers	Experiment	Universities in South Africa	South Africa	[51]
AI fosters emotional awareness for efficient learning	Empirical study	Three universities	Canada	[24]	AI is essential in higher education for preparing students for the future	Case study	Ten projects	England	[53]
AI increases the effectiveness of learning and teaching through confidence, change, and control models	Case study	Series of case studies	USA	[25]	AI enhances the learning experience through dynamic interaction between robots and students, practical design, and interactive responsiveness	Systematic review	150 articles	China	[56]
AI links brain programs and neuroscience experiments for subversive machine learning models	Experiment-Bayesian Networks	Not given	USA	[33]	AI collaboratively modifies teaching methods based on job requirements	Experiment	Chongqing Three Gorges College students	China	[58]
Algorithms and balanced works help effective mechanisms and instruction	Experiment	153 students	Macedonia	[34]	AI collaboratively modifies instructional methods based on job specifications	Experiment	Five educational theoretical approaches	Spain	[60]
Higher education aims to develop, design, and implement digital skills and language	Experiment	543 Purposes and Representations	Peru	[36]					
Educational institutions foster AI-based innovation to adapt to the impact of AI on learning	Desk research study	7 case studies	Nigeria	[37]					
5G and automation individualise higher education for increased efficiency and quality	Case study	Review of 6 surveys	Jamaica	[47]					
AI generates novel learning channels through reasoning-based learning theories and extensive networks	Experiment	800,000 training sets	South Korea	[42]					

4.3. AI impacts on assessment, future careers, and ethics in higher education

Whereas AI is used in higher education (HE) assessments and has positive effects, it is essential to note that there are also limitations and potential concerns to consider. Sanjinis [43] demonstrate how AI affects assessments by highlighting the validity of AI in reviews at various levels. Still, it is crucial to consider the potential biases that may be present in these AI-assisted reviews. Similarly, Campos [10] conclude that AI efficiently validates academic credit by 89.4%, but it is vital to consider the potential for errors and inaccuracies in this process.

Deo [16] say AI has effectively analysed assessment variables and strengthened interventions for improved graduate characteristics. Nevertheless, it is essential to consider the ethical implications of employing AI in this manner and to check that the AI is not reinforcing any preexisting biases. Additionally, even though the findings show that AI enables multilingual domains and generates comprehensive, interactive evaluations, it is vital to consider the potential for AI to perpetuate language biases and the need for diverse perspectives in the development and implementation of AI in education.

That is why the findings demonstrate that AI enables multilingual domains. Additionally, AI generates comprehensive, interactive evaluations.

In conclusion, while AI can enhance assessments greatly, it is crucial to critically examine its limitations and potential biases and ensure that diverse perspectives are considered in its development and implementation.

While the findings of Pana [38] indicate the importance of moral systems in AI, it is crucial to critically examine the proposed solutions of endowing AI with "spirit and conscious" through technical, theoretical, and psychological supplements. Wu [54] argue that guiding AI with ethics and principles will automatically ensure that it serves the interests of all societal groups. However, this assumption should be critically evaluated. The potential negative consequences of AI and robotics on specific professions, such as librarianship and radiology, as highlighted by [22], [59], should also be considered. Additionally, the potential biases in predicting future careers for learners should be critically evaluated, as Garcia [21],[20] pointed out. Therefore, it is essential to critically assess the potential societal, geographical, and government-level implications of AI's rapid changes in the quality and quantity of work, as stated by [13].

Table 1. AI impacts on assessment, future careers, and ethics in higher education

Findings	Research Design	Sample	Country	References
AI impacts evaluations in higher education at various levels.	Experiment	Educational institutions in Bolivia	Bolivia	[43]
AI is accurate in validating academic credits at a level of 89.4%.	Experiment	Two users	Brazil	[10]
AI analyses assessment variables and reinforces the intervention to improve graduate characteristics.	Experiment	4200 students	Australia	[16]
AI will revolutionise the workplace. It is difficult to predict how much AI will threaten jobs.	Empirical study	100 reports and studies	UK	[13]
AI helps predict learners' future careers.	Case study	3000 students	Spain	[21]
(67.7%) believe that AI reduces the need for radiologists, while (29.3%) believe that AI will eventually replace them.	Quantitative study	17 medical schools	Canada	[22]
Machine ethics will be of the highest quality, derived from technical research and simulated using methodologies.	Experiment	Nine intelligent agents	Romania	[38]
To benefit societies, businesses, institutions, and individuals worldwide, AI must be guided by ethics and values.	Quantitative study	Ethical Guidelines and AI Principles in China	China	[54]
AI must be guided ethically to ensure that AI benefits societies, businesses, institutions, and individuals worldwide.	Experiment	More 1.000.000 articles	Turkey	[59]

5. Conclusion

This study undertook a comprehensive evaluation of the influence of artificial intelligence (AI) on higher education, with a particular focus on critical aspects such as educational quality, learning and teaching processes, assessment methods, ethical implications, and prospective career opportunities [10], [23], [40], [43]. The analysis findings highlight a growing body of research that underscores the significance of AI in higher education and the potential advantages associated with its integration into the educational framework. This conclusion was derived after conducting the review. Nevertheless, it is crucial to acknowledge the potential negative consequences and biases that may arise from implementing AI within the educational system.

The study also identified significant gaps in the existing research. In particular, many studies generally focus on AI and higher education without investigating specific areas of learning, teaching, assessment, and quality that could help learners and educators. Additionally, there is a lack of studies on using AI in review, ethics, and future careers for students. These gaps in the literature highlight the need for more research in these areas.

Despite these gaps, the study revealed that AI research by [7], [26], [27], [55] facilitates the development of engaging learning methods. Besides, AI has assisted higher institutions in dealing with big data, retaining students, preparing learners for the future job market, and providing the necessary skills for the fourth industrial revolution [35]. This finding lends credence to previous research findings and exemplifies AI's importance in enhancing educational standards. On the other hand, additional research has been suggested to focus on how AI affects the assessments students take, their education, and future jobs.

The latter will contribute to a better understanding of the full impact that AI will have on higher education and will inform the development of AI-based educational systems that are more effective and ethical.

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