The impact of AI implementation in higher education on educational process future: A systematic review

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Systematic Review

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Abstract

Artificial intelligence (AI) has been playing a vital role in all life domains. A striking example is AI effective revolution in health and educational services during the COVID-19 pandemic. Therefore, this systematic literature review investigates how AI impacts higher education (HE) by focusing on its impact on education quality, the learning and teaching process, assessments, and future careers. This review uses a systematic qualitative research method. The data is collected in a systematic review of academic articles on AI impact on HE from 1900 to 2021 from the Web of Science, Scopus, and ERIC. The process went through a systematic inclusion and exclusion procedure based on date, language, reported outcomes, setting and type of publications. Articles selected were screened via Rayyan Software and coded using excel based on the following themes: education quality, learning and teaching, assessments, future careers, and ethics. The total number of articles included is 56. The results vindicate that AI plays an efficient role in providing better education quality services, practical learning/teaching, and assessments approach for a better future career. Likewise, AI impacts future employment, which entails that HE institutions should incorporate more AI to have better graduates that meet the future market requirements. However, studies on AI impact assessments, ethics and future careers are limited and require further investigation.

1. Introduction

We now live in an artificial intelligence era (AI). The impact of artificial intelligence (AI) on education and higher education is a hot issue of discussion and experimentation. AI is affecting education/higher education, which requires a concise description of skills universities must educate students to prepare them for an AI future of work (Grace Ufuk, 2020). Artificial intelligence has resulted in novel teaching and learning solutions that have been tested in various settings. Apart from its impact on education, AI significantly impacts labour markets, industrial services, agricultural processes, values chains, and the workplace (Kelly, 2021). AI in playing adopting virtual intelligence by most educational systems worldwide and basically by higher institutions during the pandemic (Senel & Can, 2021).

Current studies indicate that AI is vital in education quality. Equally, Khare and Stewart (2018) believe that AI positively impacts students from a life-cycle perspective using chatbots to support learners and provide better services. AI is also used in auto-grading, constructive feedback, and academic advising (Khare & Stewart, 2018). A Russian study highlighted educational services perspectives diversifying AI, the fourth revolution, and the social consequences of digitalisation markets. Results revealed that AI stimulates academic and teaching staff reduction. Meanwhile, the economy's digitalisation leads to new education services as entrepreneurship, financially independent institutions, and AI trained staff (Bogoviz et al., 2019).

An analogous Ecuadorian study on how universities gather information about students and predict academic outcomes for proactive curricula, students' attention, and resources management. This study was based on neural networks and AI to parametrise perception. The results revealed the significance of AI in processing the socio-economic data (García-Vélez et al., 2019). Evenly AI was used in the scientific literature in higher education via a study that used Web of Science and Scopus databases from 2007 to 2017 via a bibliometric approach. Results revealed an interest in the subject's literature (Hinojo-Lhavana, Aznar-Díaz, Cáceres-Reche, & Romero-Rodríguez, 2019). Correspondingly, Muniasamy and Alasiry (2020) argue that deep learning and AI impact e-learning in auto-grading via LMS platforms. The authors applied deep learning in developing e-learning sources and platforms using predictions, algorithms, and analysis. Results revealed that deep understanding plays a significant role in creating platforms and shaping the future of e-learning (Muniasamy & Alasiry, 2020).

Likewise, Alyahyan and Düşteğör (2020) consider students success as institutions' performance matrices. Therefore, they investigated AI's role in predicting at-risk students and taking preventive measures for better performance. Results revealed AI efficiency in mining data, addressing issues and students' needs. Consequently, AI-supported academicians and institutions decide to bring all potentials of success (Alyahyan & Düşteğör, 2020). Equally, Vinichenko, Melnichuk and Karácsny, (2020) studied the most efficient technologies to bridge employee motivation and institutions' incentives using motivational AI. The study investigated academic motives and the university stimulating effect connection. Findings revealed a discrepancy between motivation and stimulation, which has impacted innovation fulfilment. These gaps required applying innovative systems based on AI to meet the digital economy's requirements of the 21st century. The use of AI improved the staff creative competitiveness and impacted citation index and academic reputation. AI brought advanced solutions to the emerging problems by motivating staff, reducing the imbalance in staff motives and university incentives, and increasing staff publication and grants (Vinichenko et al., 2020).

Finally, AI and robotics are having a long-term impact on HE. These impacts are technical and pedagogical as well as social (Cox, 2021). Equally, Moridis and Economides (2009) combined various evidence on online assessment interference. A formula-based method was implemented in three European regions to predict 153 students' moods via data emanated experiments. Findings vindicated to a high level the assumptions of the formula-based method about students' moods. Evenly, results showed that algorithms and neural networks should complement each other for better recognition mechanisms. Equivalently, neural networks can replace tutoring systems that affect recognition methods (Moridis & Economides, 2009).

The taxonomy expanded upon D'Mello and Graesser (2015) dichotomy of emotion-aware systems to guide a system that can foster positive emotions along the learning process via different approaches, design features and data sources. Comparably, Kaplan and Haenlein (2019) define AI as the system's ability to interpret, learn and apply data to achieve defined goals and tasks via a flexible application. The study analysed how AI differs from the internet of things and big data. Thus, it suggested looking at AI via evolutionary stages such as narrow and general AI or focusing on other systems such as human-inspired and humanised scholars. Results presented a framework that helps an organisation consider AI's internal and external implications in three labels C-model: confidence, change and control (Kaplan & Haenlein, 2019).

Consonantly, Tashfeen (2019) explored how policymakers see education future within the continuing technology disruption. Thus, two learning alternatives were developed a vignette approach of the emerging technologies and space scenarios framework. Findings revealed that future scenarios involving

cooperative styles like human machines cooperation and active virtual learning produce more desirable benefits for education stakeholders. Implementing AI, 5G and automation will customise HE delivery and work landscape (Tashfeen, 2019).

Online learning increases demand, artificially intelligent teaching, machine learning, and teaching assistants experimented with AI teaching assistance in the USA without knowing how learners perceive AI assistants. Findings indicated AI teaching assistant efficiency, communication ease, and AI teaching assistant's eventual adoption. The researchers recommend using teacher assistants and further investigations to understand better the nuances of AI teaching assistants' learning and teaching (Kim, Merrill, Xu, & Sellnow, 2020).

Moreover, Xiao and Yi (2020) investigated AI's efficiency in HE teaching and education's remarkable regularity of individual subjects. The study suggested personalised education that considers learners' desires and societal development needs. Evenly affirm the inefficiency of traditional teaching methods in fulfilling individualised learning. Therefore, AI is the best alternative to achieving personalised learning via data analysis and modelling methods. Thus, AI predicts and tracks students' performance based on individualised training (Xiao & Yi, 2020).

GNS, Sanjinis and Nardo (2012) developed AI fuzzy logic assessment methods and competencies using Bolivia's subjective and objective tutor and tutee features. Findings indicate the method's usefulness at all education levels (GNS et al., 2012). Comparably, Camps et al. (2016) argue that HE activities human-like system applications of knowledge to analyse academic credits and validate them for students from other institutions. Thus, an AI system was created to validate higher institutions' academic credits. The approach followed elicitation, modelling and construction of knowledge base. The findings indicate that the system achieved the goal and acted as an efficient tool validating academic credits analysis to a level of 89.4% (Campos et al., 2016).

Likewise, Radović, Petrović and Tošić (2020) highlighted the requirements of an efficient curriculum along with an improved and renewed assessment method. The Comprehensive Integrative Puzzle (CIP) is one of the promising emerging practices. However, it requires high efforts, a team of experts, a native representative of the English language, and a time-consuming approach that presents an automatic generation of CIP assessments questions. Findings indicate that the adoption of ontological knowledge representation enables multilingual education domains. Medical education automation is one of the most challenging fields in the CIP. However, automation promises innovative teaching methods in all educational domains (Radović et al., 2020).

Correspondingly, sustainable AI requires ethical governance in increasing worldwide demand. China has enhanced AI technologies and published AI ethical guidelines and principles to benefit societies, companies, states, and research organisations by stressing: privacy, security, safety, reliability, accountability, transparency, and fairness. Equally, the Economic countries released AI ethical guidelines and governance regulations. In 2018, the EU announced the General Data Protection Regulation (GDPR). Equally, the White House issued AI executive order to maintain American leadership. The National Institute of Standards and Technology developed technical regulations for reliable, robust and trustworthy AI systems. Equivalently, the United Nations promised to promote AI ethics and called for an AI conference in 2019 stressing AI links with human values. Finally, Google, Amazon, Microsoft, Alibaba, Baidu and Tencent got involved in AI ethics and governance (Bozkurt et al., 2021).

AI is vital in knowledge management, learning, teaching and skills development. Thus, AI is needed along with human skills as it is a requirement of the future workforce. Automation and the gig economy radically change job descriptions and work methods, making human and AI skills, adaptability, and resourcefulness key to success (Taneri, 2020). Gong et al. (2019) highlighted the potential of AI in transforming radiology and clinical practices. The study targeted Canadian medical students and their perception of AI's influence on their radiology majors' performance. Findings revealed that most 67.7% disagree that AI would replace radiologists, in contrast with a minority of (29.3%) who agreed that AI would replace radiologists in the future. Additionally, 48.6% were anxious considering AI in radiology. The radiology community was interested in expert opinions on AI and suggested that medical students educate about AI's possible impact on radiology (Gong et al., 2019a).

Likewise, Llorente (2020) stresses the various revolutions from engine steam to electricity and assembly lines, moving to the computer in 1960 and the fourth revolution. The fourth revolution involves AI, digital technology, globalisation and hyperconnectivity (G5). This revolution requires radical lifestyle changes and the workplace. The social labour situation faces significant difficulties such as increasing unemployment, the ageing society, the emergence of new leading sectors in the job market, exponential technology development, the excessive use of robotisation and globalisation of the market. Consequently, radical changes require new educational systems, companies and work organisations. Results indicate automation will increase productivity, devalue salaries and eradicate tasks. E-workers will have different ambitions than the current ones. The concept of jobs will be replaced by career professionalism. The big corporate economy will replace the current one (Llorente, 2020). Finally, this systematic review investigates how artificial intelligence affects higher education and studies the impacts of AI on education quality, the learning and teaching process and future careers.

2. Methodology

This review is a rigorous approach synthesising and amalgamating the most recent academic papers on AI's impact on HE since 121 years. The research question was formulated based on PICOT (patient/population; intervention/indicator, compare/control; outcome; and time/type of study or question) focusing on prognosis/prediction question: Does AI implementation in higher education impact the educational process in the future? The final search equation was defined using the Boolean connector "AND", and the keyword combinations were made, ensuring one keyword for each search category (Artificial intelligence, impact, higher education). The review followed the PRISMA checklist for a systematic review, ensuring transparency and entirely reporting metanalysis and systematic review (Liberati et al., 2009). The review also used a systematic qualitative method to systematically search for evidence from primary qualitative studies and draw the findings (Seers, 2015).

The preliminary process started with titles processing. Suppose the title is related to the scope of AI and HE. In that case, the article is selected and exported to Rayyan Software, including author, year, title and abstract for further screening. Data collected is secondary via desk research focusing only on academic articles relevant to the abovementioned topic and processed via the reference management App Mendeley. The limited researcher investigation to the Web of

Science, Scopus, and ERIC across various disciplines ensures reliability and validity. The researcher created a research protocol made of five features: (1) date, (2) language, (3) reported outcomes, (4) setting and (5) type of publication. The protocol used transparent criteria of inclusion and exclusion to shortlist articles researched. The researcher screened articles via Rayyan Software. The protocol was to minimise bias, ensure transparency, replicability, and as an indicator of feasibility (Choi et al., 2019).

Eligibility assessment

To ensure the adequacy of screening, the researcher used Rayyan Software, a free mobile and web app for systematic literature review provided by the University of Qatar. A total of 509 articles was found in the first stage and exported via Endnote for screening following the designed inclusion/exclusion criteria. Therefore, the total number of included articles is 56 from Scopus, Web of Science and ERIC. The researcher thematically coded the articles via Excel. Consequently, four major areas were highlighted, education quality, learning and teaching, assessment, future career, and AI ethics in higher education. (For further details, see figure 1)

Inclusion and exclusion criteria

The article's inclusion used the following criteria: 1900 to 2021, language limited to English only, and publication types were limited to academic articles. The setting was only linked to higher education institutions and AI. The review also was limited to only consistent, appropriate outcomes (The University of Melbourne, 2021). Overall, the study's scope focused on Human Science and disciplines like Computer Science. The exclusion criteria were as follows: exclude sources not written between 1900 and 2021, sources written in other languages than English, sources with inconsistent outcomes, sources not linked to higher education.

3. Findings

The final selection included 56 scientific articles that provided evidence regarding the educational quality, Learning and teaching, and AI ethics in higher education and Future Careers in Higher education. Table 1 summarises the information on the articles: reference, country, sample, research design, Key findings.

Table 1: Summary of significant findings

References	Country	Sample	Research design	Key findings
Impact on the Educational quality				
(Assiri et al., 2020)	Saudi Arabia	Articles and conferences 2009-2019 (e-academic advising)	Systematic literature review	The application of AI is both practical and efficient. Adopting a multitasking system necessitates the develop ground-breaking academic advice systems.
(Bañeres et al., 2020)	Spain	2 undergraduate courses in 6 semesters	Experimental research	AI provides early warnings to help stakeholders and at-risk situations. When it comes to spotting at-risk students, AI is more effective than human advisors.
(Bojórque & Pesántez-Avilés, 2020)	Latin America	Information about syllabus, grades, assessments, and online content from a Latin American University	Experimental research	AI enhances individualized learning and helps to design e-learning platforms.
(Bogoviz et al., 2019)	Russia	Academic years 2000/2001-2018/2019.	Forecasting method	AI minimizes academic staff, expands educational services, and ensures financial independence.
(Breaux, 2017).	U SA	2 scenarios	"Framework Foresight" method	AI enables students to communicate more effectively and to feel more connected to the rest of the world.
(Chen et al., 2020)	China	30 articles	Systematic review	Artificial intelligence helps with decision-making, adaptability, cognitive capacities, grading, feedback, and learning.
(Cox, 2021)	UK	200 fictions	Systematic review	AI sparks a broader debate by posing questions such as how it might be used to teach higher-order skills and the nature of datafication.
(Fayoumi & Hajjar, 2020)	Saudi Arabia	A large volume of data	Experimental method	AI enables quality assurance of planning, academic advising and monitoring the educational decisions.
((Korepin et al., 2020)	Russia	1600 respondents aged 18-54	Experimental method	AI enhances Problem-solving, creativity, and time management. Higher education institutions' essential big data, and the internet.
(Limani et al., 2019)	Kosovo	168 respondents	Qualitative method	AI, the internet of things, and cloud computing are the most critical digital transformation technologies.
(Bogoviz et al., 2019)	Russia	1000 students & academic staff	Forecasting method	AI reduces academic staff, brings new education services such as entrepreneurship and establishes its own.
(Prinsloo, 2020).	South Africa	Black Box Society. list of articles here: https://journals.sagepub.com/page/bds/collections/revisitingtheblackboxsociety	Experimental method	AI aids strategic planning and successful learning and teaching. As a result, AI provides timely, accurate intervention.
(Sekeroglu et al., 2019)	Portugal	1,044 Students	Experimental method	AI enhances individualized learning and helps to design e-learning platforms.
(Tamlä et al., 2019)	Germany	23.046 final thesis titles (1999-2016)	Statistical method:	AI, the internet of things, and Cloud technologies are promising in developing and innovating HE curriculum.
(Tsai et al., 2020)	Taiwan	3552 students	Experimental method	With a rate of 68 to 77 per cent, AI accuracy forecasted if students would drop out.
(Alyahyan & Düşteğör, 2020)	Turkey	Articles from 2015-2020	Systematic review	AI helps predict-risk students and efficiently perform data mining.
(Yakubu et al., 2020)	Nigeria	1116 students	Experimental method:	AI develops LMS systems and predicts the learner needs.
Impact on the learning and teaching process				
(Aparicio et al., 2018)	Spain	11 professors	Mixed-methods	AI boosts active and executive learning, which enhances the learning quality.
(Bhalla, 2019)	Uk	153 students	Case study	AI integrates empathy via thinking to reduce bias, provide feedback, input, and solutions.
(CY & Chunyan, 2017)	Singapore	Not given	Experimental method	AI developed language teaching skills and revealed an English teaching efficiency.
(Fan et al., 2020)	China	6 projects	Experimental: Brain-imaging technology	AI helps to map the brain at multiple scales and explore how neural activity patterns transform into cognitive functions.
(Gamez, 2019)	UK	200 students	Experimental method	AI via neuro-lecturing measures students cognitive learning process and reacts timely, providing consistent feedback.
(Harley et al., 2017)	Canada	3 Universities	Empirical method	AI helps develop emotional awareness for an efficient learning process.
(Kaplan & Haenlein, 2019)	USA	Series of case studies	Case study	AI entails three C-model to confidence, change, and control. Therefore, it enhances learning and teaching.
(Loftus & Madden, 2020).	USA	Not given	Experimental method via Bayesian Networks	AI connects brain programs and investigates neuroscience experiments for subversive working model: perception.
(Moridis & Economides, 2009)	Macedonia	153 students	Experimental method	Algorithm and neural works are helpful for mechanisms and efficient tutoring.
(Ocaña-Fernandez et al., 2019)	Peru	543 Purposes and Representations	Experimental study	Universities face a significant problem in developing, designing, and implementing digital skills and innovation.
(Olusoji Ilori and Ajagunna (2020)	Nigeria	7 case studies	Desk research method	AI has a significant impact on how people learn. Educational institutions will serve as incubators for AI-based innovation.
(Tashfeen, 2019)	Jamaica	Review of 6 surveys	Case study	5G and automation customise and personalise higher education for better productivity and quality.
(W. H. Kim & Kim, 2020).	South Korea	800,000 training sets were collected from a commercialized mobile application teaching the Korean language.	Experimental method	AI creates novel learning channels by adopting reasoning learning theories via in-depth networks.
(Waghid et al., 2019)	South Africa	Universities in South Africa (Number not given)	Experimental method	Incorporating artificial intelligence (AI) into all higher education institutions prepares students for the future.
(Williams, 1992)	England	10 projects	Case study	AI is vital for higher education as it prepares the learner for future life.
(Xu and Yu, 2020).	China	150 articles	Systematic review	AI creates a motivating relationship between robots and students for higher learning through practical experience.
(Yang et al., 2020)	China	Chongqing Three Gorges College students	Experimental method	AI tailors teaching methods according to job requirements collaboratively.

(Zapata-Ros, 2018).	Spain	5 educational theoretical approaches	Experimental method	AI develops personal and group skills efficiently and adequately
(Zawacki-Richter et al., 2019)	Germany	146 articles	Systematic review.	AI improves administrative services, prediction/profiling, assessment, personalised adaptive systems
Impact on assessments				
(GNS et al., 2012)	Bolivia	Educational institutions in Bolivia 2012	Experimental method	AI impacts HE assessments at various levels.
(Campos et al., 2016)	Brazil	2 users	Experimental method	AI is efficient in validating academic credits by a level of 89.4%.
(Deo et al., 2020).	Australia	4200 students	Experimental method	AI is efficient in analysing assessments variables and reinforcing intervention for better graduate attr
Ethics and Future Careers in higher education				
Clifton et al. (2020)	UK	100 reports and studies	Empirical method	AI will revolutionize the workplace. It is tough to say how much AI will threaten jobs.
(García-Peñalvo et al., 2018)	Spain	3000 students	A case study	AI helps predict learners' future careers.
(Gong et al., 2019b)	Canada	17 medical schools	Quantitative method	(67.7%) think that AI reduces the need for radiologists, whereas (29.3%) believe that AI will eventua
(Pana, 2006)	Romania	9 intelligent agents	Experimental method	Machine ethics can/will be of incredible quality because it will be developed from technical research a
(Wu et al., 2020)	China	Ethical guidelines and AI principles in China	Quantitative study	Ethics and values must guide AI to ensure that it is helpful to societies, businesses, institutions, and
(Yıldırım & Yıldız, 2018)	Turkey	More than a million articles	Experimental method	AI and robotics will impact some professions, such as librarianship and radiology

Findings address four crucial topics as summarised in the above table (1) Impact on the Education quality, (2) Impact on the learning and teaching process, and (3) Impact on assessments, and (4) Impact on ethics and future careers in higher education. The following part is a deep analysis of the significant results found.

Impact on the Education quality

Findings indicate that AI transforms education quality: AI helps learners communicate better and connect to the world (Breaux, 2017). The internet of things, Cloud technologies and AI, are promising in developing and innovating HE curricula (Tamla et al., 2019; Limani et al., 2019). AI reduces academic staff and brings new education services such as entrepreneurship and AI training for financially independent institutions (Ogoviz et al., 2019). Besides, AI improves personalised education and develops e-learning platforms (Sekeroglu et al., 2019). AI develops LMS systems and predicts the learner needs (Yakubu et al., 2020). Likewise, AI processes structured and unstructured data to reduce management workload and speeds decision-making (Bojorque & Pesántez-Avilés, 2020). Equally, AI enhances problem-solving, creativity, time management and communication (Korepin et al., 2020). AI reinforces strategic planning and effective learning and teaching. Therefore, AI provides speedy, accessible data and intelligent analysis that leads to proper intervention at the right time (Prinsloo, 2020). AI boosts cognitive abilities, learning adaptability and timely decision making. AI enables instructors to take multiple actions simultaneously: grading, giving feedback and detecting at-risk students (Chen et al., 2020). Constantly, AI helps predict-risk students and efficiently perform data mining (Yahyan and Düştegör, 2020). Therefore, (Fayoumi and Hajjar, 2020; Tsai et al., 2020; Assiri, Al-Ghamdi and Brdese, 2020 and Bañeres et al., 2020) (the educationally advanced visualisation and early interventions. Briefly, AI improves creative teaching, impacts HE institutions' academic reputation and citation index, prepares learners for future life (Vinichenko et al., 2020).

Impact on the learning and teaching process

Results revealed a vital need for AI in teaching and learning (Williams, 1992). Moridis and Economides (2009) recommended using algorithms and neutral works for better recognition mechanisms and efficient tutoring. Likewise, Harley et al. (2017) found that AI helps develop emotional awareness for efficient learning. Equally, AI developed language teaching skills and revealed an English teaching efficiency (CY & Chunyan, 2017). Results show that AI boosts active and executive learning (Aparicio et al., 2018). Similarly, findings vindicate that AI develops personal and group skills efficiently and adequately (Zapata-Ros, 2018).

Additionally, according to Kaplan and Haenlein (2019), AI entails three C-models: confidence, change, and control. Therefore, it enhances learning and teaching efficiency. Besides, AI via neuro-lecturing measures students cognitive learning process and reacts timely, providing constructive feedback (Gamez, 2019). Alike (Waghid, Waghid and Waghid, 2019; Ocaña-Fernandez, Valenzuela-Fernandez and Garro-Aburto, 2019) found that AI integration into all higher institutions prepares learners for their future careers. Similarly, Tashfeen (2021) found that 5G and automation customise and personalise HE. While Bhalla (2019) insists that AI integrates empathy via thinking to reduce bias, provide feedback, input, and solutions.

Furthermore, findings justify that AI efficiently enhances four domains: admin services, prediction and profiling, assessment and personalised adaptive systems, equally intelligent tutoring (Zawacki-Richter et al., 2019). Meanwhile, AI collaboratively tailors teaching methods according to job requirements (Yang et al., 2020). Consonantly, AI supports students and teachers to work together in a praxis approach to explore the world around them (Loftus & Madden, 2020). Analogously, AI connects bran programs and investigates neuroscience experiments for subversive working models applying machine thinking, decision-making, and perception (Fan et al., 2020). Equivalently, AI creates a motivational relationship between robots and students for better learning through practical design and interactive reactions and teacher assistants (Xu and Yu, 2020). AI creates novel learning channels by adopting reasoning learning theories via in-

depth networks (W. H. Kim & Kim, 2020). Finally, findings indicate the need for a dynamic, rapid learning and teaching process parallel with technological and digital advances (Olusoji Ilori & Ajagunna, 2020).

Impact on assessments

AI impacts HE assessments by revealing the importance of AI in assessments and at different levels (GNS et al., 2012). Camps et al. (2016) concludes that AI is efficient in validating academic credits by a level of 89.4%. Evenly, outcomes vindicate that AI has proven its efficiency in analysing assessments variables and reinforcing intervention for better graduate attributes (Deo et al., 2020). Finally, results pinpoint that AI enables multilingual domains and generates comprehensive, interactive assessments.

Impact on Ethics and Future Careers in higher education

Results reveal a crucial need for moral systems. Therefore, efficient technical, theoretical and psychological supplements must reinforce AI with spirit and conscience (Pana, 2006). Additionally, AI must be guided by ethics and principles to ensure that it is beneficial for societies, companies, institutions and humans worldwide (Wu et al., 2020). Concerning future careers, findings indicate that AI and robotics will impact some professions, such as librarianship and radiology (Yildirim and Yildiz, 2018; Gong et al., 2018). Besides, results stressed that AI helps predict learners' future careers (García-Peñalvo et al., 2018). Finally, it is needed to explore the rapid transformation of the quality and quantity of work socially, geographically, and at a governmental level (Clifton et al., 2020).

4. Conclusions

This literature review focused on the influence of artificial intelligence on higher education. The impact of artificial intelligence (AI) on education and higher education is becoming a burning issue worth experimentation as AI is affecting life and education/higher education. The literature reviewed has covered four major areas: the impact of AI on educational quality, learning and teaching process, assessment, and ethics and future careers. The existing literature highlights the importance of AI in higher education and insists on implementing AI in the educational system and training academic staff and learners with AI for better educational systems and a better future. The significant gaps found are that studies conducted are about AI and higher education in general and do not focus on particular areas in education such as learning, teaching, assessment, and quality to assist the learner and tutor more. Most of the studies conducted are based on experimental methods. Lack of studies related to the use of AI in assessment, ethics and future careers of learners. This literature review tried to cover these gaps and findings vindicate the vital role of AI in transforming higher education services, quality, teaching, learning methods. The review indicates the importance of AI in education quality which meets with the findings of (Radović et al., 2020; Camps et al. 2016; GNS et al., 2012; and Grace Ufuk, 2020). AI helps create engaging learning methods, which agrees with the findings of (Xiao & Yi, 2020; Kelly, 2021; Senel & Can, 2021; Khare & Stewart, 2018; and Bogoviz et al., 2019). AI assists in moulding higher institutions that can deal with big data, retain students, prepare the learner for the future job market, providing the proper skills required by the fourth revolution, which goes hand in hand with the results found by (Muniasamy & Alasiry, 2020; (Alyahyan and Düştegör, 2020; Vinichenko et al., 2020; and Tashfeen, 2019). Finally, it is recommended that further investigation prioritise the impact of AI use on the learners' assessments and the ethical impacts on education and future careers.

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Availability of data and materials

<https://rayyan.ai/reviews>

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Figures

Figure 1

Inclusion and exclusion process Note: the researcher designed the figure