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Artificial Intelligence in Education: A Systematic Mapping Study using Scopus and Web of Science

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Abstract

Education in the 21st century is beginning to adopt the use of artificial intelligence, which is a type of technology. Through a search of the Scopus and the Web of Science databases, the primary objective of this methodical investigation is to locate publications that have been subjected to the rigors of peer review and are associated with the field of artificial intelligence in education. Additionally, analyze current trends and challenges in applying artificial intelligence in education. A bibliometric survey of the application of artificial intelligence in educational settings is also analyzed in further detail here. For the purpose of gaining access to the relevant literature, the Scopus and Web of Science databases were utilized. Utilizing the more advanced keyword search capabilities of the VOS viewer software along with the PRISMA methodology. The sample for the study consisted of a total of 298 articles and studies were analyzed between the years 2014 and 2020. According to the results of a bibliometric study, there are ten researchers who stand out as the primary scholars contributing to the field of artificial intelligence technology in education. An examination of the relevant literature reveals that there is a requirement for the development of software and applications of artificial intelligence in education, specifically those that are able to generate graphics from the text that has been loaded. Education has the potential to be a significant driver of advancement in natural language processing within artificial intelligence.

Keywords: artificial intelligence, education, bibliometric analysis, prisma, natural language processing

INTRODUCTION

These days, the developments and advancements that have been made in technology play a very important role in people's everyday lives. Many people believe that the 21st century will be remembered as the technological era (Raja & Nagasubramani, 2018). It is also seen as the basis for the economic growth of a country, where the effects can be felt in every field including Education. This is because it can be said that education is the foundation for economic growth. The worldwide educational system was severely disrupted as a result of the pandemic caused by the Covid-19 virus (Teras, Suoranta, Teras & Curcher, 2020). All teaching activities are now carried out with the assistance of technology, which has a negative impact not only on traditional teaching practises but also on learning activities that have traditionally relied on the classroom (Chabibie, 2020). According to a report that was published in 2019 by the United Nations Educational, Scientific, and Cultural Organization (UNESCO), as many as 74 percent of students all over the world are impacted by the Covid-19 pandemic. Because of this situation, both teachers and students are forced to rely exclusively on technology in order to work together for the purpose of gaining access to education.

The aftermath of the COVID-19 incident has provided direct evidence of the significance of the integration of technology into instructional settings. In the meantime, Valverde-Berrocoso, Del Carmen Garrido-Arroyo, Burgos-Videla, and Morales-Cevallos, (2020) stated that heutagogy is one of the appropriate approaches for students to adapt to and ensure access to the teaching activities. They said that heutagogy is among the appropriate approaches. According to Harun, Nazir, and Hussin (2019), the heutagogy approach is a learning method that allows students the freedom to choose learning methods that best suit their requirements and needs. The Artificial Intelligence learning model has opened up a huge space in realising the educational aspirations of the 21st century, according to Goksel and Bozkurt (2019).

In particular, it becomes common practise for students who access their education with only a moderate amount of guidance from their teachers. Cahapay (2020) claims that there is still room to provide more advanced educational resources by utilising the most recent technology such as artificial intelligence. According to Ocana Fernandez., Luis Alex Valenzuela, and Lourdes Garro-Aburto (2019), the component of artificial intelligence is a major topic in the educational trends of the present day. Educators and students alike make extensive use of a great number of applications in the modern era; however, there are some differences between the K-12 model and the configurations that are necessary for educational institutions. On the other hand, the incorporation of this aspect of artificial intelligence into the design of applications for educational resources is not as common as it once was.

SIGNIFICANCE AND OBJECTIVE

Suparno (2019) states that the first examples of artificial intelligence can be found in technologies that were developed in the 1950s. On the other hand, getting a foothold in the educational system can be challenging. The UNESCO Annual Education Report (2019) reveals that the inherent challenges in

identifying the components that need to be absorbed from this technology are the root cause of the problems that arise when trying to accept artificial intelligence in the context of the educational setting. It has been suggested by Albahri, Zaidan, Albahri, Zaidan, Abdulkareem, et al. (2020) that the application of artificial intelligence can assist in the facilitation of collaborative learning. In circumstances in which students are not physically present in the same location, computer-supported collaborative learning is one of the aspects that demonstrates the greatest potential for success. Students now have a range of options to choose from regarding the length of their studies and the location of their classrooms.

AI systems are used to monitor discussion groups, providing teachers with information on discussion and student support to guide student engagement and learning (Zawacki-Richter, Marn, Bond & Gouverneur, 2019). Applications developed with artificial intelligence techniques such as machine learning and superficial text processing are used to develop AI systems. AI systems are used to monitor discussion groups. Therefore, the purpose of this in-depth research is to locate, through the databases Scopus and Web of Science, publications that have been subjected to scholarly scrutiny and are related to the study of artificial intelligence in educational settings. The research work was able to precisely summarise the research objective as below:

Research Objective

1. Conduct a literature review on topics concerning the application of artificial intelligence in the field of education.
2. Find patterns in the research that has been done on the use of artificial intelligence in educational settings.
3. Conduct research based on the reviewed literature to investigate the effects that artificial intelligence technology will have on the educational system.

Research significance

1. Contributed to the identification of clusters that are studied frequently and will allow for the improvement of studies related to those clusters in the future.
2. Identifying research trends in the field through the application of the PRISMA methodology and other bibliometric methods.
3. Recommend the efficacy of using technology in education, particularly with regard to the impact it has on the academic performance and behaviour of students.

METHODOLOGY

In the context of research on this subject, a systematic literature review is preferable. PRISMA, which stands for "Preferred Reporting Items for Systematic Review and Meta-Analysis," and bibliometric analysis have been utilised in order to provide answers to the research questions. The PRISMA method

was used to create a shortlist, and 298 works were chosen from the Scopus and Web of Science databases based on clear inclusion and exclusion criteria. These criteria are as follows:

1. The article covers the time period 2014 to 2020
2. The artificial intelligence in education is the article's primary focus
3. A duplicate article with the same author and subject has been removed the article period of 2014 to 2020.
4. Article focus on artificial intelligence in education.
5. Duplicate article with s*ame author and topic removed.*

PRISMA Approach

According to Sierra-Correa and Cantera Kintz (2015), the implementation of PRISMA will result in the following three benefits: (1) clearly defining research questions that call for the completion of a systematic review; (2) identifying criteria for inclusion or exclusion; and (3) attempting to view a large database of scientific literature at one time. In light of this, the research utilised this methodology to carry out a comprehensive analysis of the field of artificial intelligence in the educational setting. The searches were conducted independently against the titles, keywords, and abstracts of works located in a variety of databases.

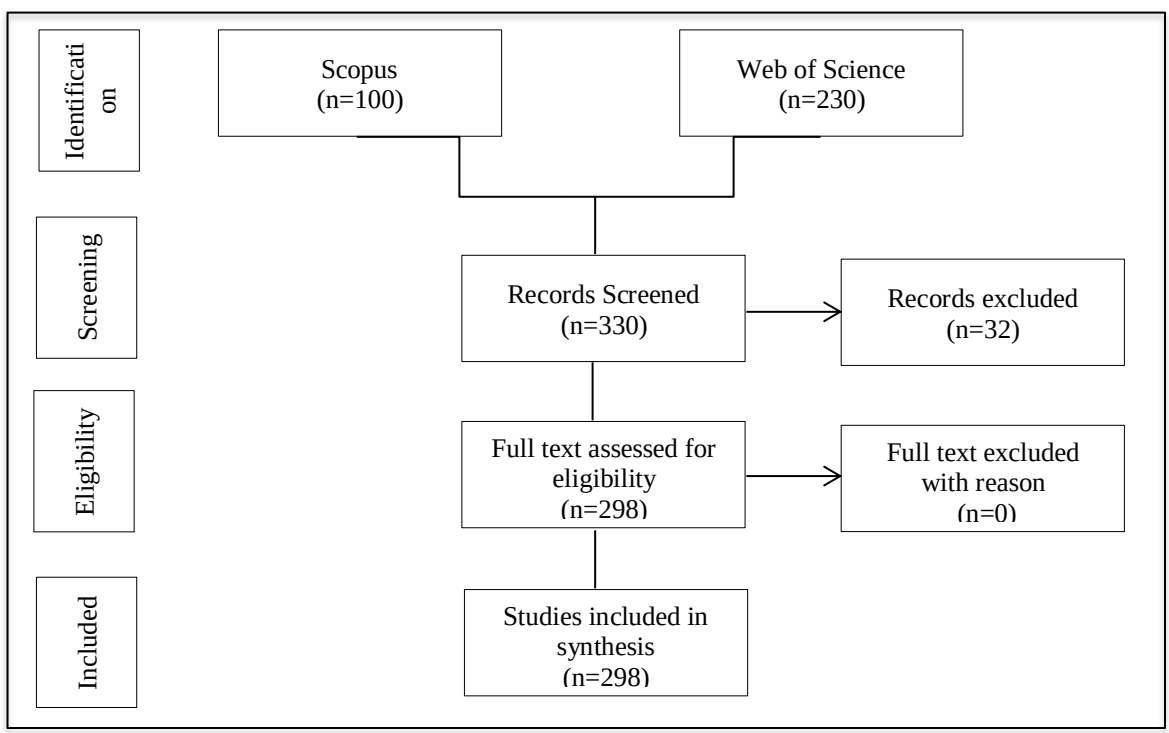

Figure 1: PRISMA flowchart for systematic review of artificial intelligence

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BIBLIOMETRIC ANALYSIS

A bibliometric study was carried out in order to investigate the developing pattern of employing artificial intelligence in academic settings. The article was used to conduct bibliometric analysis, and the results were filtered using the keywords shown in the table. The first step in bibliometric analysis is performing a keyword analysis, which takes place in the first phase. The analysis investigated with total of ten different keywords. In the second phase, an analysis of the publication was carried out based on a cluster that had been formed from the previous phase's total of 298 studies. The following is a list of the findings that were derived from the bibliometric analysis, which was conducted in two phases:

Analysis of Keywords

A total of five sets of keywords were used in determining the study through the Scopus database and the Web of Science. The primary keyword used is artificial intelligence and teaching. While the secondary keywords used are model and development. The keywords used in this bibliometric analysis regarding artificial intelligence and model are depicted in Table 2, in which the set of keywords are used with “AND” or “OR” operator.

Table 2: List of all keywords

Keywords set	Keywords	Occurrences	Relevance
Keywords_Set1	“Artificial intelligence” OR “artificial” And “Ai” OR “applicability”	40	2.19
Keywords_Set2	“model” And “computer graphic” OR “computer” OR “graphic”	45	1.26
Keywords_Set3	“teaching” OR “software” And “development” OR “animation” OR “internet”	80	2.10
Keywords_Set4	“game” OR “education” And “challenge”	54	0.70
Keywords_Set5	“Higher education”And “teaching tool” OR “trend”	79	0.98

Analysis of Cluster

Next, all 298 studies were entered into the VOS viewer software to analyse information about the clusters or trends of the studies conducted. As Figure 2 and Table 3 show a total of three clusters have been identified.

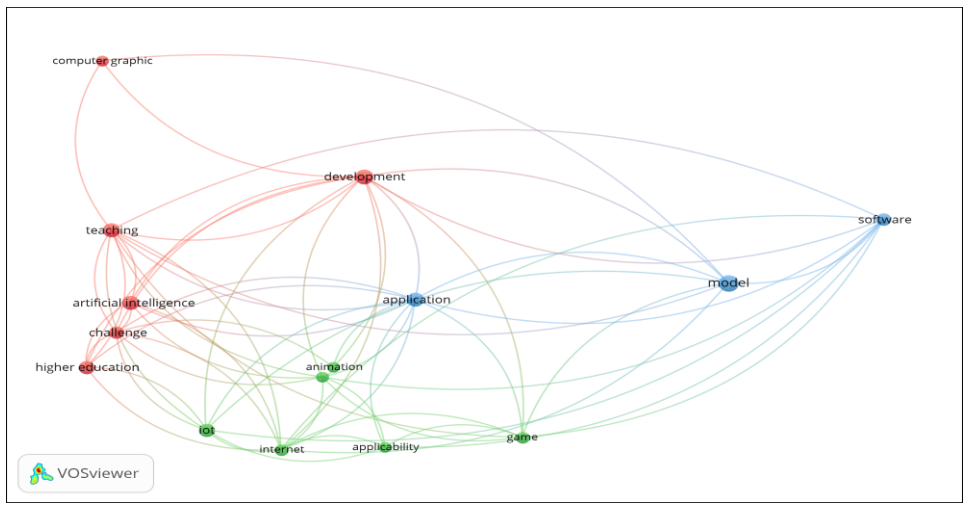

Figure 2: Analysis based on cluster

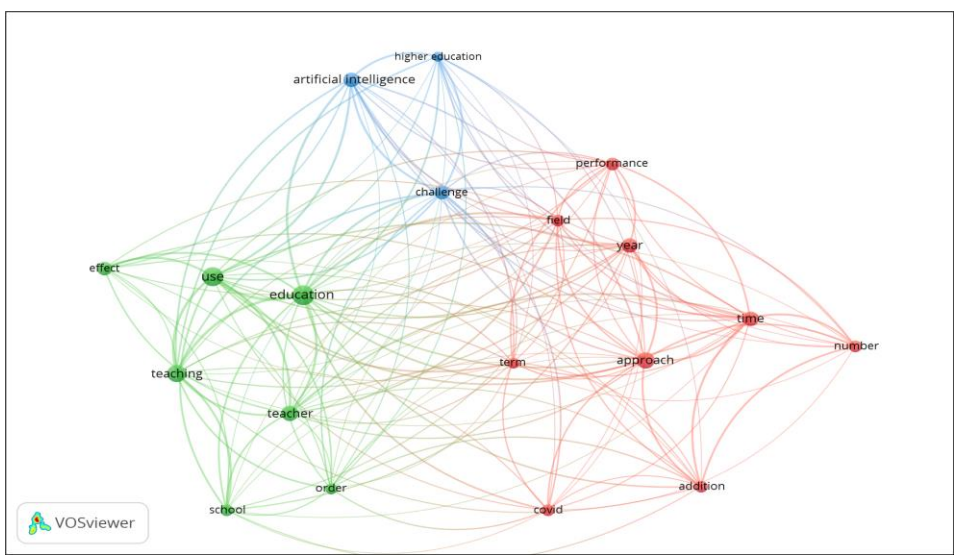

Figure 3: Analysis based on abstract and title

Table 3 shows the items for each of the identified clusters. With this analysis, the second research question is answered, namely, the research trend shows that most of the research is conducted in the development of artificial intelligence models and software. Also shows research trends related to animation and computer gaming using artificial intelligence technology. Overall, research trends cover the field of artificial intelligence and education as well as the challenges of its use.

Table 3: List of all clusters

Cluster	Items
Cluster 1	Artificial Intelligence, Challenge, Computer Graphic, Development, Higher Education, teaching
Cluster 2	Animation, applicability, computer, game, internet, IoT
Cluster 3	Application, model, software

DISCUSSION

This comprehensive review, which made use of PRISMA and other bibliometric techniques, provided answers to three of the research questions that were developed. There was a total of 298 studies reviewed, all of which were found in Scopus and the Web of Science. When screening the entirety of the content of the study, a total of five different sets of keywords were published. The results of bibliometric research have provided an overview of the trends and effects of the implementation of artificial intelligence in educational settings on the pupils. In general, there have been a lot of studies done on different aspects of implementing artificial intelligence in the classroom. According to the trends in usage, the majority of research is focused on the creation of applications and software as well as models for using artificial intelligence in educational settings. Studies relating to the development of gaming applications for use in educational settings are also reflected in this trend. It has been suggested by Albahri, Zaidan, Albahri, Zaidan, Abdulkareem, et al. (2020) that the application of artificial intelligence can assist in the facilitation of collaborative learning.

The fact that students do not need to be in the same place at the same time is one of the factors that contributes to the success of collaborative learning that is supported by computers. Artificial intelligence systems are used to monitor discussion groups, providing teachers with information on discussion and student support to guide student engagement and learning (Zawacki-Richter, Marn, Bond & Gouverneur, 2019). Applications developed with artificial intelligence techniques such as machine learning and superficial text processing are used to develop artificial intelligence systems. These systems are used to monitor discussion groups. In conclusion, Tanveer, Hassan, and Bhaumik (2020) argue that the application of artificial intelligence can improve the educational opportunities available to students who have disabilities.

Trend and Challenges in Apply Artificial Intelligence in Education

Jailani et al. (2020) stated that the use of sophisticated information and communication technology is actually able to improve the effectiveness of teaching and learning of children in preschool. Therefore, this artificial intelligence approach is adopted as one of the learning approaches in preschool education. The proof is that through the National Preschool Standard Curriculum (KSPK), there is a pillar of science and technology and also educators are advised to use ICT across the curriculum (Raja & Nagasubramani, 2018).

A study conducted by Suparno (2019) on 60 preschool teachers found that 60% agreed that awareness of the use of artificial intelligence and the latest technologies in children's learning is at a low level. This matter is also explained in the same study, which is as many as 68% admit that they have limited knowledge in the effectiveness of ICT-assisted teaching and learning. This study shows us that preschool educators are still not aware of the importance of using ICT in the teaching and learning of children in preschool.

Preradovic et al (2017) also conducted a study on the use of ICT among preschool teachers. The results of their study found that most teachers use ICT for documentation matters (56%), accessing information (82.6%) and communication in the form of email (43.5%) only. Only a small number (34.8%) use ICT to support children's learning in preschool. In this study as well, educators think that the use of ICT in preschools is low due to the lack of competence of educators in handling ICT because the development of ICT is happening very rapidly in addition to the lack of intensive training provided for that purpose.

FUTURE WORK

The following are some recommendations for the future that have been derived from studies on the application of technology that uses artificial intelligence in education through the use of systematic literature reviews and bibliometric meta-analyses:

1. Research examining the efficacy of employing technologies that make use of artificial intelligence in teaching reveals that there are some limitations. As a result, there is a pressing need to conduct additional research regarding the efficiency of the application of various forms of technology.
2. The trend of research in artificial intelligence is also shown in this review; however, research relating to the combination of IoT technology and artificial intelligence is still lacking.
3. The implementation of artificial intelligence requires coordination not only with the development of Industrial Revolution 4.0 but also with education in the 21st century.
4. The information presented in Tables 2 and 3 indicates that there is a requirement for a study to be conducted regarding the level of knowledge of artificial intelligence technology held by educators.

CONCLUSION

This article provides an analysis of the application of artificial intelligence in educational settings. The growth in the study of artificial intelligence is indicative of growing interest in this field of academic inquiry. This article provides an analysis of the efficiency of utilising artificial intelligence as well as the current trend. A total of 298 studies that were cited in Scopus and the Web of Science were investigated using a systematic and bibliometric approach. According to the findings, the practise of heutagogy education can be achieved by integrating different methods and approaches in accordance with the shifting trends in the world of technology. This can be accomplished by employing cutting-edge methods such as artificial intelligence in educational settings. In line with this, Jailani, Ning, Latih, Ismail, and Muda, et al., (2020) stated that the development of multimedia applications by combining the most recent elements of technological advancement can bring students closer to the activities that are involved in teaching. The creation of applications using technology bridges not only the gap in technology itself, but also the gap between different groups of students and the educational activities they participate in.

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