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A Bibliometrics Analysis for Artificial Intelligence Implementation of Employment in Education Institutions

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ABSTRACT: Artificial Intelligence (AI) represents the capacity of computers to emulate human intelligence, raising concerns about its potential impact on the role of educators. As students progressively rely on AI for task completion, there is a perceived threat to the traditional role of educators. To address this challenge, this paper advocates for the adoption of the Role Play Model and Project-Based Learning methods in education. These approaches are inherently human-centric and cannot bereplicated by AI, ensuring that students continue to require the guidance and expertise of educators. Utilizing bibliometric analysis with data from Scopus spanning the years 1985 to 2023, this paper delves into the evolution of AI in education. It emphasizes the importance of active interaction and guidance from educators in helping the educational sector adapt to the AI era, thereby enabling students to remain competitive in an increasingly AI-driven world. It underscores the essential role educator's play in cultivating deep understanding and skills in students, which AI cannot completely substitute. In summary, educators must recognize their pivotal role in shaping students' education in an AI-dominated landscape.

KEYWORDS: artificial intelligence, lecturers, education, schools, colleges.

I. INTRODUCTION

The rapid advancements in Artificial Intelligence (AI) technology have influenced various aspects of human life, including education [1], [2]. In the current digital era, there are many pros and cons regarding the use of AI in teaching and learning systems [3], [4]. This research focuses on the impact of artificial intelligence on the performance of educators in the context of current and future education, particularly in higher education institutions [5]. AI can assist in better academic management, optimize the learning process, and provide more personalized experiences to each student [6], [7]. On the other hand, the rise of sophisticated technology raises concerns about the possibility of automation systems replacing human jobs [8], [9].

This paper aims to comprehensively discuss the implications of using AI in education, especially concerning the performance of educators in higher education institutions. Additionally, it will explore strategic efforts that can be undertaken to harness the potential benefits of AI in educational development while considering the issues and challenges that may arise [10], [11]. It is hoped that this research will provide valuable insights for practitioners, policymakers, researchers in the field of education, and anyone interested [12], [13]. The objective of this study is to provide a fair overview of how AI impacts the performance of educators and to offer policy recommendations and practical steps to maximize the benefits of this technology for the progress of the education sector [14], [15].

II. METHOD

A. Finding Keyword using Scopus

To conduct a comprehensive review of the research topic, a thorough search was conducted using the reputable scientific literature database, Scopus. By utilizing keywords such as "artificial intelligence (AI), lecturers, teaching, teachers, schools, students, campuses, and jobs," this search aimed to identify relevant articles and provide valuable insights for this research. Scopus, being a well-known platform that encompasses scientific publications from various disciplines, serves as a reliable source to obtain a wide range of articles that have been reviewed by experts, enabling an in-depth examination of this research topic from various perspectives.

B. Downloading Search Result

After conducting the search on Scopus and obtaining the results, we stored the findings in CSV (Comma-Separated Values) format. The choice of the CSV format was made due to its ease of storing data in a simple text format that can be accessed and analyzed using various computer programs. By using this format, the research data can be seamlessly integrated into data analysis software or other databases, enabling researchers to perform manipulation, visualization, and further analysis of the research outcomes.

C. Running the Downloaded CSV in Biblioshiny Software

Biblioshiny is a specialized application designed specifically for conducting bibliometric analysis, including the analysis of data originating from Scopus. This powerful tool provides researchers with the ability to visualize and analyze extensive literature data stored in CSV files from Scopus. By utilizing Biblioshiny, researchers can explore various bibliometric indicators, such as citation patterns, co-authorship networks, and co-occurrence of keywords, to gain valuable insights into the research landscape and identify emerging trends or influential publications in the field.

D. Analyzing Relevant Aspects

Based on the research discussion, a bibliometric analysis was performed on the data available in the CSV file to identify research trends, measure the impact and visibility of the research, and evaluate the development of research topics related to the subject under investigation.

By employing these steps, the study aims to utilize data sources from Scopus, download search results in CSV format, utilize the Biblioshiny application for analysis and conduct a comprehensive bibliometric analysis to explore relevant research aspects and assess the progress of research topics related to the subject being studied.

III. RESULT

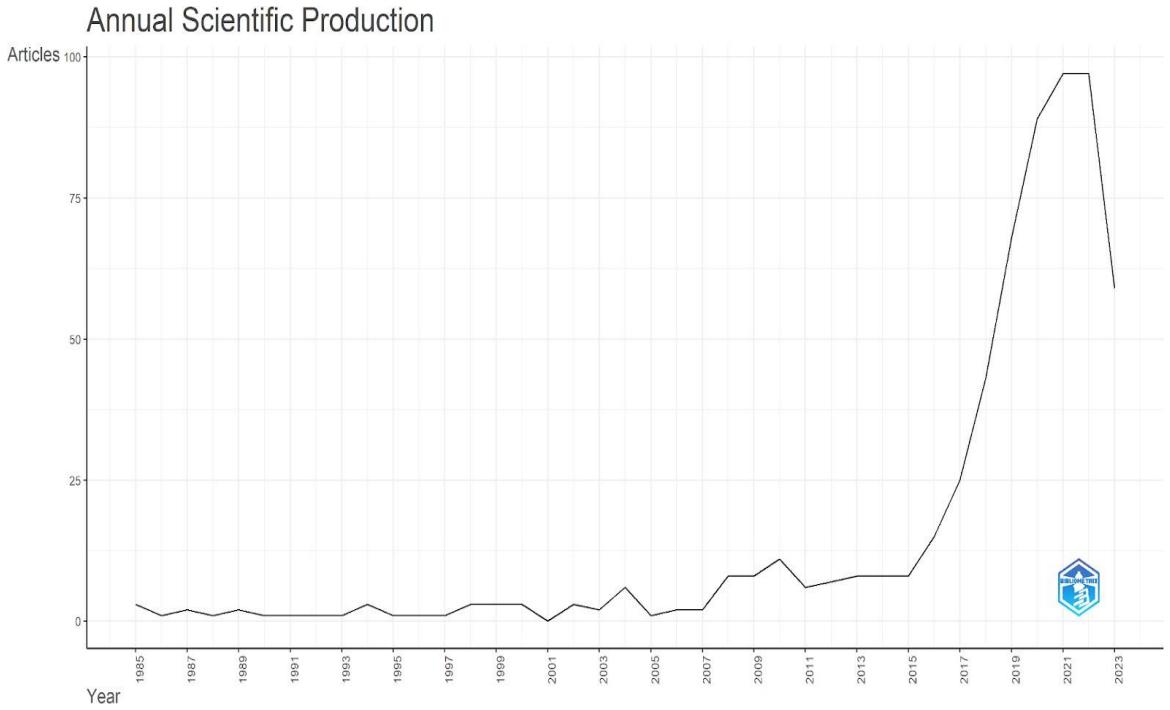
This research uses the term "findings" to refer to the results obtained from bibliometric analysis of scientific literature on virtual reality, self-efficacy, and interpersonal communication. These findings encompass various metrics, such as the number of publications, types of publications, keywords, authors, annual output, citations, impact factors, productive institutional affiliations, as well as thematic analysis and evolution.

A. General Information About The Analyzed Data

A comprehensive study was conducted over 38 years, from 1985 to 2023, successfully gathering 601 documents that encompass various types of scientific publications. These documents are stored in a CSV file and have been subjected to bibliometric analysis, originating from 408 different sources. Out of the total number of documents, 282 are articles and 319 are conference papers, providing diverse insights into this research area. The information retrieval process was carried out globally and resulted in a total of 1,702 author keywords. Within the collected data range through bibliometric analysis, there were 1,860 authors involved in writing these documents, with 114 authors working independently on their respective documents.

B. Annual Scientific Production and Research Trend

The analysis of the annual scientific production trends from the 601 documents used in the research indicates that before the year 2011, the number of published articles was relatively low, with only about 3 articles per year. In 2011, there was a slight increase to 11 publications, and then a significant change occurred in 2016, with the number of publications reaching 15 documents per year. The highest peak was achieved in the years 2021 and 2022, with the number of publications reaching 97 documents. From this overview of changes, it is evident that the interest of authors in this field has been steadily increasing, especially in recent years. The data demonstrates a notable surge in scientific output, indicating a growing interest and engagement of researchers in this area, particularly in the past few years.



A. *Annual Scientific Production*

C. Documents With the Most Citations and Impact Factor

This section discusses the most relevant or productive sources of articles. Out of the 601 documents published across 408 sources, there are the top 10 most productive sources, as shown in Table 1. The most productive source is "Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)" (27.4%), followed by "Advances in Intelligent Systems and Computing" (11.1%). The impact of each journal is measured using the H- index, which calculates the number of articles (h) from that journal that have received at least h citations. Therefore, the journal with the highest impact based on the H-index is "Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)," as seen in Table 2.

Table 1. Most Relevant Sources

No	Most Relevant Sources		
	Sources	**Articles**	**% of Articles**
1	Lecture Notes in Computer Science (Including SubseriesLecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	32	27.4%
2	Advances in Intelligent Systems and Computing	13	11.1%
3	IEEE Access	13	11.1%
4	ACM International Conference Proceeding Series	12	10.3%
5	ASEE Annual Conference and Exposition, ConferencenProceedings	12	10.3%
6	Journal of Physics: Conference Series	11	9.4%
7	Lecture Notes in Networks and Systems	8	6.8%
8	IEEE Transactions on Learning Technologies	6	5.1%
9	IEEE Global Engineering Education Conference, Educon	5	4.3%
10	Lecture Notes Of The Institute For Computer Sciences, Social-Informatics And Telecommunications Engineering,Lnicst	5	4.3%

Table 2. Most Impacful Source as per H Index

No	Most Impacful Source as per H Index	
	Name of the Source	**H - index**
1	Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	7
2	IEEE Access	6
3	Academic Radiology	3
4	ACM International Conference Proceeding Series	3
5	ASEE Annual Conference and Exposition, Conference Proceedings	3

6	Insights Into Imaging	3
7	Procedia Cirp	3
8	Procedia Computer Science	3
9	Proceedings - Frontiers in Education Conference, Fie	3
10	Proceedings of 2010 International Conference on Communication and Computational Intelligence, INCOCCI-2010	3

In Table 3, the most frequently cited article, with the highest global citation count, is authored by Laguarta J and was published in the source "IEEE Open Journal of Engineering in Medicine and Biology." The article is titled "COVID-19 Artificial Intelligence Diagnosis Using Only Cough Recordings." In this paper, the authors developed an AI sound-processing framework using cough recordings to determine whether a person is infected with COVID-19. This article's high citation count indicates its significant impact and recognition within the scientific community, showcasing the relevance and importance of their research inthe context of COVID-19 diagnosis and the application of artificial intelligence in the medical field.

Table 3. Most Cited Document

No	Most Cited Document		
	Document	**Year**	**Citation**
1	LAGUARTA J, 2020, IEEE OPEN J ENG MED BIOL	2020	272
2	CORTEZ P, 2008, EUR CONCURR ENG CONF, ECEC - FUTURE BUS, TECHNOL CONF, FUBUTEC	2008	237
3	HAJIAN S, 2016, PROC ACM SIGKDD INT CONF KNOWL DISCOV DATA MIN	2016	222
4	SIMA V, 2020, SUSTAINABILITY	2020	204
5	SCHWARTZ HA, 2013, INT CONF WEBLOGS SOC MEDIA,ICWSM	2013	182
6	DE MAURO A, 2018, INF PROCESS MANAGE	2018	173
7	PERALTA G, 2017, PROC IEEE INT WORKSHOP ELECTRON, CONTROL, MEAS, SIGNALS APPL MECHATRONICS, ECMSM	2017	122
8	BUDA M, 2019, RADIOLOGY	2019	106
9	MEHMOOD R, 2017, IEEE ACCESS	2017	103
10	CARUSO L, 2018, AI SOC	2018	96

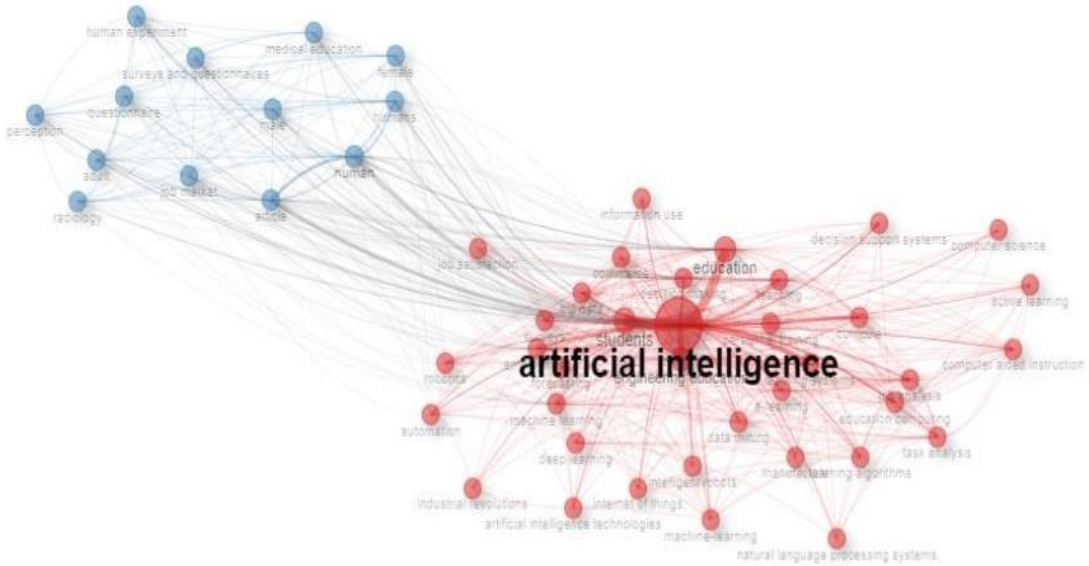
D. Authors and Affiliation

In this section, detailed information about the authors and the impact of their work is presented. Out of a total of 1,274 authors involved in the creation of the 601 documents, there is an average of 2.11 authors per document. The top 10 most productive authors are Yingying Zhang with 8 works and Kenneth R. Koedinger with 4 works, as shown in Table 4. Table 4 also displays the top 10 authors with the highest Total Citations, which are Ferran Hueto and Jordi Laguarta with an equal total citation count of 272 citations. These authors have been highly cited, indicating the significant impact and influence of their research within the scientific community. Their work has garnered recognition and has been widely referenced by other researchers, solidifying their contributions to the field of study.

Table 4. Top 20 Author Production, and the Number of Citations

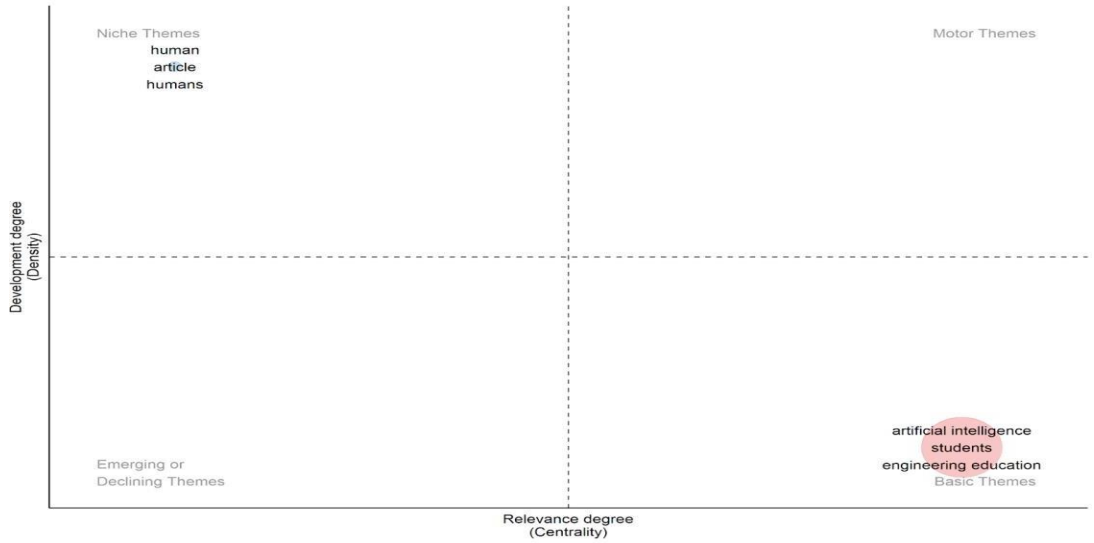
Top 20 Author Production, and the Number of Citations			
Author	**Articles**	**Author**	**Total Citations**
Zhang Y	8	Hueto F	272
Koedinger KR	4	Laguarta J	272
Wang Y	4	Subirana B	272
Yang Y	4	Silva A	265
Chen Y	3	Cortez P	237
Hegyesi F	3	Bonchi F	222
Liu J	3	Castillo C	222
Vassigh S	3	Hajian S	222
Wang J	3	Gheorghe IG	204
Wang L	3	Nancu D	204

E. Thematic Analysis



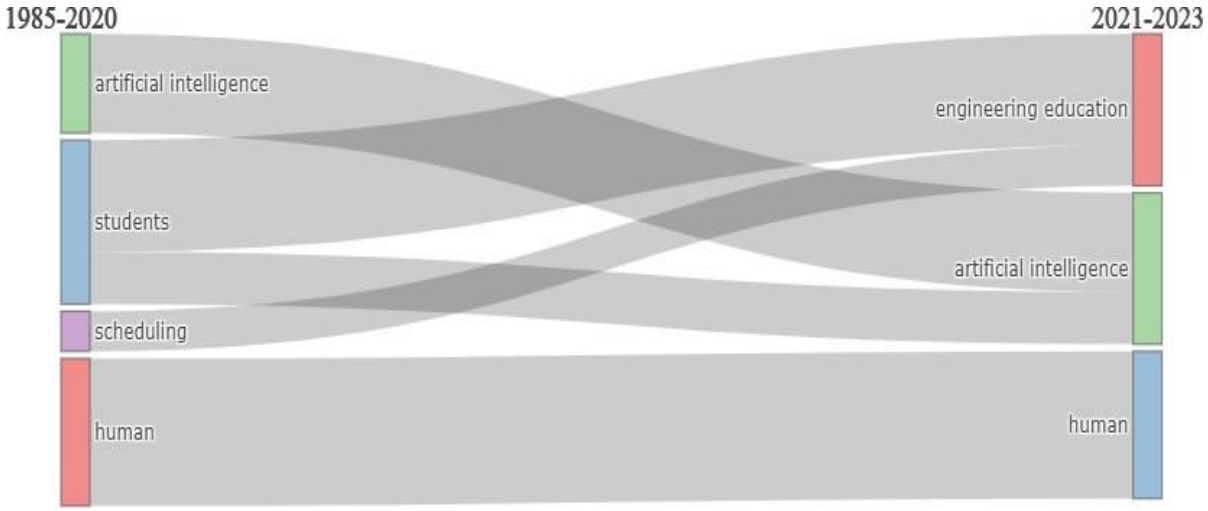
B. Co-occurrence Network

In (Figure B), there are several main topics interconnected with each other. From these topics, it can be observed that there are different sizes of circles, where larger circles indicate the dominance of research related to that topic. In this context, Artificial Intelligence (AI) stands out as the most dominant topic, as evidenced by the largest circle. Furthermore, AI is connected to almost all other research topics, signifying that even in other areas of investigation, AI remains an integral part of the research, although not always the primary focus. This indicates that the CSV file predominantly comprises studies that incorporate AI in their research.



C. Thematic Map

In (Figure C), four quadrants can be identified, each serving a distinct purpose. They are named Basic Themes, Motor Themes, Niche Themes, and Emerging or Declining Themes. Basic Themes encompass research topics of fundamental importance, acting as a foundation for more specific research domains. Motor Themes house research areas that are currently dominant, with numerous researchers extensively exploring and developing prototypes in those fields. Following this, Emerging or Declining Themes cover research topics that are either highly relevant or gradually losing prominence. Lastly, Niche Themes represent a quadrant for highly specific research topics that are limited to certain sub-fields.



D. *Thematic Evolution*

Regarding (Figure 4), a thematic evolution analysis has been performed using bibliometric software to identify the research trends over time. The analysis involves dividing the research timeline into two thematic time slices: slice one and slice two. Thematic time slice one is depicted on the left side, while thematic time slice two is represented on the right side. This division ismade to account for the transition of research from one period to another. The research span in (Figure 4) ranges from 1985 to 2020.

Thematic time slice one encompasses four sub-topics, namely artificial intelligence, students, scheduling, and humans. On the other hand, thematic time slice two, covering the period from 2021 to the present (2023), focuses on three main topics: engineering education, artificial intelligence, and humans. These topics are continuations of the ones explored in the previous time slice. In thematic time slice one, the dominant topic is students. However, in thematic time slice two, the topic of students merges with artificial intelligence. This can be explained by the fact that in the earlier period, researchers had not yet fully directed

their attention toward artificial intelligence in the context of education. Nonetheless, as time progressed, researchers realized the significance of artificial intelligence in the realm of education, leading to an increased number of studies in this area during the second thematic time slice.

E. *Thematic Map Time Slice*

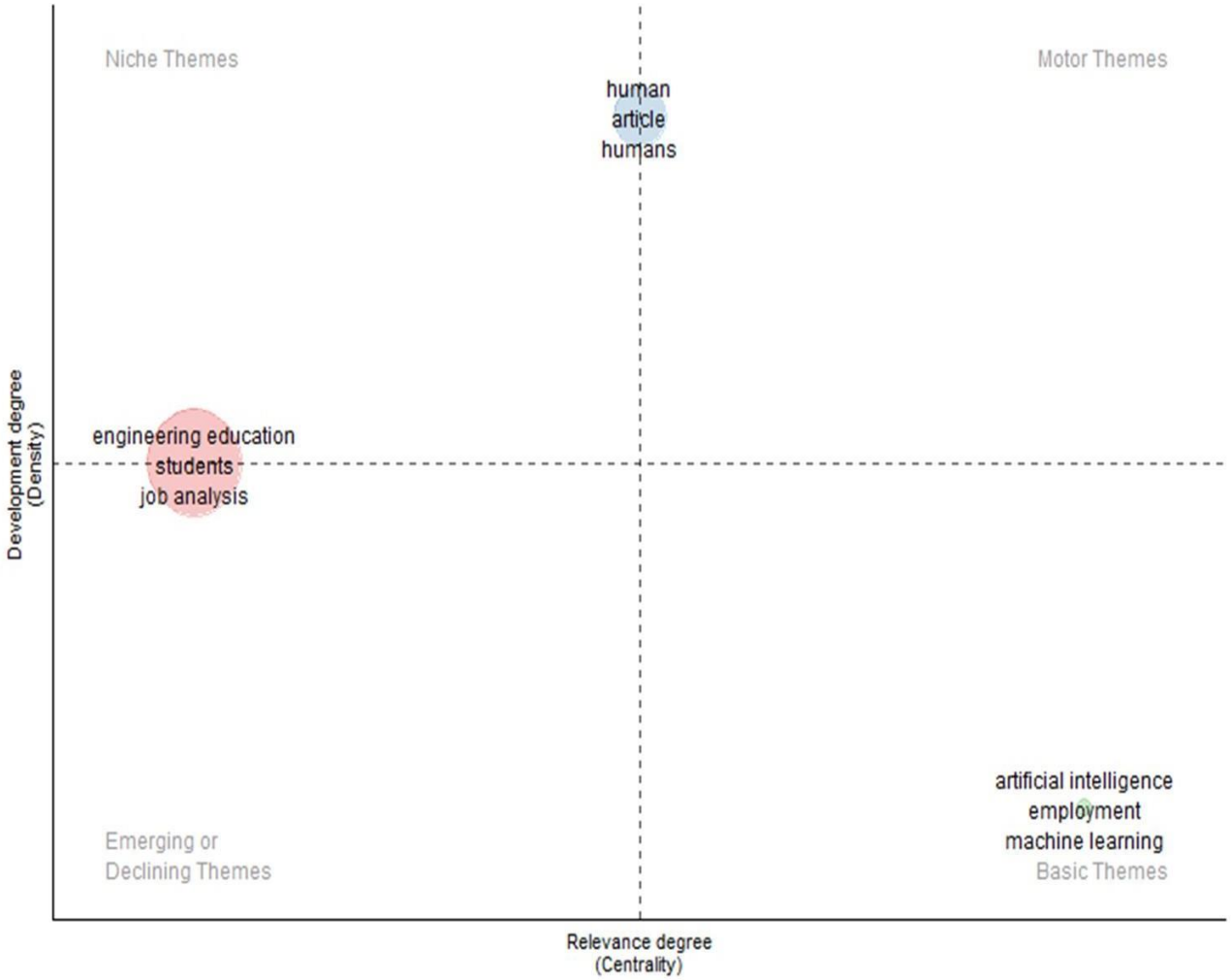
In (Figure E), which represents thematic map time slice one, there are four research topics with distinct layouts, reflecting their respective levels of importance. In the basic themes section, topics such as artificial intelligence, education, and employment are still considered fundamental and lack specific research directions. They remain the primary focus of research during that period.

On the other hand, in the emerging or declining themes section, research topics like scheduling, machine learning techniques, and intelligent systems are presented. These three topics vary in terms of importance. Some experience increasing relevance, while others have started to decline in popularity or even be forgotten.

Moving on to the Niche themes section, the research topic of humans is highlighted, indicating that it was thoroughly and extensively studied by researchers during that time.

Furthermore, in the Motor themes section, topics such as students, engineering education, and learning systems are dominant in terms of the number of research studies. The larger size of the circles in the Motor themes section signifies a higher number of articles discussing these topics compared to others.

It should be noted that the size of each circle in the image (Figure E) varies, indicating the number of articles related to that topic. The Motor themes section contains the highest number of articles compared to the other topics.



F. *Thematic Map Time Slice*

In (Figure F), which represents thematic map time slice two, there are three research topics resulting from the transformationof thematic time slice one. The position of the research topics has changed due to a shift in research focus. It can be observed that between the Niche themes and Motor themes sections, the research topic of humans stands out. This topic is currently dominant in research, with studies focusing on highly specific aspects.In the Niche themes and Emerging or Declining themes sections of (Figure F), the research topics of engineering education, students, and job analysis are presented. Some of these topics are highly specific, while others are considered important or mayhave declined in interest. However, it is evident that the dominant circle points towards the Niche themes section, indicatingthat these topics are extensively researched in a specific context rather than being of general importance or decreasing interest. Finally, in the Basic theme section, there is one research topic, namely artificial intelligence, employment, and machine learning. However, these topics are still considered fundamental and do not have a clear research direction among the researchers.Thematic map time slice two, namely (Figure F), is dominated by the research

topics of engineering education, students, andjob analysis, as the number of articles discussing these topics exceeds that of other topics.

IV. CONCLUSION

The utilization of artificial intelligence (AI) technology in education has brought both challenges and opportunities to the role of educators. As students increasingly rely on AI to complete tasks, the role of educators may become threatened [16], [17]. However, to address this, the implementation of methods like the Role Play Model and Project-Based Learning becomes crucial since these methods cannot be replicated by AI, thus ensuring that students still require guidance and active interaction from educators [18], [19].Even though AI can offer benefits in improving learning efficiency and personalization, the key role of educators in shaping students' deep understanding and skills cannot be fully replaced by AI [20], [21]. Therefore, educators must be aware of the significance of their role in facing the AI era, ensuring the advancement of education, and keeping students competitive in a world increasingly connected to AI technology [22]. This research provides valuable insights for practitioners, policymakers, and researchers in the field of education to wisely and strategically harness the potential of AI for educational progress [23], [24].

V. FUTURE RESEARCH DIRECTION

After successfully implementing the role-play model and project-based learning methods, students must be prepared to compete with AI in the job market. This is because, in the future, AI has significant potential to replace human positions in various fields of work [25]. For instance, researchers in China predict that around 278 million workers in China will be replaced by AI by the year 2049 [26]. Furthermore, AI has already demonstrated its ability to function as a music teacher [27].Despite AI's capability to streamline tasks for humans, even handling complex duties like optimizing network capacity, coverage, and Quality of Service (QoS) in HetNets [28], and its prevalent use in Information and Communication Technology (ICT) for technical and vocational education and training [29], it remains crucial for humans to prepare themselves as prospective students ready to learn about AI [30]. While AI possesses remarkable abilities, there is one aspect that AI lacks, which humans inherently possess, and that is emotions. Therefore, humans continue to play a vital role in the workforce by combining professionalism in performance with a strong sense of moral conscience.In facing the AI surge in the job market, humans need to continuously adapt and innovate to remain relevant and competitive. Understanding and mastering AI technology is the key to addressing future challenges. Nevertheless, human valuessuch as empathy, creativity, and adaptability remain critical differentiating factors that set humans apart from AI.By upholding professionalism in the workplace and being driven by a good conscience, humans can confidently face the changes brought about by AI. The emotions and inherent mental capabilities that humans possess will always be irreplaceable aspects that contribute positively to society and the job market.

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