“Relationship between artificial intelligence and legal education: A bibliometric analysis”

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RELATIONSHIP BETWEEN ARTIFICIAL INTELLIGENCE AND LEGAL EDUCATION: A BIBLIOMETRIC ANALYSIS

Abstract

This study aims to explore past research trends and identify key future directions at the intersection of artificial intelligence and legal education. The study's data were gathered from the Scopus database, comprising 68 selected documents spanning from 1999 to 2024. The research methodology involves the use of VOSviewer software for bibliometric analysis. The results reveal that research on artificial intelligence and legal education, while still limited, has been undertaken in various countries, focusing on five primary research directions, including: (1) Improving technical education systems in colleges and universities through educational technology and modern legal learning systems; (2) Application of artificial intelligence and algorithms in the legal field; (3) Applying computational theory and e-learning technology in legal education; (4) Legal education and legal knowledge; (5) Digital transformation in the field of legal training. Based on the research results, five future research directions on this topic are also proposed, including: (1) Application of artificial intelligence in analyzing and predicting legal trends; (2) Artificial intelligence in personalizing the legal learning experience; (3) Artificial intelligence and legal professional ethics; (4) Development of artificial intelligence tools supporting legal teaching and research; and (5) Integration of artificial intelligence into online learning systems for legal education.

Keywords artificial intelligence, law education, legal profession, legal teaching, co-citation analysis, co-occurrence analysis, keyword analysis

JEL Classification M00, K10, K30, I21

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INTRODUCTION

In today's world, the scientific and technological revolution, particularly in artificial intelligence (AI), is profoundly affecting the existence, development, and future of all professions and fields in most countries. The integration of information and communication technology into the legal services sector has even given rise to a new type of service known as legal technology (Mania, 2023). This development significantly influences the education of law at higher education institutions, including colleges and universities.

Recent studies have shown that advanced AI tools such as GPT-4.0 have successfully completed high-difficulty exams in the professional bar licensing tests in the United States (the bar exam). GPT-4.0 outperformed ChatGPT, GPT-3.5, and the average student scores, excelling in an exam that featured multiple-choice questions, open-ended essay questions testing theoretical knowledge, and practical law applications (Katz et al., 2024). This demonstrates the need for a serious reassessment of the relationship between AI and law, both historically and looking towards the future (Bex, 2024). AI has the potential to be a valuable tool in supporting the provision of legal services in society as well as in the field of legal education.

Consequently, the relationship between AI and legal education has attracted significant attention and been the subject of numerous studies by various authors. Despite, only a small number of scholars have delved into the exploration of AI's impact on legal education through bibliometric analysis. Although the bibliometric method is often used to reassess the state of past research and thereby provide suggestions for potential future research directions. The value and contribution of this study are to enrich and diversify the theoretical overview and lay the foundation for future empirical research related to the topic of the relationship between AI and legal education

1. LITERATURE REVIEW

In the 1950s, the term "artificial intelligence" (AI) was coined by the pioneering American inventor John McCarthy, who formally introduced it in 1956, defining it as "the science and engineering of creating intelligent machines". Today, AI has impacted all fields, including education, particularly higher education at colleges and universities in every country. For learners (students), AI serves as a tool to improve their academic performance. The features and technological platforms of AI enable learners to study more effectively and creatively, leading to better outcomes (Rahayu, 2023). Meanwhile, for educators, AI aids in designing better curricula, increasing interaction with students, and enhancing the learning environment (Kim et al., 2022).

The emergence, development, and robust application of AI in education have driven changes in legal education. Consequently, legal education needs to consider integrating AI to support and enhance the quality and effectiveness of training, ensuring that graduates are better prepared to meet the new demands of the AI era.

The application of AI and technology offers transformative opportunities for legal education. By carefully and intentionally integrating these tools, educational institutions, particularly at the higher education level in colleges and universities, can create a future where legal education becomes more engaging, effective, and accessible for all students (Mustapha, 2024). For instance, thanks to AI, digital and virtual libraries will provide a wealth of easily accessible resources. AI-based legal research assistants, chatbots, and citation generators simplify the research process, saving time and effort. Learners can personalize their learning experiences and self-assess their improvement throughout their studies. Virtual classrooms offer flexibility and scalability, allowing law students to learn from anywhere in the world. Interactive simulations through virtual forensic labs, case management software, and mock courts can help students develop practical skills and experience real-life legal scenarios. AI can even assist in assessment and certification, providing automated grading and plagiarism detection. These tools offer numerous benefits for students researching legal issues.

To conduct legal education in the context of integrating AI, law schools need to invest in faculty training, develop specialized courses on AI and law, and update curricula to incorporate these tools. Additionally, schools must establish specific ethical guidelines for using AI in teaching and research. In China, according to the study by Wei and Fengru (2021), the model of legal education incorporating AI has been reformed to combine three aspects in one tool: changing practice methods, innovating teaching aids, and innovating teaching methods to enhance the integration of theory and practice in legal education.

Thus, it can be seen that there is a close relationship between AI and legal education, and the application of AI will help transform the training model, improving efficiency and quality to meet the needs of learners and the expectations of society. Research on the relationship between AI and legal education has also been carried out quite diversely and from many different aspects such as: impact of ChatGPT on legal education and practice (Ajevski et al., 2023), digital transformation in law education (Demchenko et al., 2021), effects of AI-supported situational interactive teaching on law students (Shi et al., 2024), AI and legal education (Connell & Black, 2019). However, there are very few studies on the topic of the relationship between AI and legal education that use the bibliometric method. Through investigation, only a few

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studies have been conducted, such as those by V. Maphosa and M. Maphosa (2023), Hinojo-Lucena et al. (2019), Pradana et al. (2023), L. Valanciene and D. Valanciene (2022), and Aydemir and Cebeci (2023). Meanwhile, bibliometric analysis is a scientific method that utilizes quantitative tools and techniques to analyze bibliographic data, such as the number of articles, citation frequencies, h-index, citation networks, etc. The main objective of this analysis is to evaluate and measure the development of research fields, journals, researchers, and research organizations. This method has become an important tool in scientific management and development, enhancing the efficiency and quality of research in various fields. Through this method, it becomes feasible to pinpoint emerging research trends and areas of interest within the scientific community, gain deeper insights into the evolution of research fields over time, delineate collaborative networks among researchers, organizations, and nations, and grasp the interconnections and influences among various research endeavors.

Various definitions of this method showcase its diverse and valuable contributions. Pritchard (1969) defined bibliometrics as "*the application of mathematical and statistical methods to books and other forms of communication*," while Narin (1987) described it as "a collection of methods for quantitatively analyzing scientific and technological literature." More recently, Glänzel and Moed (2002) also clarified: "*Bibliometrics is the quantitative analysis of written communication through its formal features such as authorship, citation, and publication*". Depending on the analysis purpose, the content of the bibliometric analysis method is carried out under various techniques such as co-authorship, co-occurrence, co-citation, and bibliographic coupling (van Eck & Waltman, 2017).

The co-authorship technique is used to study and analyze the collaborative relationships among researchers, research organizations, or countries through documents they co-author. When two or more researchers write and publish a scientific paper together, they are considered co-authors of that paper. By analyzing co-authorship data, one can identify and evaluate collaborative relationships within the scientific community (Silva et al., 2019). The co-occurrence technique is a method in bibliometric analysis used to study and analyze relationships between terms, keywords, or concepts that appear together in scientific documents. When two or more terms are found together within a document, they are termed as co-occur. This technique helps identify semantic relationships and connections between research topics, thereby gaining a better understanding of the structure and content of research fields (Qiu et al., 2014). In addition, the co-citation technique is a method in bibliometric analysis used to study and analyze the relationships between scientific documents based on their co-citation by other documents. When two or more documents are co-cited by another document, they are considered to be co-cited. The degree of co-citation between two documents can reflect the degree of relevance or similarity in their content (Leung et al., 2017).

Therefore, the topic of the relationship between AI and legal education through the bibliometric method is an interesting one, with relatively few studies published to date. The purpose of this study is to explore and assess the state of research on this topic so far and to provide suggestions for potential future research directions in this area. This also serves as a basis for scientists to consider developing empirical research models in different countries, especially emerging ones.

2. METHOD

The process of collecting and processing data is shown in Figure 1. To gather data for bibliometric analysis, the research team utilized the Scopus database and conducted a search using specific keyword combinations, including ("AI" OR "Artificial intelligence") AND ("law education" OR "legal education"). The search yielded a total of 70 documents across various formats. These documents spanned from 1999 to 2024 (as of the survey date on 06/03/2024). To ensure the data's comprehensiveness and richness for analysis, the team excluded 2 studies that were pending publication (Article in press). Following this screening process, 68 documents were identified as the official dataset for the study.

Afterward, they were exported as a CSV file for additional refinement, which included standard-

Source: Author's compilation.

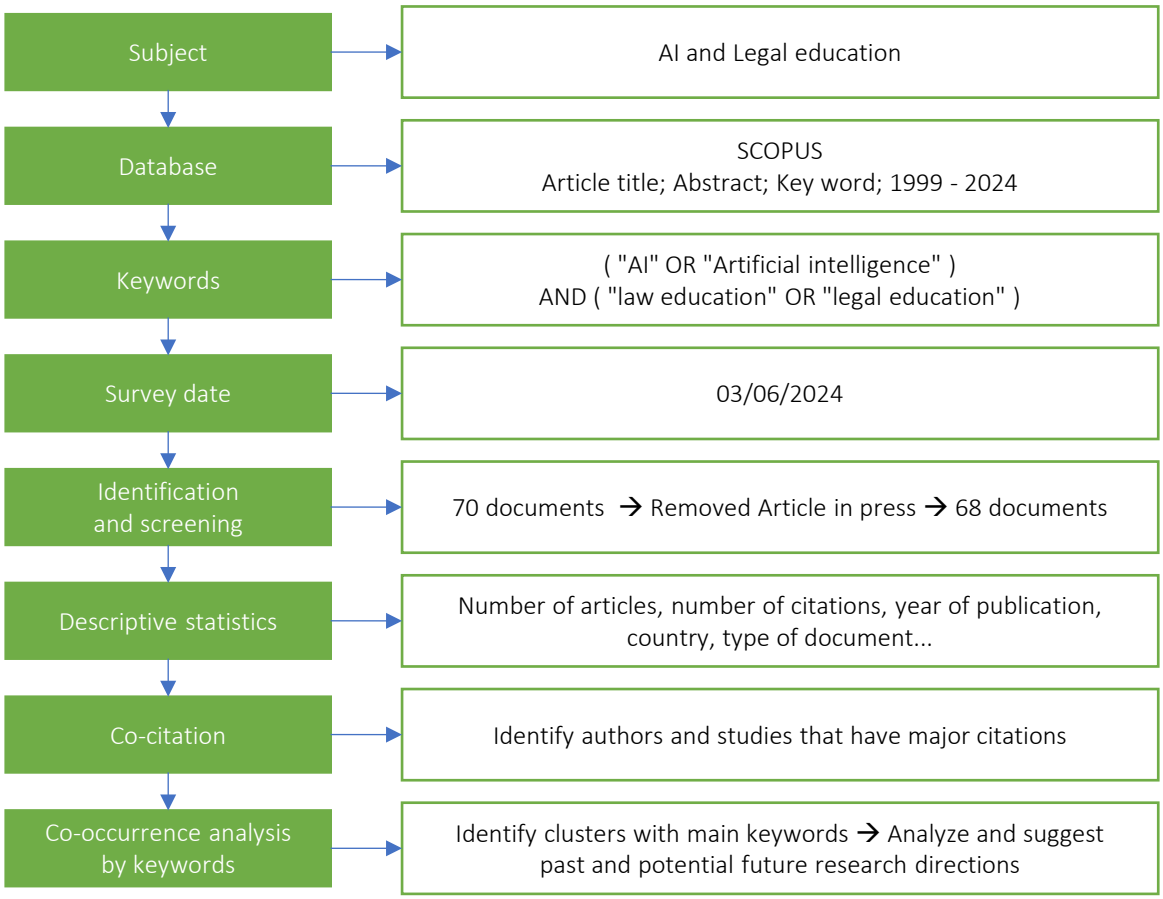

Figure 1. Research procedures

izing abbreviations to their corresponding full terms, such as AI being expanded to "Artificial intelligence," to ensure consistency. This meticulous step aims to enhance the accuracy of keyword analysis, facilitating the statistical counting of keyword frequency and the exploration of relationships between keywords and research works.

The research team initiated their analysis by conducting descriptive statistics on the 68 documents, scrutinizing key indices including article count, citations, document types, authors' countries, and publishing journals. These findings provide readers with an overview of the research trends concerning the integration of AI and legal education. Following this, they employed VOSviewer software to conduct co-citation and co-occurrence analyses. The goal was to cluster documents that referenced similar sources, producing a systematic diagram that displayed clusters of relevant research papers. Following this, the research team proceeded to discuss and categorize these groups into main clusters, naming them based on the general content of the documents contained within each cluster. Additionally, the team categorized keywords into the identified clusters and analyzed keywords within the same cluster to ascertain future research directions.

3. RESULTS

3.1. Descriptive statistics

3.1.1. Number of documents and citations

Based on Figure 2, it can be observed that from 1999 to June 3, 2024, a total of 68 publications related to the relationship between artificial intelligence and legal education were identified. During this period, it is noticeable that from 1999 to 2018, publications on this topic were not continuous and regular. Several years, such as 2000–2003, 2008, 2013–2015, and 2017–2018, had no record-

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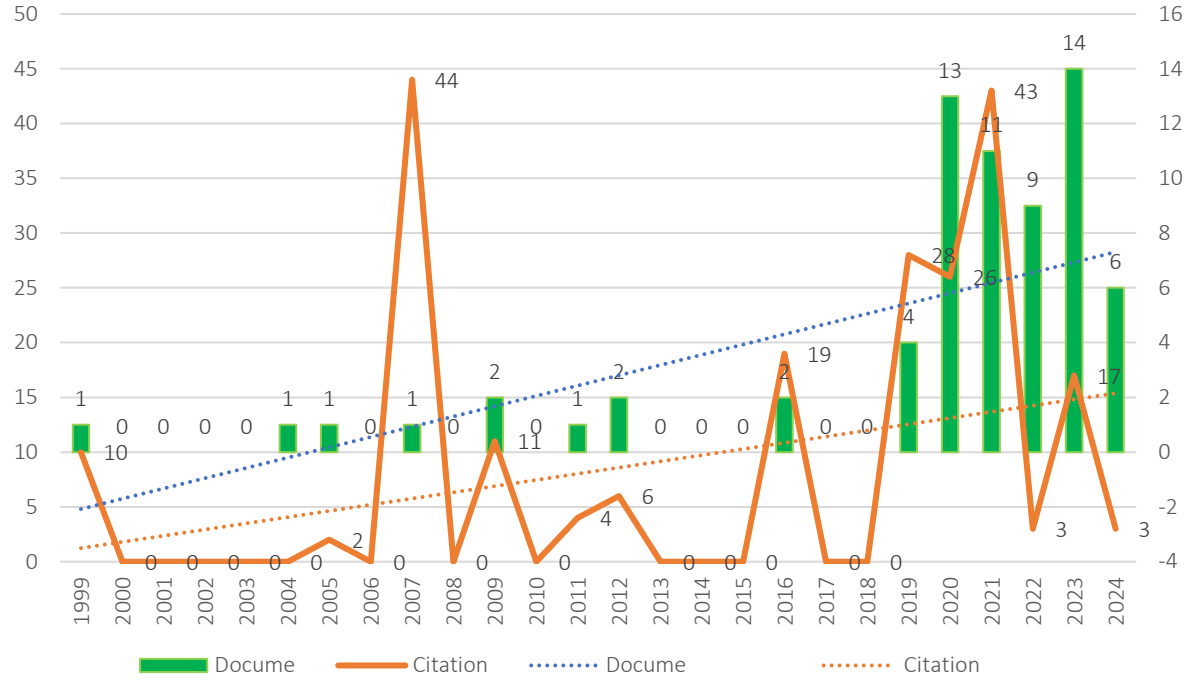

Figure 2. Analysis by number of documents and citations

ed publications in the Scopus database. From 2019 to 2024, there were 57 documents, accounting for 83.8% of the total documents to date, with a total of 119 citations (representing 55% of the total citations throughout the period). The average citation count per document was 3.17, and per year was 8.64. These figures indicate that research on the topic of artificial intelligence (AI) and legal education remains relatively scarce, and it has only garnered increased attention from researchers since 2019.

According to Table 1, the earliest publication on the topic of AI and legal education in the Scopus database was authored by Xu et al. (1999). The paper, titled "A fuzzy theoretical approach to case-based representation and inference in CISG," was published in Artificial Intelligence and Law. However, it was not until 4-5 years later that another related study was recorded (Kambayashi, 2004; Aleven et al., 2005; Reed & Grasso, 2007). The period from 2008 to 2018 saw a similar pattern, with only 1-2 publications related to the topic, and in some years, no publications were recorded at all. This indicates that the topic of the relationship between AI and legal education was not widely addressed during the period from 1999 to 2018.

3.1.2. Country/territory of author

According to Figure 3, the publication of studies related to the topic of AI and legal education receives significant attention from various countries and territories worldwide. The data show that China is particularly interested in this topic, with a remarkable number of publications compared to other countries (14 out of 68 documents, accounting for 20.58%). The next group of countries has publications ranging from 5 to 7 papers, including Russia, the United States, India, and the United Kingdom. Following them are countries with 3 to

Table 1. Some statistical indicators about the number of documents and citations

No.	Statistical indicators about	Result	Notes
1	Number of documents (1999–2024)	68	
2	Number of citations	216	
3	Highest citations year	2007	44 citations
4	Highest documents year	2023	14 documents
5	The period with the highest and most consistent publication	2019–2024	57 documents (83.8%), 119 citations (55%)
6	Average number of citations for the entire period (= 2/25 year)	8.64/year	–
7	Average number of citations per article (= 2/1)	3.17/ document	–

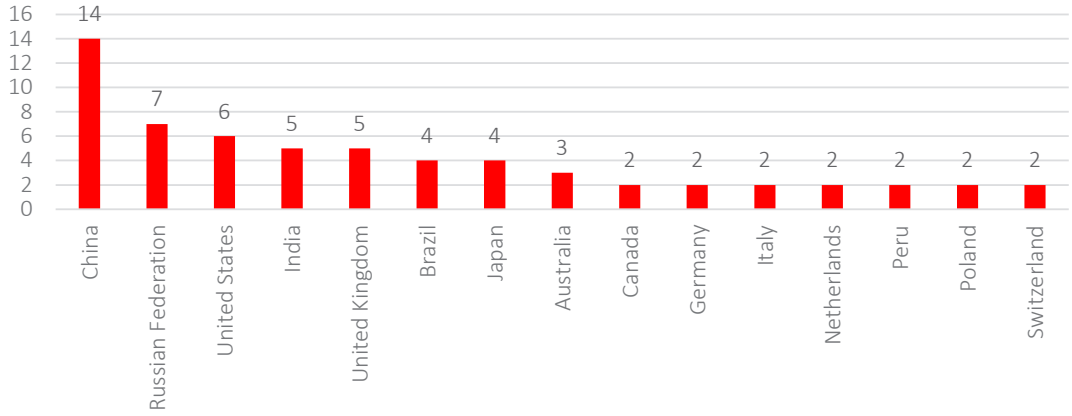

Figure 3. Statistics of countries with many publications on AI and legal education topics

4 publications, such as Brazil, Japan, and Australia, and finally, there is a group of countries with 2 publications each. Among these 15 countries, Asia accounts for 5 countries (China, Russia, India, Japan, Australia), the Americas have 4 countries (the United States, Canada, Peru, Brazil), and Europe includes 6 countries (the United Kingdom, Germany, Italy, Netherlands, Poland, Switzerland).

Employing VOSviewer software further, co-authorship connections among countries were investigated, setting a minimum occurrence threshold of 5 publications for each country. The findings, depicted in Figure 4, were thus obtained.

Based on this statistical analysis, four countries with author groups publishing over 5 documents are listed at the respective country addresses, with China having the highest number of publications and the United Kingdom having the highest number of citations. However, up to this point, the total link strength index = 0 indicates that there is no collaborative relationship among these countries' research groups, mainly consisting of independent research.

3.1.3. Type of document

Based on Figure 4, it is evident that as much as 41.2% of the publications in the SCOPUS dataset are derived from scientific journals, accounting for 28 papers. Following that are conference papers, comprising 35.3% (24 papers), with the remainder being other forms of publication such as books, book chapters, conference reviews, notes, and editorials.

Table 2. Statistics of co-authorship relationships between countries

Selected	Country	Documents	Citations	Total link strength
☑	China	14	14	0
☑	India	5	3	0
☑	Russian Federation	7	12	0
☑	United Kingdom	5	67	0
☑	United States	6	19	0

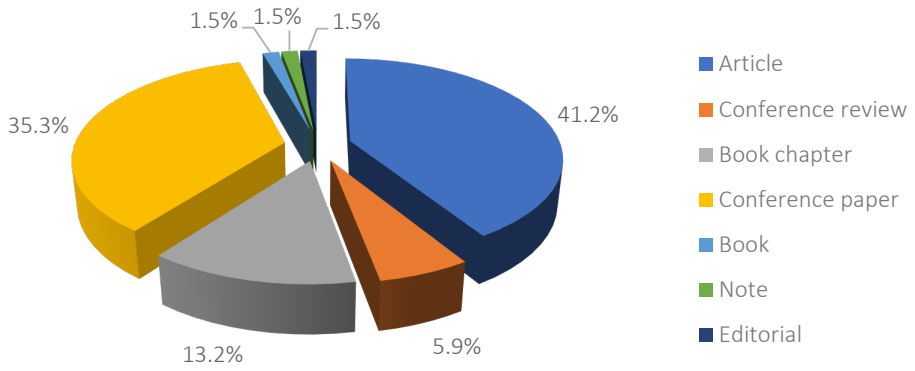

Figure 4. Analysis by type of publication

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Table 3. Top 10 journals/conference proceedings

Source: Scimago, Scopus output.

Rank	Journal name / Conference name	Subject	Articles	Citation	Citations per document	Scopus quartile	H-index	SCImago Journal Ranking 2023
1	Communications in Computer And Information Science	Computer Science (miscellaneous)/ Mathematics (miscellaneous)	4	1	0.3	Q4	69	0.2
2	AIP Conference Proceedings	Physics and Astronomy (miscellaneous)	3	26	8.7	Not yet	83	0.15
3	Frontiers In Artificial Intelligence and Applications	Computer Science (Artificial Intelligence)	3	12	4.0	Q4	64	0.28
4	ACM International Conference Proceeding Series	Computer Science (Artificial Intelligence)	2	2	1.0	Not yet	151	0.25
5	Advances in Intelligent Systems and Computing	Computer Science (miscellaneous)/ Engineering (Control and Systems Engineering)	2	2	1.0	None (out Scopus in 2021)	69	0
6	Artificial Intelligence and Law	Computer Science (Artificial Intelligence)/Social Sciences (Law)	2	19	9.5	Q1	49	1.5
7	Journal of Physics Conference Series	Physics and Astronomy (miscellaneous)	2	4	2.0	Q4	99	0.18
8	Law Teacher	Social Sciences (Education/Law)	2	13	6.5	Q3	14	0.19
9	Revista Juridica	Social Sciences (Law)	2	1	0.5	Q3	3	0.15
10	Revista Opiniao Juridica	Social Sciences (Law)	2	5	2.5	Q3	2	0.15

Table 3 shows that the topic of AI and legal education is predominantly published in conference proceedings within the field of computer science, focusing on the development of AI in various domains, including social sciences (law). Additionally, some journals such as Artificial Intelligence and Law, Law Teacher, Frontiers in Artificial Intelligence and Applications, Revista Juridica, and Revista Opiniao Juridica feature articles related to the topic of AI and legal education. However, except for the Artificial Intelligence and Law journal, which is ranked Q1, most of the other journals are ranked only at Q3 and Q4 levels, and some journals have even been excluded from the Scopus database (such as Advances in Intelligent Systems and Computing). Nonetheless, the H-Index scores of these journals and conferences are relatively high, indicating that the articles have a high citation performance.

3.1.4. Research field

Based on Figure 5, the fields of Computer Science and Social Sciences are the two fields with the most publications related to the topic, with 35

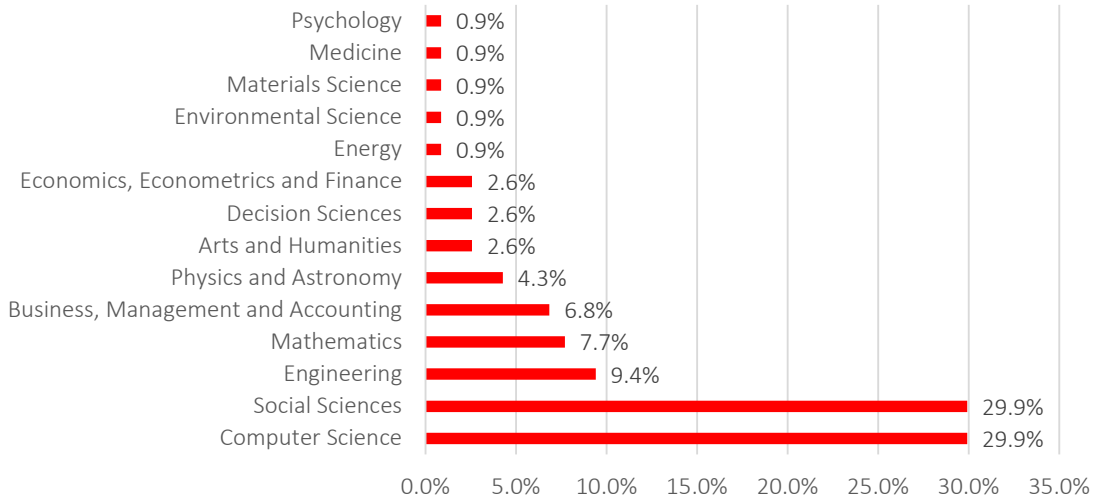

Figure 5. Analysis by field of publication

documents each (accounting for 29.9%). This is quite reasonable as the AI topic is often associated with the field of Computer Science, while legal education relates to the field of Social Sciences. Additionally, a single study may be related to multiple fields, hence the total percentage may exceed 100%, indicating a trend towards interdisciplinary research.

3.2. Co-citation analysis

The co-citation network associated with the AI and legal education model was revealed and visually represented using VOSviewer software. Using its visualization capabilities, observers can identify the most frequently cited publications in the citation network and understand the citation connections between these publications and their associated clusters (van Eck & Waltman, 2017). From an initial pool of 68 articles, a co-citation analysis requiring a minimum of 8 citations per article revealed 2 clusters within the co-citation network of documents on AI and legal education, involving 9 authors

Figure 6 illustrates the visualization outcome produced by VOSviewer, portraying the citation relationships within two clusters. Cluster 1, highlighted in red, encompasses 6 notable authors: Reed C., Aleven V., Pinkwart N., Walton D., Lynch C., and

Table 4. Top article or conference paper with the highest citations

Authors' names	Document title	Journal/ Conference name	No. of citation
Reed and Grasso (2007)	Recent advances in computational models of natural argumen	International Journal of Intelligent Systems	44
Fobel and Kuzior (2019)	The future (Industry 4.0) is closer than we think. Will it also be ethical?	AIP Conference Proceedings	26
Simpson (2016)	Algorithms or advocacy: does the legal profession have a future in a digital world?	Information & Communications Technology Law	19
Ajevski et al. (2023)	ChatGPT and the future of legal education and practice	The Law Teacher	13
Shahzadi et al. (2021)	6G vision: Toward future collaborative cognitive communication (3c) systems	IEEE Communications Standards Jounral	13
Janeček et al. (2021)	Education for the provision of technologically enhanced legal services	Computer Law & Security Review	10
Xu et al. (1999)	A fuzzy theoretical approach to case-based representation and inference in CISG	Artificial Intelligence and Law	10
Demchenko et al. (2021)	Digital Transformation of Legal Education: Problems, Risks and Prospects	European Journal of Contemporary Education	9
Mommers et al. (2009)	Understanding the law: improving legal knowledge dissemination by translating the contents of formal sources of law	Artificial Intelligence and Law	9

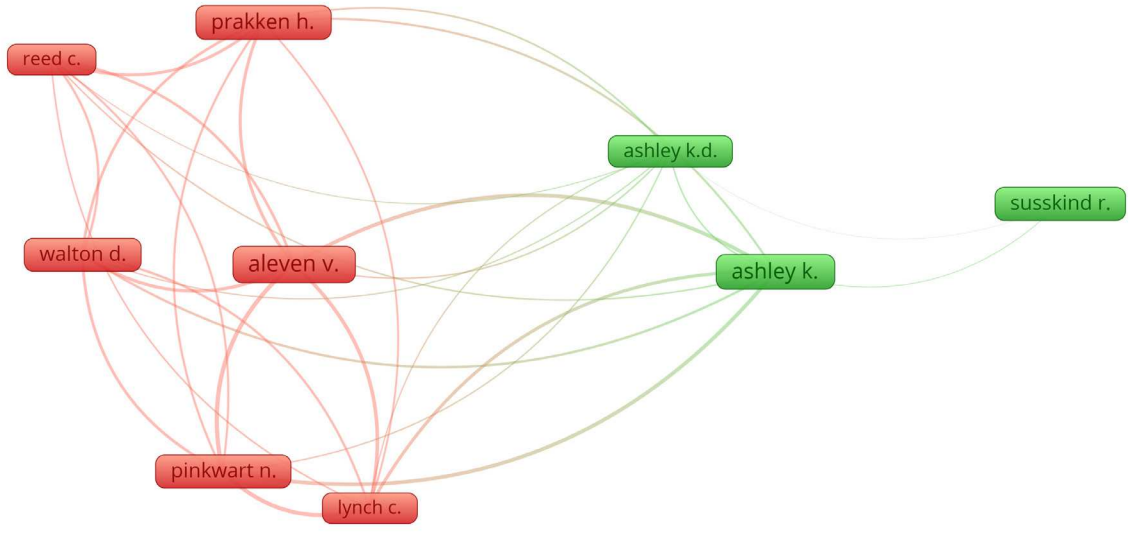

Figure 6. Co-citation network map by authors

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Prakken H. Meanwhile, Cluster 2, highlighted in green, includes 3 prominent authors: Ashley. K.D, Ashley. K, and Susskind. R. Based on identifying these two author clusters and an extensive analysis of the research literature, the author group has assembled the data presented in Table 4.

3.3. Co-occurrence analysis

A comprehensive analysis of 444 keywords suggested by the authors of the 68 retrieved papers from SCOPUS was conducted using VOSviewer 1.6.20 software. The criteria set required keywords to appear at least three times. The size of the bubbles reflects the frequency of occurrence of the keywords, while the thickness of the connecting lines between two keywords signifies the intensity of their co-occurrence. From this analysis, 21 keywords met the specified condition. The results from VOSviewer indicate that these keywords were grouped into 5 clusters, as depicted in Figure 7 and detailed in Table 5.

As shown in Figure 8, the trajectory of the yellow cluster represents the most recent research direction, covering the period from 2022 to the present. According to the keywords presented in Table 4, these studies focus on improving technical education systems at universities and colleges through educational technology, modern legal learning systems, and the application of artificial intelligence and algorithms in the legal field.

Table 5. Keyword analysis statistics

Cluster	Keywords and frequency of occurrence	Theme
1 (Red)	**6 keywords:** colleges and universities (3), curricula (3), education computing (9), engineering education (7), learning systems (3), students (10)	Enhancing technical education systems at universities and colleges through educational technology and modern legal learning systems
2 (Green)	**6 keywords:** algorithms (3), artificial intelligence (43), law (3), lawyers (3), legal profession (6), technology (4)	Applying artificial intelligence and algorithms in the legal industry: Revolutionizing the legal profession and legal practice
3 (Blue)	**5 keywords:** computation theory (3), e-learning (5), legal education (31), legal reasoning (4), legal technology (3)	Applying Computational Theory and E-Learning Technology in Legal Education: Enhancing Legal Argumentation Skills and Utilizing Legal Technology
4 (Yellow)	**3 keywords:** education (4), laws and legislation (6), legal knowledge (3)	Legal Education and Legal Knowledge: Building a Foundation of Legal Understanding Through Education
5 (Purple)	**1 keyword:** digital transformation (3)	Digital Transformation in Legal Education

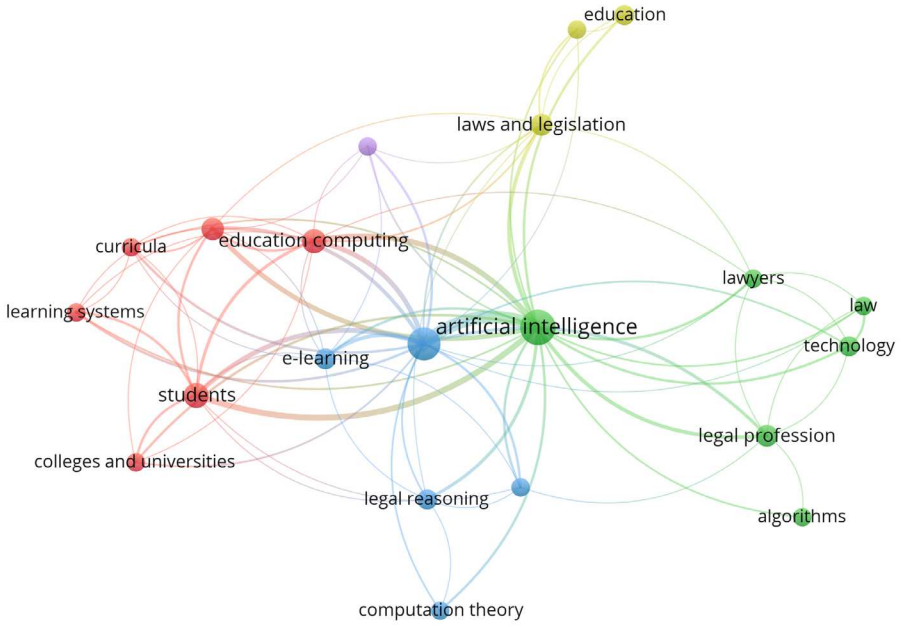

Figure 7. Map of co-occurrence by keywords

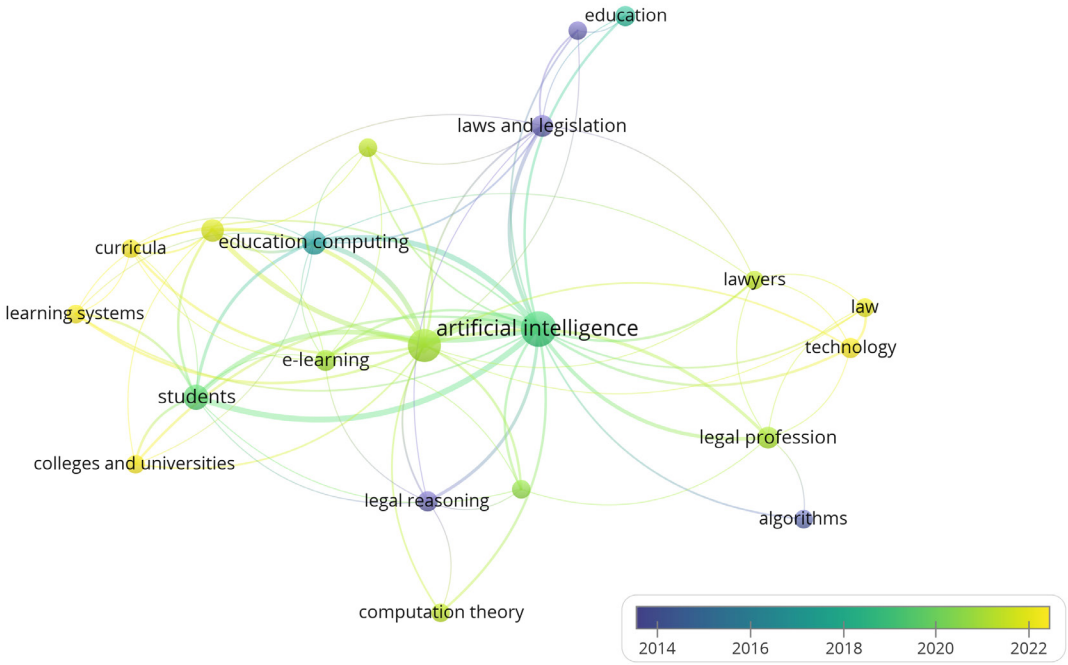

Figure 8. Overlay visualization map of co-occurrence by keywords

4. DISCUSSION

From 1999 to 2024, the topic of AI and legal education has garnered considerable attention from authors worldwide, as evidenced by the analysis of formal publications in the Scopus database. By employing VOSviewer software for descriptive statistical, co-citation analysis, and keyword analysis, the author group has categorized previous research into five main directions.

Firstly, the research direction related to "*Improving technical education systems at colleges and universities through educational technology and modern learning systems*". This research direction is the most recent trend, with the most frequently appearing keywords in this cluster being "colleges and universities," "curricula," "education computing," "engineering education," "learning systems," and "students." The studies in this direction primarily address the following issues:

1) *Integrating technology in education*: Using educational technology (EdTech) to enhance the learning experience of engineering students;

2) *Curriculum development*: Designing and improving technical curricula to align with modern requirements and technological advancements;

3) *Learning systems:* Implementing intelligent learning systems and digital learning support tools;

4) *Enhancing teaching quality*: Training and supporting instructors in utilizing technology tools to improve teaching effectiveness;

5) *Enhancing student experience:* Creating new and innovative learning methods to provide engineering students with better learning experiences and more efficient knowledge absorption. This theme can serve as the foundation for research, discussions, and projects aimed at enhancing the quality of technical education at higher education institutions.

Illustrative studies in this direction include those authored by A. Babacan and H. Babacan, (2015), Saxer (2000), Thanaraj and Gledhill (2023).

Secondly, a subsequent research direction delves into the theme of "Applying artificial intelligence and algorithms in the legal industry: *Revolutionizing the legal profession and legal practice*". While more focused than the initial research

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direction, it reflects a recent trend. Key terms defining this cluster encompass "algorithms," "artificial intelligence," "law," "lawyers," "legal profession," and "technology". The primary subjects for this subsequent research direction are as follows:

1) *AI in legal research*: Using artificial intelligence to analyze legal texts, research documents, and predict legal trends;

2) *Algorithm in legal consulting*: Developing algorithms to assist lawyers in legal consulting and decision-making;

3) *Automation of legal processes*: Applying technology to automate legal processes, such as drafting contracts, handling legal documents, and case management;

4) *AI and professional ethics:* Exploring ethical and legal issues related to the use of AI in the legal industry, including privacy rights, data security, and legal responsibility;

5) *Training and preparation for the future:* Preparing lawyers and law students with the skills and knowledge needed to work effectively in a technology-supported legal environment.

Illustrative studies in this direction include those authored by Ma and Hou (2021), Alarie et al. (2018), Biresaw (2023), Hu and Lu (2020), and Shi et al. (2024).

Thirdly, the research direction related to "*Application of computation theory and e-learning technology in legal education: Enhancing legal reasoning skills and utilizing legal technology*" is also a noteworthy trend in the current widespread need for innovative teaching methods in education in general and legal education in particular. The key keywords for this cluster include "computation theory," "e-learning," "legal education," "legal reasoning," and "legal technology". The primary subjects for this subsequent research direction are as follows:

1) *Computation theory in legal education*: Using concepts and methods from computation theory to improve the approach to and resolution of legal issues;

2) *E-learning in legal training*: Implementing e-learning platforms and tools to enhance the learning experience for law students, including distance learning, online learning, and interactive modules;

3) *Development of legal reasoning skills*: Using technology and online learning methods to train and enhance students' legal reasoning skills;

4) *Legal technology in education*: Integrating modern legal technologies into the curriculum to familiarize students with and proficiently use legal support tools;

5) *Innovative teaching methods*: Exploring creative and effective teaching methods based on e-learning and computation theory to improve the quality of legal training.

Illustrative studies in this direction include those authored by Kopotun et al. (2020), Douglas and Johnson (2010), and Kapoor et al. (2024).

Fourthly, the research direction related to "*Legal education and legal knowledge: Building a foundation of legal understanding through education*". This research direction includes key keywords such as "education," "laws and legislation," and "legal knowledge". The primary subjects for this subsequent research direction are as follows:

1) *Legal education in the education system*: Integrating legal knowledge into the curriculum from elementary to university level to enhance students' and learners' legal awareness;

2) *Development of legal education programs*: Designing and improving legal education programs to meet the requirements of modern society and legal changes;

3) *Enhancing legal literacy for citizens:* Promoting legal education in the community so that individuals can understand and comply with laws, thereby contributing to the construction of a law-abiding society;

4) *Training of teachers and law instructors*: Enhancing the capacity and legal knowledge

of teachers and instructors so that they can effectively impart legal knowledge;

5) *Application of technology in legal education:* Using educational technologies and online tools to improve the teaching and learning of legal knowledge. This theme could serve as a foundation for research, discussions, and projects aimed at improving and disseminating legal education, thereby enhancing legal awareness and understanding in society.

Illustrative studies in this direction include those authored by Goodenough (2012), and Egelandsdal and Færstad (2024).

Fifthly, the research direction related to "*Legal education and legal knowledge: Building a foundation of legal understanding through education*". The primary subjects for this subsequent research direction are as follows:

1) *Integrating technology into legal teaching:* Utilizing digital innovations like artificial intelligence, machine learning, and virtual reality to optimize instructional techniques within legal education;

2) *Developing online learning platforms*: Building and deploying e-learning platforms that allow law students to study remotely and more flexibly;

3) *Improving curriculum design*: Adjusting and updating curriculum to align with the necessary skills and knowledge in the digital legal environment;

4) *Providing digital skills training for law students*: Equipping law students with the necessary digital skills to work effectively in an increasingly digitized legal environment;

5) *Utilizing digital tools in legal research:* Using digital tools and software to support legal research, from legal document retrieval to legal data analysis;

6) *Challenges and opportunities of digital transformation*: Exploring the challenges and opportunities that digital transformation brings to legal education, including information security and privacy issues. This theme could serve as a foundation for research, discussions, and projects aimed at promoting digital transformation in legal education, thereby enhancing the quality of training and preparing law students for the digital age.

Illustrative studies in this direction include those authored by Maharg (2016) and Demchenko et al. (2021).

Therefore, applying quantitative bibliometric analysis techniques using data from the Scopus platform has allowed for a coherent comprehension of the five main research directions outlined above, employing key keywords extracted from publications. Although the number of studies related to the topic is not yet extensive, in line with the current trend of scientific and technological advancement across all fields, it is an inevitable trend in each country and economic region. As a result, the author team puts forward recommendations for prospective research pathways closely linked to the subject of the correlation between AI and legal education, outlined as follows:

1) *Application of artificial intelligence in analyzing and predicting legal trends*. This research direction allows scientists to explore how AI can be used to analyze legal documents, precedents, and legal data to predict trends and changes in the legal system. This can help improve the quality of teaching and learning content in legal education;

2) *Artificial intelligence in personalizing the legal learning experience*. Research in this direction could focus on how AI can be used to develop personalized learning systems for law students, enabling them to access learning materials tailored to their level and learning needs;

3) *AI and legal professional ethics*. This research direction may explore ethical issues related to the use of AI in legal education, including privacy rights, data security, and the impact of AI on the roles and responsibilities of future lawyers and legal experts;

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4) *Development of AI tools to support teaching and legal research*. Scientists may focus on researching and developing AI tools to support educators in lesson planning, grading, and assisting students in researching and addressing complex legal issues;

5) *Integration of AI into online learning systems for legal education*. This could be a direction where scientists focus on researching how AI can be integrated into online learning platforms to enhance teaching and learning effectiveness, including using chatbots to answer student queries, automated grading systems, and performance analysis of learning.

These areas not only enhance the caliber of legal education but also equip law students and professionals with the essential competencies to thrive in the contemporary legal landscape. While the analysis above has identified five historical research trajectories and proposed five novel ones for the near future, this study exclusively relies on the Scopus database for retrieving AI and legal education publications, without incorporating additional sources such as WOS or Google Scholar, Researchgate, and PubMed. Hence, there is a pressing need to broaden the database framework to encompass diverse sources, ensuring a more exhaustive and precise analysis of research directions. Secondly, establishing the frequency of co-citations and the minimum occurrence of keywords based on the intuition of the research team. This also sets the direction for future research endeavors.

CONCLUSION

Using co-citation and co-occurrence analysis methods for 68 publications related to the relationship between artificial intelligence and legal education collected from the Scopus database as of June 3, 2024, this study aims to delineate historical research paths and suggest potential avenues for future research. Descriptive data show that 68 publications were published from 1999 to 2024 with a very limited and intermittent number of studies. The topic of artificial intelligence and legal education has only attracted attention from researchers since 2019 until now. The published studies have been conducted diversely in many countries, with China being the most dominant – this is also the country evaluated to have the most research on artificial intelligence in various industries and fields. Following the analysis, the authors have pinpointed five research trajectories from the past and put forward an additional five for future exploration. This indicates that this is a very promising research direction that may explode in the future when the impact of science and technology, especially artificial intelligence, begins to spread to all countries worldwide, especially developing and underdeveloped countries.

AUTHOR CONTRIBUTIONS

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