International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050

INTERNATIONAL JOURNAL OF MODERN EDUCATION (IJMOE)
www.ijmoe.com

GLOBAL ACADEMIC EXCELLENCE

AI-ASSISTED ADAPTIVE IN TEACHING AND LEARNING: A BIBLIOMETRIC REVIEW

Asmara Alias[1*], Bahbibi Rahmatullah[2], Marzita Mansor[3]

[1] Department of Computer Science and Digital Technology, Faculty of Computing and Meta Technology, Universiti Pendidikan Sultan Idris (UPSI), Perak, Malaysia
Email: asmara@meta.upsi.edu.my
[2] Department of Software Engineering and Smart Technology, Faculty of Computing and Meta Technology, Universiti Pendidikan Sultan Idris (UPSI), Perak, Malaysia
Email: bahbibi@meta.upsi.edu.my
[3] Department of Computer Science and Digital Technology, Faculty of Computing and Meta Technology, Universiti Pendidikan Sultan Idris (UPSI), Perak, Malaysia
Email: marzita@meta.upsi.edu.my
[*] Corresponding Author

Article Info:

Article history:
Received date: 30.09.2025
Revised date: 20.10.2025
Accepted date: 28.11.2025
Published date: 15.12.2025

To cite this document:

Alias, A., Rahmatullah, B., & Mansor, M. (2025). AI-Assisted Adaptive in Teaching and Learning: A Bibliometric Review. *International Journal of Modern Education, 7* (28), 720-735.

DOI: 10.35631/IJMOE.728050

This work is licensed under CC BY 4.0

Abstract:

The rapid advancement with regard to Artificial Intelligence (AI) has transformed multiple educational domains, particularly in adaptive teaching and learning, where AI technologies play a crucial role in personalizing instruction and enhancing learning outcomes. Despite its increasing significance, there remains a lack of comprehensive bibliometric evidence that maps the intellectual structure, research patterns, and emerging trends in this field. This study addresses this gap by conducting a bibliometric analysis of AI-assisted adaptive teaching and learning to identify publication dynamics, research hotspots, and global collaboration networks. Data were collected from the Scopus database via advanced search strategies incorporating the keywords "Artificial Intelligence," "Adaptive," "Teaching," and "Learning," which yielded 866 relevant publications. The dataset was cleaned and harmonized using OpenRefine to ensure consistency, while statistical and graphical analyses were performed through the Scopus analyzer. Visualization of co-authorship, keyword co-occurrence, and thematic clustering was generated using VOSviewer to offer a deeper comprehension regarding the field's conceptual and intellectual structures. The results reveal a significant growth trajectory of publications over the past decade, dominated by contributions from China, the United States, India, and the United Kingdom, highlighting the global nature of research in this area. Keyword co-occurrence analysis identified core themes, for example, intelligent tutoring systems, machine learning (ML), adaptive learning environments, and collaborative learning, with emerging interest in areas like deep learning, educational data mining, and personalized learning pathways. These research findings demonstrate that AI-

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050

assisted adaptive teaching and learning research is highly interdisciplinary, bridging education, computer science, and cognitive sciences, and is increasingly shaped by international collaborations. In conclusion, this study provides an overview of the knowledge structure in AI-driven adaptive education and offers valuable insights for scholars, practitioners, and policymakers. These insights help identify future research directions, strengthen cross-border partnerships, and advance innovative pedagogical frameworks that leverage AI for inclusive and effective learning.

Keywords:

Artificial Intelligence, Adaptive, Information Technology

Introduction

Artificial Intelligence (AI) has emerged as a transformative force in the educational sector, offering opportunities for personalized learning, enhanced student engagement, and administrative efficiency. The integration of AI in education is not just a technological advancement but a paradigm shift that promises to revolutionize traditional teaching and learning methods. AI-assisted adaptive teaching and learning systems leverage machine learning algorithms to tailor educational experiences to individual student needs, optimizing learning outcomes and fostering a more inclusive and efficient educational environment (Guo & Yu, 2023; Raja et al., 2024). This bibliometric analysis aims to explore the trends, patterns, and dynamics of AI-assisted adaptive teaching and learning, providing a comprehensive overview of the current state of research in this field.

The impact of AI on education has been extensively studied, with a focus on its potential to enhance personalized learning experiences, improve student engagement, and streamline administrative tasks. AI-driven tools such as intelligent tutoring systems and automated grading have been shown to significantly boost student performance and reduce the administrative burden on educators (Joel et al., 2024; Ketak et al., 2024). Note that these tools enable personalized learning by adapting instructional content to the individual needs, preferences, and abilities of students, fostering self-directed learning and promoting student autonomy (Chandra, 2025; Kayyali, 2025). However, the integration of AI in education also presents challenges, including high costs, ongoing maintenance, and the risk of widening educational disparities (Joel et al., 2024; Ketak et al., 2024).

Other than that, research has highlighted the dual impact of AI on education, emphasizing both its benefits and drawbacks. AI technologies offer innovative methods for personalized education, optimized outcomes, and enhanced student engagement (Dei, 2025). Nonetheless, concerns about reduced teacher roles, increased student dependence on technology, and ethical issues such as data privacy and algorithmic bias have been raised (Ellington, 2025). To address these challenges, it is crucial to ensure equitable access to AI technologies, robust governance frameworks, and comprehensive teacher training programs (Aravindh & Singh, 2024).

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050

Bibliometric analysis has emerged as a valuable tool for understanding the trends and patterns in educational research, including the integration of AI in adaptive teaching and learning. By analyzing a comprehensive sample of academic articles, bibliometric approaches can identify key areas of interest, prominent researchers, and the temporal evolution of topics in this field (Gómez et al., 2025; Lim & Ghazali, 2017). Recent studies have shown a significant increase in the use of mixed methodological approaches in educational research, suggesting a trend towards integrating quantitative and qualitative methods to address complex research questions. Additionally, there has been an increase in international collaboration among researchers, highlighting the globalized nature of research in AI-assisted education (García et al., 2025).

The potential of AI to revolutionize education is evident in various practical applications and case studies. AI-powered adaptive learning systems provide individualized content tailored to each student's strengths and weaknesses, significantly improving academic outcomes (Rajput, 2025). These systems allow educators to implement differentiated instruction, accommodating students with varying abilities and learning styles. Moreover, AI-driven chatbots and virtual tutors offer instant guidance and support outside classroom hours, making learning more accessible (Akavova et al., 2023). However, the successful integration of AI in education requires careful consideration of ethical issues, such as data privacy, algorithmic bias, and the digital divide (Akavova et al., 2023; Aravindh & Singh, 2024; Ellington, 2025).

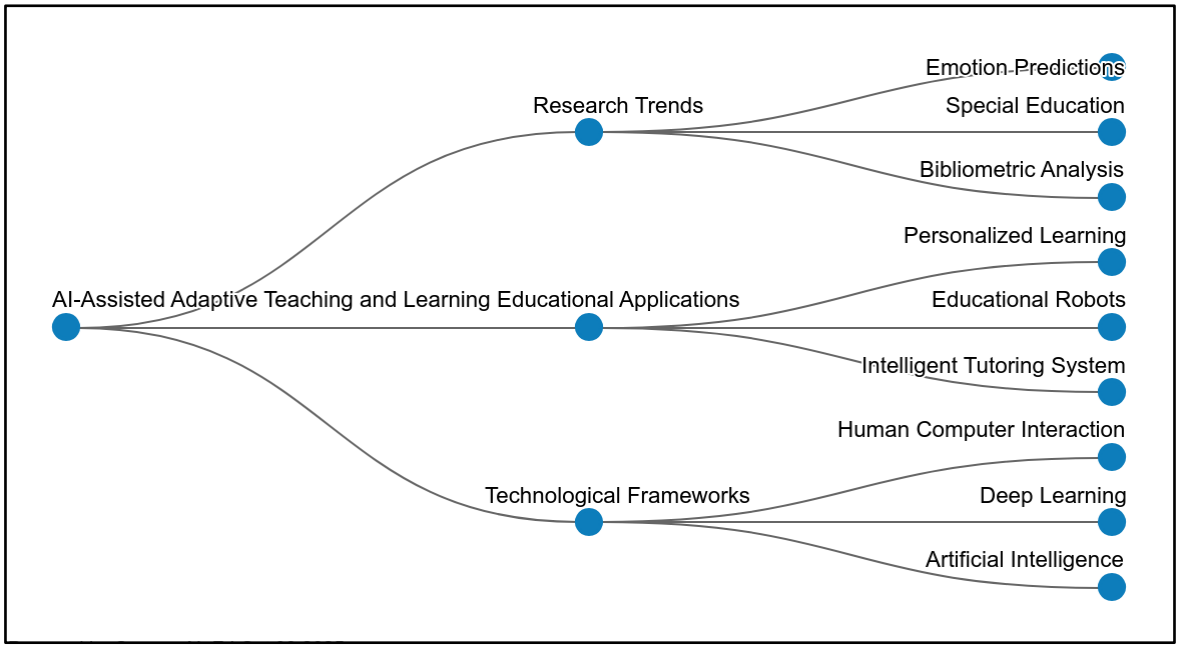

Figure 1: The Concept Map For The Core Dimension

The concept map in Figure 1 highlights the core dimensions of AI-Assisted Adaptive Teaching and Learning by categorizing research into three main clusters: research trends, educational applications, and technological frameworks. Research trends emphasize emerging areas such as emotion predictions, special education, and

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050

bibliometric analysis, reflecting the growing interest in understanding learner diversity, emotional engagement, and knowledge mapping. Educational applications focus on personalized learning, educational robots, and intelligent tutoring systems, showcasing AI's role in tailoring instruction, supporting collaboration, and enhancing real-time feedback for learners. Meanwhile, technological frameworks center on human-computer interaction, deep learning, and the broader field of AI, which provide the technical backbone for adaptive systems. Together, these dimensions illustrate how AI transforms education by integrating cognitive, emotional, and technological aspects to create more responsive and inclusive learning environments. The map concludes that future advancements will rely on bridging educational needs with robust AI technologies, ensuring both accessibility and adaptability across diverse learning contexts.

In conclusion, the integration of AI in adaptive teaching and learning holds significant promise for reshaping education. By leveraging AI technologies, educators can create personalized and effective learning experiences that cater to the diverse needs of students. However, to fully realize the potential of AI in education, it is essential to address the associated challenges and ensure equitable access to these technologies. This bibliometric analysis provides valuable insights into the current state of research in AI-assisted adaptive teaching and learning, highlighting the trends, patterns, and dynamics that are shaping the future of education.

Research Question

RQ1: What are the research publications of AI in Teaching and Learning up to the year of publication?
RQ2: What are the Top Ten Most Cited Authors?
RQ3: Where are the Top Ten Countries of publication most cited?
RQ4: What are popular keywords for this study?
RQ5: What is co-authorship by countries' collaboration?

Methodology

Bibliometrics involves gathering, organizing, and analyzing bibliographic data from scientific publications (Alves et al., 2021; Assyakur & Rosa, 2022; Verbeek et al., 2002). Beyond basic statistics, such as identifying publishing journals, publication years, and leading authors (Wu & Wu, 2017), bibliometrics includes more sophisticated techniques like document co-citation analysis. Hence, conducting a successful literature review requires a careful, iterative process to select suitable keywords, search the literature, and perform an in-depth analysis. This approach helps to compile a comprehensive bibliography and achieve reliable results (Fahimnia et al., 2015). With this in mind, the study focused on high-impact publications, as they provide meaningful insights into the theoretical frameworks that shape the research field. To ensure data accuracy, Scopus served as the primary source for data collection (Al-Khoury et al., 2022; di Stefano et al., 2010; Khiste & Paithankar, 2017). Additionally, to maintain quality, the study only considered articles published in peer-reviewed academic journals, deliberately excluding books and lecture notes (Gu et al., 2019). Elsevier's Scopus, known for its broad coverage, collected publications from 2015 through December 2025 for further analysis.

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050

Data Search Strategy

To ensure comprehensive coverage of literature on AI in assistive and adaptive teaching and learning, a systematic search strategy was employed using Elsevier's Scopus database, which is widely acknowledged for its comprehensive indexing of peer-reviewed academic publications. The search was conducted in October 2025, as in TABLE 1, through the Scopus advanced search feature. The query string applied was **TITLE-ABS-KEY ((“Artificial intelligent”) AND (assist* OR adapt*)) AND PUBYEAR > 2009 AND PUBYEAR < 2026 AND (LIMIT-TO (DOCTYPE, “ar”) OR LIMIT-TO (DOCTYPE, “cp”)) AND (LIMIT-TO (LANGUAGE, “English”))**. This formulation was carefully designed to capture relevant research where AI is directly associated with assistive or adaptive functions in educational contexts.

The scope was set between 2010 and 2025 to reflect recent developments in AI applications within education, while ensuring a sufficiently broad time window to capture trends and emerging patterns. The search was further refined, as shown in TABLE 2, by limiting document type to journal articles and conference proceedings, as these represent high-quality, peer-reviewed sources and are most suitable for bibliometric analysis. Excluded from consideration were books, book chapters, reviews, and other non-article sources, as these often duplicate or synthesize findings rather than present original research. Additionally, the language filter was restricted to English to ensure consistency in analysis and accessibility of content.

Note that applying these criteria yielded an initial dataset of 866 documents. This corpus provides a robust foundation for subsequent bibliometric analysis, allowing for the identification of key publication outlets, collaborative networks, influential authors, and evolving research themes in the domain of AI-assisted adaptive teaching and learning.

Table 1

The Search String

Scopus	TITLE-ABS-KEY ((“Artificial intelligent”) AND (assist* OR adapt*)) AND PUBYEAR > 2009 AND PUBYEAR < 2026 AND (LIMIT-TO (DOCTYPE “ar”) OR LIMIT-TO (DOCTYPE, “cp”)) AND (LIMIT-TO (LANGUAGE, “English”)) Accessed Date: October 2025

Table 2

The Selection Criterion Is Searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Time line	2010 – 2025	< 2009

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050

Literature Type	Journal (Article), Conference	Book, Review

Data Analysis

VOSviewer refers to an intuitive bibliometric software established at Leiden University, Netherlands, by Nees Jan van Eck and Ludo Waltman (van Eck & Waltman, 2010, 2017). The software is broadly implemented for analyzing and visualizing scientific literature, focusing on creating clear network visualizations, clustering related elements, as well as producing density maps. Moreover, its flexibility allows the analysis of co-citation, co-authorship, and keyword co-occurrence networks, providing researchers with a detailed view with regard to research landscapes. Note that the interactive interface and regular updates facilitate dynamic and practical exploration regarding large datasets. VOSviewer's capability to customize visualizations, to measure metrics, and integrate with multiple bibliometric data sources encourages it an essential tool for researchers seeking to understand complex research domains.

Datasets that include information such as title, publication year, journal, author name, citation, as well as keywords in PlainText format were gathered from the Scopus database, covering the period from 2015 to December 2025. These datasets were subsequently determined utilizing VOSviewer software version 1.6.20. By employing VOS clustering and mapping techniques, the software enabled the examination and generation of bibliometric maps. Serving as an alternative to the Multidimensional Scaling (MDS) method, VOSviewer positions items within the range of low-dimensional spaces, which ensures that the distance between any two items precisely represents their degree of similarity and relatedness (van Eck & Waltman, 2010). Here, VOSviewer shares certain similarities with the MDS approach (Appio et al., 2014). However, unlike MDS—which mainly depends on similarity measures such as Jaccard and cosine indices—VOS utilizes a more appropriate method with regard to normalizing co-occurrence frequencies, known as the Association Strength (AS_{ij}), which is measured as (Van Eck & Waltman, 2007):

$$AS_{ij} = \frac{C_{ij}}{w_i w_j},$$

where is "proportional to the ratio between on the one hand the observed number of co-occurrences of *i* and *j* and on the other hand the expected number of co-occurrences of *i* and *j* under the assumption that co-occurrences of *i* and *j* are statistically independent" (Van Eck & Waltman, 2007).

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050

Findings

RQ1: What Are The Research Publications Of AI In Teaching And Learning Up To The Year Of Publication?

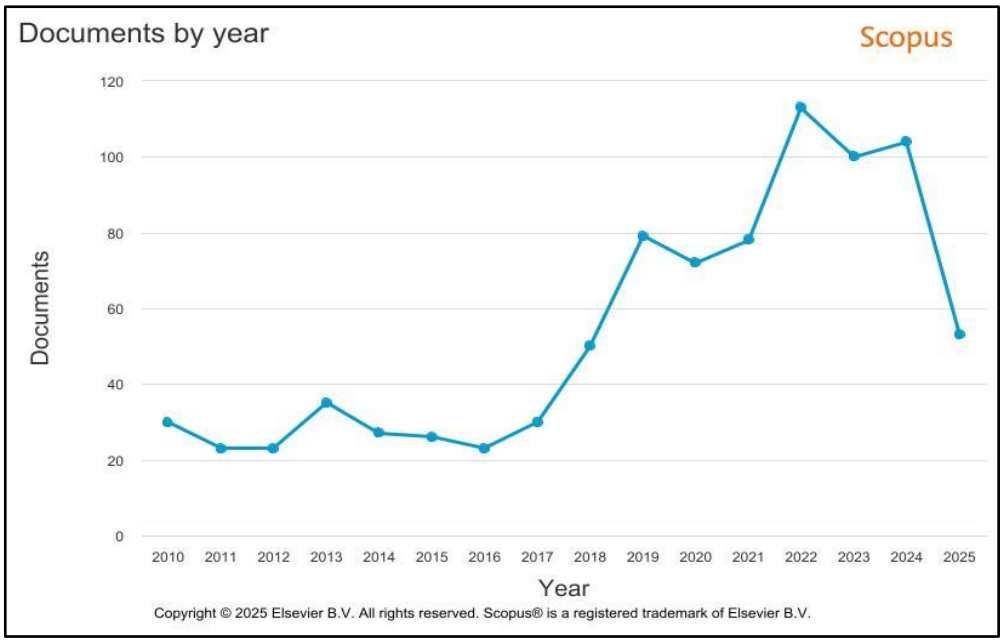

Figure 2: Publication of AI in Teaching and Learning by Years

Table 3: Number Of Publications By Years

Year	Number of Publications	Percentage
2025	53	6.1
2024	104	12.0
2023	100	11.5
2022	113	13.0
2021	78	9.0
2020	72	8.3
2019	79	9.1
2018	50	5.8
2017	30	3.5
2016	23	2.7
2015	26	3.0
2014	27	3.1
2013	35	4.0
2012	23	2.7
2011	23	2.7
2010	30	3.5

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050

The publication trend from 2015 to 2025 in TABLE 3 indicates a steady growth in research on *AI-Assisted Adaptive Teaching and Learning*, with notable acceleration after 2017. Between 2010 and 2016, annual outputs fluctuated modestly, ranging between 23 and 35 publications, suggesting that early exploration of AI in education was still at a formative stage, primarily driven by conceptual and experimental studies. A significant upward trajectory begins in 2017, rising sharply from 30 publications in 2017 to 113 in 2022, highlighting the rapid integration with respect to AI technologies in educational research. This surge aligns with global advancements in natural language processing, machine learning, and adaptive systems, which began to demonstrate scalable applications in digital learning platforms. Furthermore, the COVID-19 pandemic (2020–2021) likely accelerated the adoption of AI-driven solutions in online and blended learning, reflected in the strong publication growth during these years.

Interestingly, the data reveal a peak in 2022 (113 publications), followed by a slight decline in 2023 (100) and 2024 (104), and a more noticeable drop in 2025 (53). This decline may be attributed to two factors. First, 2025 data may be incomplete since the dataset was collected in October, meaning the final year's count could still increase. Second, publication saturation could be occurring, where the field has transitioned from broad exploratory studies to more specialized, interdisciplinary research, thereby reducing overall volume but potentially increasing depth and quality. Overall, the trend reflects both technological momentum and contextual influences, showing how AI has become a central component in shaping adaptive teaching and learning practices while also indicating a potential stabilization of the field.

RQ2: What are the Top Ten Most Cited Authors?

The top ten most influential works by Authors in *AI-Assisted Adaptive Teaching and Learning,* as in TABLE 4, reveal the interdisciplinary nature of research driving this study.

Table 4: Top Ten Most Cited Authors

Authors	Title	Source title	Cited by
Ucar & Korkmaz (2020)	COVIDiagnosis-Net: Deep Bayes-SqueezeNet based diagnosis of the coronavirus disease 2019 (COVID-19) from X-ray images	Medical Hypotheses	648
McLean & Osei-Frimpong (2019)	Hey Alexa … examine the variables influencing the use of artificial intelligence in-home voice assistants	Computers in Human Behaviour	562
Lv et al. (2021)	Does a cute artificial intelligence assistant soften the blow? The impact of cuteness on customer tolerance of assistant service failure	Annals of Tourism Research	264
Yang et al.(2022)	Bioinspired Phototropic MXene-Reinforced Soft Tubular Actuators for Omnidirectional Light-Tracking and Adaptive Photovoltaics	Advanced Functional Materials	259
Hasan et al.(2021)	Consumer trust and perceived risk for voice-controlled artificial intelligence: The case of Siri	Journal of Business Research	230
Iwendi et al. (2020)	Realizing an Efficient IoMT-Assisted Patient Diet Recommendation System Through Machine Learning Model	IEEE Access	200

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050

Pham et al. (2020)	Development of advanced artificial intelligence models for daily rainfall prediction	Atmospheric Research	188
van Dijk et al.(2020)	Improving automatic delineation for head and neck organs at risk by Deep Learning Contouring	Radiotherapy and Oncology	182
Hong et al.(2020)	Modelling landslide susceptibility using LogitBoost alternating decision trees and forest by penalizing attributes with the bagging ensemble	Science of the Total Environment	177
Tian & Mao (2010)	An ensemble ELM based on modified AdaBoost.RT algorithm for predicting the temperature of molten steel in ladle furnace	IEEE Transactions on Automation Science and Engineering	176

The most cited article title *COVIDiagnosis-Net* by Ucar and Korkmaz (2020) with 648 citations, highlights the role of AI in medical diagnostics during the COVID-19 pandemic, demonstrating how global crises accelerate research in adaptive AI systems. Following this, McLean and Osei-Frimpong (2019) discovered factors impacting the adoption of AI-powered voice assistants in *Computers in Human Behaviour* (562 citations), underscoring the growing significance of AI in everyday learning environments through in-home technologies.

Note that highly cited works emphasize user interaction and trust in AI. Lv et al. (2021) examined the impact of anthropomorphic design, showing how "cuteness" in AI assistants affects tolerance of service failures (264 citations). Similarly, Hasan et al. (2021) investigated consumer trust and risk perception in voice-controlled AI (*Journal of Business Research*, 230 citations). Beyond human–AI interaction, technical advancements also dominate, such as Yang et al. (2022) on adaptive photovoltaics (259 citations) and Iwendi et al. (2020) on IoMT-assisted diet recommendations (200 citations).

Environmental and engineering applications, including rainfall prediction (Pham et al., 2020, 188 citations), automated delineation in oncology (van Dijk et al., 2020, 182 citations), landslide susceptibility (Hong et al., 2020, 177 citations), and steel temperature prediction (Tian & Mao, 2010, 176 citations), further illustrate the broad impact of AI. Collectively, these studies reflect how AI's adaptive potential extends across healthcare, education, consumer interaction, and environmental systems, shaping both theoretical and applied dimensions of learning and adaptation.

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050

RQ3: Where Are The Top Ten Countries Of Publication Most Cited?

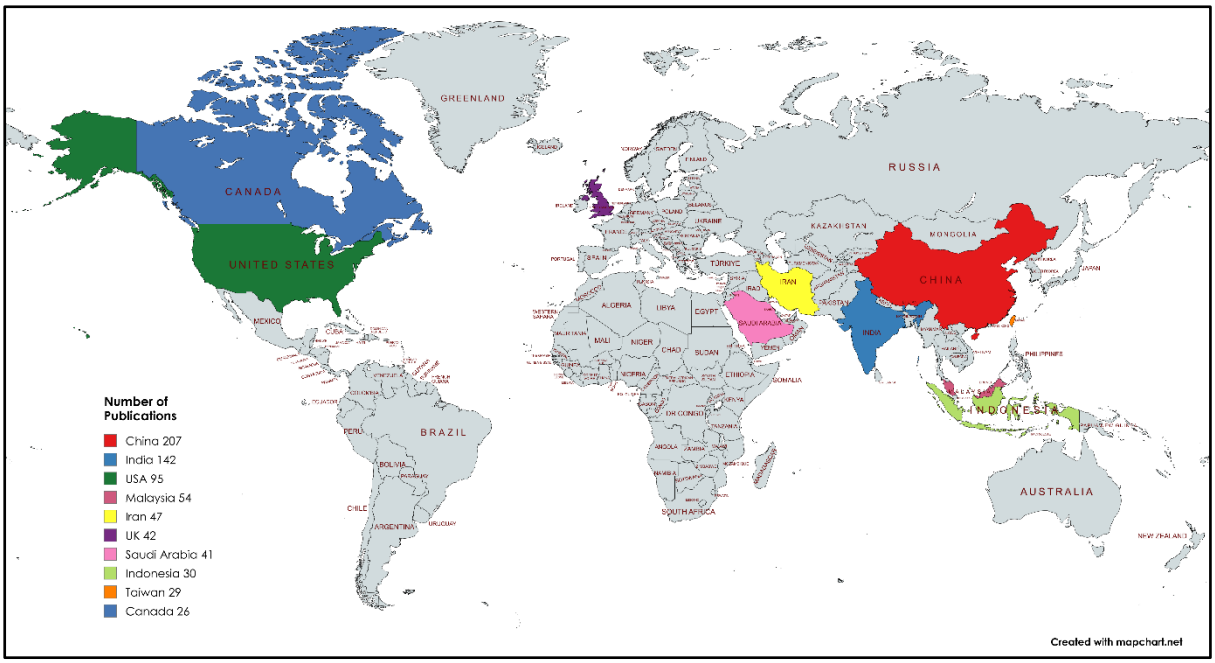

Figure 3: Top Ten Countries of Publication Most Cited

Figure 3 illustrates the distribution of publications, clearly dominated by Asian nations, particularly China (207 documents) and India (142 documents).

China's leadership can be attributed to its strong national policies and investments in AI as part of its broader technological development agenda. India's high output reflects its growing emphasis on digital learning technologies and the large-scale adoption of AI in education, driven by its vast population and government initiatives like Digital India. The United States, traditionally a leader in AI research, shows a slightly lower output compared to China and India, with 95 documents. This may be because much of its AI educational research is dispersed across interdisciplinary domains and is not always indexed under the narrow scope of AI-assisted adaptive teaching and learning.

The middle tier is from Malaysia (54), Iran (47), the United Kingdom (42), and Saudi Arabia (41), reflecting the growing global focus on integrating AI with educational technologies in both developed and developing contexts. Malaysia and Saudi Arabia's relatively high outputs can be linked to government policies encouraging EdTech innovation and research funding in higher education institutions. Meanwhile, Indonesia (30), Taiwan (29), and Canada (26) represent emerging contributors, likely due to growing collaborations, regional research networks, and the increasing accessibility of AI tools in education. Therefore, the overall distribution emphasizes that while AI in adaptive teaching is a global concern, publication output is shaped by national priorities, funding availability, and policy frameworks that encourage the integration of AI into educational systems.

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050

RQ4: What Are Popular Keywords For This Study?

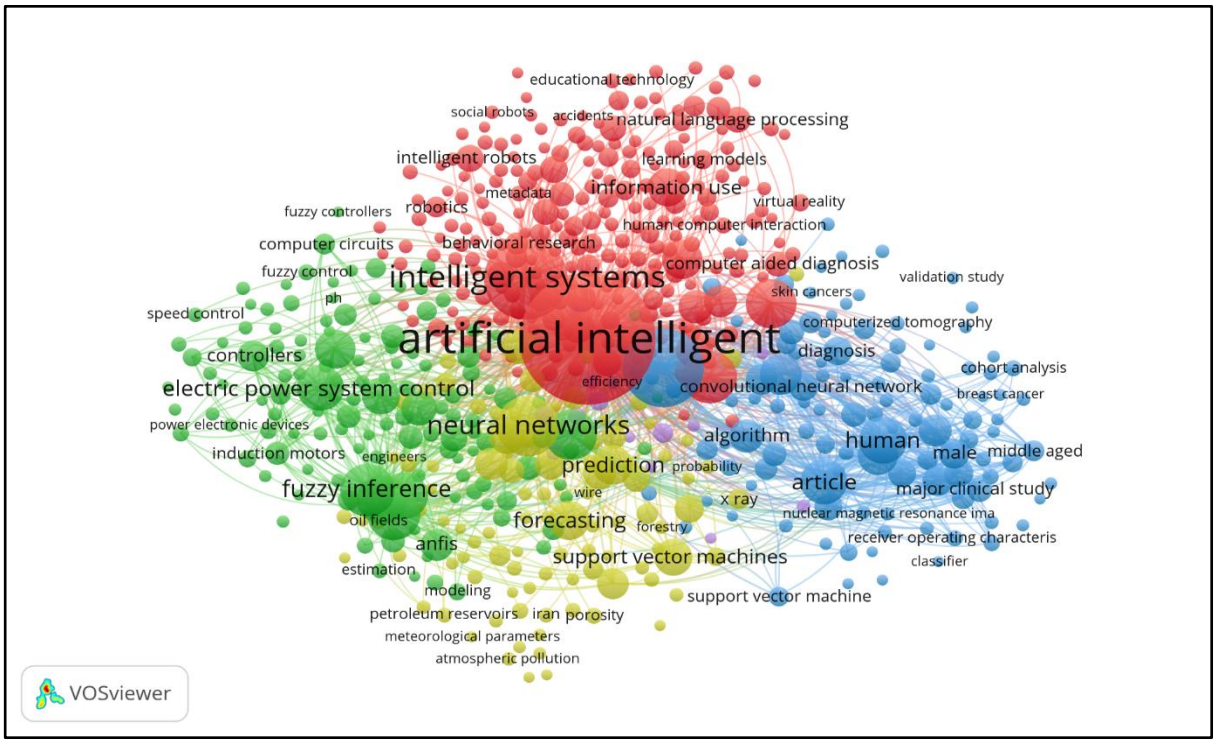

Figure 4 Network Visualization for Popular Keywords in the Study

The visualization networks shown in Figure 4 illustrate how keywords such as AI, intelligent systems, neural networks, fuzzy inference systems, and machine learning dominate the network. Here, node size indicates frequency, and link strength represents their interconnectedness. Co-occurrence analysis of author keywords in VOSviewer identifies how frequently specific terms appear together across a collection of publications, revealing thematic connections and research patterns within the field. In this study, the analysis was conducted using the full counting method, with a minimum occurrence threshold of five. Out of 7,979 total keywords, 589 met the threshold, and a minimum cluster size of five was set, resulting in the generation of five clusters. Through this visualization, the network reveals the most influential terms and how they co-occur to form clusters that represent subfields or thematic focuses in AI research.

The results contribute to the body of knowledge by highlighting the intellectual structure of the field and mapping both emerging and established research directions. The strong presence of clusters around topics like machine learning, deep learning, fuzzy systems, diagnostic imaging, and Industry 4.0 demonstrates the multidisciplinary applications of AI in both technical and applied domains. This reinforces the growing role with regard to AI in healthcare, industrial systems, education, and optimization technologies. By identifying co-occurring keywords and their clusters, the analysis provides researchers with insights into current trends, dominant paradigms, and potential research gaps, thereby offering a structured understanding of how AI-driven studies evolve and intersect across disciplines.

International Journal of Modern Education
EISSN: 2637-0905
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050

RQ5: What Is Co-Authorship By Countries' Collaboration?

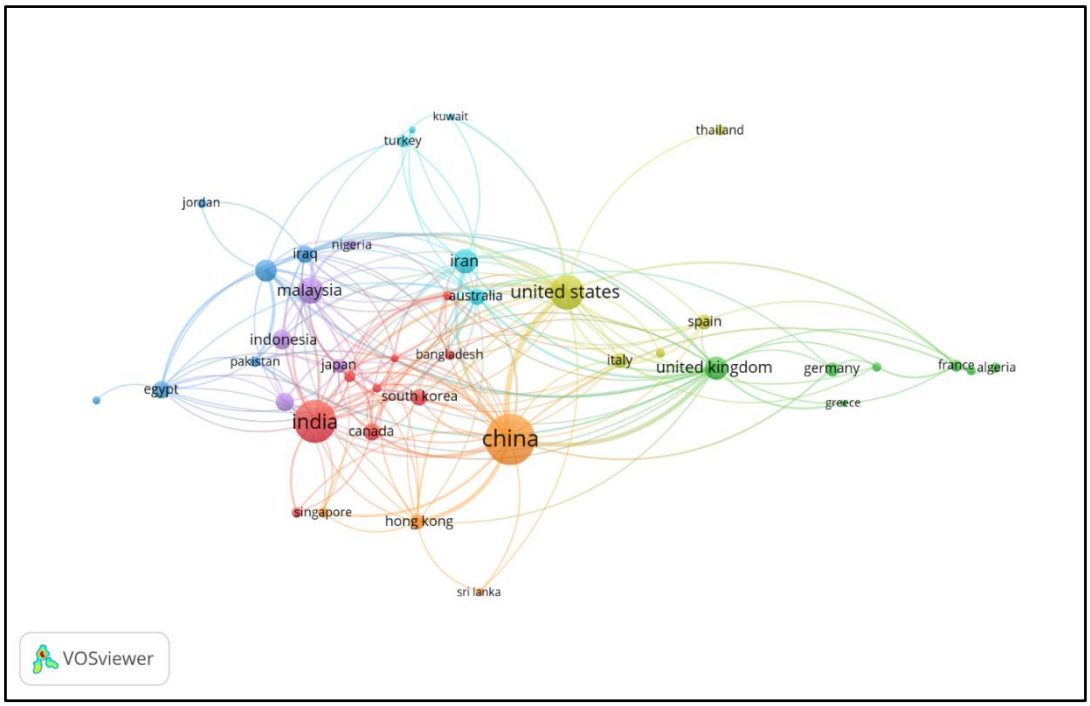

Figure 5 Network Visualization for Co-Authorship by Countries

Co-authorship by countries in VOSviewer, as in Figure 5, refers to analyzing scientific collaboration patterns between nations by examining how often authors from different countries publish together. This type of co-occurrence analysis provides insights into international research networks, showing which countries are most active and interconnected in contributing to a specific research domain.

In this map, the full counting method was applied with a minimum threshold of five documents, resulting in 42 out of 80 countries being included. A minimum cluster size of five was also set, producing seven clusters that represent groups of countries with stronger collaborative ties. The network visualization highlights both the productivity of individual countries and the intensity of their collaboration links, with node size showing the volume of publications and link strength demonstrating the depth of partnerships.

The findings add to the body of knowledge by identifying leading nations in the field, such as China, the United States, the United Kingdom, India, and Saudi Arabia. These nations produce a high volume of research and demonstrate strong collaboration networks. Regional patterns emerge, with countries like Malaysia, Egypt, and Iraq forming active partnerships within their clusters, while developed nations such as Australia, Canada, and European countries connect through established international collaborations. This demonstrates how knowledge production in AI and related domains is shaped by global cooperation, highlighting both dominant players and emerging contributors. Such insights are valuable for understanding the dynamics of scientific advancement, encouraging cross-border partnerships, and informing policy decisions to strengthen global research capacity.

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050

Conclusion

This bibliometric analysis aimed to assess the intellectual structure, research dynamics, and global collaboration networks within the domain of AI-assisted adaptive teaching and learning. By examining 866 publications indexed in Scopus, this research aimed to address key questions concerning publication trends, highly cited authors, influential countries, prominent keywords, and patterns of international co-authorship.

The findings determine that research activity in this field has grown significantly over the past decade, with a notable increase from 2017 onwards, reflecting the broader integration of AI into educational contexts. Leading contributions have emerged from China, the United States, India, and the United Kingdom, supported by expanding regional participation from countries such as Malaysia, Saudi Arabia, and Iran. Keyword analysis revealed that research themes are concentrated around intelligent tutoring systems, adaptive learning environments, machine learning, deep learning, and educational data mining, underscoring the interdisciplinary nature of this area.

This research advances the field by mapping the evolution of AI-assisted adaptive learning research and offering insights into emerging and established themes, and highlighting the significance of international collaboration in shaping knowledge production. The results indicate strong practical implications, as the findings may inform policy frameworks, guide the development of adaptive educational technologies, and encourage evidence-based decision-making in education systems. Nonetheless, the analysis is limited by its reliance on Scopus as the sole database, exclusion of non-English publications, and the potential incompleteness of data for the year 2025. Future research could develop the scope by integrating multiple databases, incorporating grey literature, and applying longitudinal comparisons across disciplines. Overall, this research highlights the importance of bibliometric approaches in identifying global trends, research gaps, and collaborative patterns. It provides a foundation for scholars and practitioners to further advance the field of AI-assisted adaptive teaching and learning and strengthen its impact on educational innovation.

Acknowledgement

The authors express their sincere gratitude to the Special Interest Group (SIG): Information System and Technology Integration (ISTI) as well as the Faculty of Computing and Meta-Technology (FKMT), Universiti Pendidikan Sultan Idris (UPSI), for their support and the opportunity to prepare and publish this article.

References

Akavova, A., Temirkhanova, Z., & Lorsanova, Z. (2023). Adaptive learning and artificial intelligence in the educational space. In T. M.Y. (Ed.), *E3S Web of Conferences* (Vol. 451). EDP Sciences. https://doi.org/10.1051/e3sconf/202345106011

Al-Khoury, A., Hussein, S. A., Abdulwhab, M., Aljuboori, Z. M., Haddad, H., Ali, M. A., Abed, I. A., & Flayyih, H. H. (2022). Intellectual Capital History and Trends: A Bibliometric Analysis Using Scopus Database. *Sustainability (Switzerland)*, *14*(18). https://doi.org/10.3390/su141811615

Alves, J. L., Borges, I. B., & De Nadae, J. (2021). Sustainability in complex projects of civil construction: Bibliometric and bibliographic review. *Gestao e Producao*, *28*(4). https://doi.org/10.1590/1806-9649-2020v28e5389

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050
Appio, F. P., Cesaroni, F., & Di Minin, A. (2014). Visualizing the structure and bridges of the intellectual property management and strategy literature: a document co-citation analysis. *Scientometrics*, *101*(1). https://doi.org/10.1007/s11192-014-1329-0

Aravindh, K., & Singh, B. (2024). Applications of Artificial Intelligence in Education. In *Next-Generation AI Methodologies in Education* (pp. 21–40). IGI Global. https://doi.org/10.4018/979-8-3693-7220-3.ch002

Assyakur, D. S., & Rosa, E. M. (2022). Spiritual Leadership in Healthcare: A Bibliometric Analysis. *Jurnal Aisyah : Jurnal Ilmu Kesehatan*, *7*(2). https://doi.org/10.30604/jika.v7i2.914

Chandra, R. (2025). Learning reimagined: Role of AI in empowering classroom education. In *Unveiling Social Dynamics and Community Interaction in the Metaverse* (pp. 271–280). IGI Global. https://doi.org/10.4018/979-8-3693-8628-6.ch013

Dei, M. O. (2025). The impact of AI on the adaptation of educational materials and teaching methods to the needs of each student. *LatIA*, *3*. https://doi.org/10.62486/latia2025124

di Stefano, G., Peteraf, M., & Veronay, G. (2010). Dynamic capabilities deconstructed: A bibliographic investigation into the origins, development, and future directions of the research domain. *Industrial and Corporate Change*, *19*(4). https://doi.org/10.1093/icc/dtq027

Ellington, L. M. (2025). Personalized education in the age of AI: Innovations and implications. In *AI, Personalization, Equity, and the Future of Learning* (pp. 369–390). IGI Global. https://doi.org/10.4018/979-8-3373-5097-4.ch013

Fahimnia, B., Sarkis, J., & Davarzani, H. (2015). Green supply chain management: A review and bibliometric analysis. In *International Journal of Production Economics* (Vol. 162). https://doi.org/10.1016/j.ijpe.2015.01.003

García, L. K. O., Hoyos Alayo, W. M., Taboada, S. L. V, & Benites, N. I. P. (2025). BIBLIOMETRIC ANALYSIS ON BRIDGING THE DIGITAL DIVIDE AMONG UNIVERSITY STUDENTS: TRENDS AND PROSPECTS. *Revista Conhecimento Online*, *1*, 193–220. https://doi.org/10.25112/rco.v1.3963

Gómez, M. C. S., García, J. L. C., Castro, S. V, & del Brio Alonso, I. (2025). Research Methods in the Educational Field: Bibliometric Analysis - A Comparative Study between Scopus and WoS. *Revista Espanola de Educacion Comparada*, *46*, 141–172. https://doi.org/10.5944/reec.46.2025.40201

Gu, D., Li, T., Wang, X., Yang, X., & Yu, Z. (2019). Visualizing the intellectual structure and evolution of electronic health and telemedicine research. *International Journal of Medical Informatics*, *130*. https://doi.org/10.1016/j.ijmedinf.2019.08.007

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050
Guo, Y., & Yu, H. (2023). Exploration of Education Transformation and Teacher Literacy in the Age of Artificial Intelligence. *Proceedings - 2023 5th International Workshop on Artificial Intelligence and Education, WAIE 2023*, 38–42. https://doi.org/10.1109/WAIE60568.2023.00014

Hasan, R., Shams, R., & Rahman, M. (2021). Consumer trust and perceived risk for voice-controlled artificial intelligence: The case of Siri. *Journal of Business Research*, *131*, 591–597. https://doi.org/10.1016/j.jbusres.2020.12.012

Hong, H., Liu, J., & Zhu, A.-X. (2020). Modeling landslide susceptibility using LogitBoost alternating decision trees and forest by penalizing attributes with the bagging ensemble. *Science of the Total Environment*, *718*. https://doi.org/10.1016/j.scitotenv.2020.137231

Iwendi, C., Khan, S., Anajemba, J. H., Bashir, A. K., & Noor, F. (2020). Realizing an Efficient IoMT-Assisted Patient Diet Recommendation System Through Machine Learning Model. *IEEE Access*, *8*, 28462–28474. https://doi.org/10.1109/ACCESS.2020.2968537

Joel, R., Lakshmi, N., Shanthakumar, P., Jeba Freeda, T. D., Siva, A., & Thalapathi Rajasekaran, R. (2024). Evaluating the Impact of AI Tools on Teaching Effectiveness and Student Outcomes: Opportunities and Challenges. In *Improving Student Assessment With Emerging AI Tools* (pp. 273–300). IGI Global. https://doi.org/10.4018/979-8-3693-6170-2.ch010

Kayyali, M. (2025). Impact of AI on student learning outcomes: Measuring success and identifying challenges. In *Transforming Education With AI-Powered Personalized Learning* (pp. 81–122). IGI Global. https://doi.org/10.4018/979-8-3693-8382-7.ch004

Ketak, R., Mittal, S., Gupta, V., & Gupta, H. (2024). Online Edtech Platform with AI Doubt Assistance. *2024 2nd International Conference on Disruptive Technologies, ICDT 2024*, 1395–1399. https://doi.org/10.1109/ICDT61202.2024.10489310

Khiste, G. P., & Paithankar, R. R. (2017). Analysis of Bibliometric term in Scopus. *International Research Journal*, *01*(32), 78–83.

Lim, S. C. J., & Ghazali, I. S. (2017). Research evolution in design engineering education: A visual approach using thematic network. *IEEE International Conference on Industrial Engineering and Engineering Management*, *2017-Decem*, 504–508. https://doi.org/10.1109/IEEM.2017.8289942

Lv, X., Liu, Y., Luo, J., Liu, Y., & Li, C. (2021). Does a cute artificial intelligence assistant soften the blow? The impact of cuteness on customer tolerance of assistant service failure. *Annals of Tourism Research*, *87*. https://doi.org/10.1016/j.annals.2020.103114

McLean, G., & Osei-Frimpong, K. (2019). Hey Alexa … examine the variables influencing the use of artificial intelligent in-home voice assistants. *Computers in Human Behavior*, *99*, 28–37. https://doi.org/10.1016/j.chb.2019.05.009

Pham, B. T., Le, L. M., Le, T.-T., Bui, K.-T. T., Le, V. M., Ly, H.-B., & Prakash, I. (2020). Development of advanced artificial intelligence models for daily rainfall prediction. *Atmospheric Research*, *237*. https://doi.org/10.1016/j.atmosres.2020.104845

Raja, S., Jebadurai, D. J., Ivan, L., Mykola, R. V, Ruslan, K., & Nadiia, P. R. (2024). Impact of Artificial Intelligence in Students' Learning Life. In *Studies in Systems, Decision and Control* (Vol. 516, pp. 3–17). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/978-3-031-49544-1_1

Rajput, R. (2025). Use of artificial intelligence to solve problems in the classroom. In *New Technological Applications in the Flipped Learning Model* (pp. 137–168). IGI Global. https://doi.org/10.4018/979-8-3373-0437-3.ch005

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 28 (December 2025) PP. 720-735
DOI: 10.35631/IJMOE.728050
Tian, H.-X., & Mao, Z.-Z. (2010). An ensemble ELM based on modified AdaBoost.RT algorithm for predicting the temperature of molten steel in ladle furnace. *IEEE Transactions on Automation Science and Engineering*, *7*(1), 73–80. https://doi.org/10.1109/TASE.2008.2005640

Ucar, F., & Korkmaz, D. (2020). COVIDiagnosis-Net: Deep Bayes-SqueezeNet based diagnosis of the coronavirus disease 2019 (COVID-19) from X-ray images. *Medical Hypotheses*, *140*. https://doi.org/10.1016/j.mehy.2020.109761

van Dijk, L. V, van den Bosch, L., Aljabar, P., Peressutti, D., Both, S., Steenbakkers, J. H. M., Langendijk, J. A., Gooding, M. J., & Brouwer, C. L. (2020). Improving automatic delineation for head and neck organs at risk by Deep Learning Contouring. *Radiotherapy and Oncology*, *142*, 115–123. https://doi.org/10.1016/j.radonc.2019.09.022

van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, *84*(2). https://doi.org/10.1007/s11192-009-0146-3

van Eck, N. J., & Waltman, L. (2017). Citation-based clustering of publications using CitNetExplorer and VOSviewer. *Scientometrics*, *111*(2), 1053–1070. https://doi.org/10.1007/s11192-017-2300-7

Van Eck, N. J., & Waltman, L. (2007). Bibliometric mapping of the computational intelligence field. *International Journal of Uncertainty, Fuzziness and Knowldege-Based Systems*, *15*(5). https://doi.org/10.1142/S0218488507004911

Verbeek, A., Debackere, K., Luwel, M., & Zimmermann, E. (2002). Measuring progress and evolution in science and technology - I: The multiple uses of bibliometric indicators. *International Journal of Management Reviews*, *4*(2). https://doi.org/10.1111/1468-2370.00083

Wu, Y. C. J., & Wu, T. (2017). A decade of entrepreneurship education in the Asia Pacific for future directions in theory and practice. In *Management Decision* (Vol. 55, Issue 7). https://doi.org/10.1108/MD-05-2017-0518

Yang, M., Xu, Y., Zhang, X., Bisoyi, H. K., Xue, P., Yang, Y., Yang, X., Valenzuela, C., Chen, Y., & Wang, L. (2022). Bioinspired Phototropic MXene-Reinforced Soft Tubular Actuators for Omnidirectional Light-Tracking and Adaptive Photovoltaics. *Advanced Functional Materials*, *32*(26). https://doi.org/10.1002/adfm.202201884