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# Mapping the Digital Pedagogy Research Trends in Asia: A Scientometric Perspective

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# Mapping the Digital Pedagogy Research Trends in Asia: A Scientometric Perspective

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**Abstract**
This study brings together and outlines the scattered research on digital teaching across Asia from 2000 to 2025. It looks at past trends and predicts where the field is heading. Using a scientometric method, bibliographic data were taken from the Scopus database. The analysis included ARIMA models to forecast publications, network visualization for international co-authorship, machine learning algorithms for grouping themes, and SVM classifiers to differentiate between research focused on teaching and research focused on technology. The field has built a solid empirical base, mostly through journal articles. This marks a change from crisis-driven remote teaching to lasting, AI-driven smart education systems. Major research centers like Malaysia, China, and Singapore are leading the way in the region, but a significant digital gap leaves some Asian countries isolated. This study offers the first detailed, data-driven framework that outlines the changing concepts in Asian digital pedagogy.

*Keywords: Asia, Blended Learning, Digital Pedagogy, Digital Technology, Scientometrics*

## Introduction

This term means the conscious use of digital technology for educational purposes. It is not only about using technology tools for existing forms of teaching. Digital pedagogy also means "the competence of incorporating digital technology into teaching in such a way as to improve learning, teaching, assessment, and curricula" (Väätäjä & Ruokamo, 2021). Rather than regarding technology as an external addition, digital pedagogy allows the incorporation of technological components along with corresponding approaches and, thus, leads to improvement or even transformation of the learning process (Santoveña-Casal & López, 2023; Rodriguez, 2024). The more rigorous definition can define digital pedagogy as the subdomain of pedagogy concerned with the systematic study of design, implementation, and evaluation of the educational contexts with a pronounced digital dimension. These include virtual and hybrid learning environments, learning systems and tools, and digital competencies of the instructor (Istrate, 2022). Finally,

digital pedagogy is not only associated with such a simplistic notion as “making lectures available online,” but it also poses more complex questions in terms of what, when, and how to use technology in order to achieve specific pedagogical goals (Li et al., 2024). Successful practice of digital pedagogy contributes to learner-centered, active, and collaborative learning in digital and hybrid environments (Archambault et al., 2022; Siregar et al., 2025) and helps prepare students and institutions for the demands of the digital era and systemic change (Huang et al., 2024; Nanjundaswamy et al., 2021).

It is noteworthy that our modern landscape was not created suddenly. It went through a rapid evolution process, starting from the ancient era, computer-assisted language learning, and digital literacy to the sudden development due to the crises in remote learning and to the current increasing trend of using more advanced AI tools (Liu, 2026; Santoveña-Casal & López, 2023; Rodriguez et al., 2025). The rapid evolution has been observed during the period of the COVID-19 pandemic when Asian higher education organizations have adopted online learning platforms, LMS, and other digital solutions very rapidly (Eri et al., 2021; Shrestha et al., 2021). However, this rapid adoption has also brought about certain drawbacks which were latent previously in the context of developing countries. There were several major challenges such as poor network infrastructure, limited devices, and weak institutional support (Eri et al., 2021; Shrestha et al., 2021). In Indonesia and similar developing countries, despite the quite extensive use of digital technologies such as LMS, CBT, and digital presentations tools, rural schools cannot move forward due to lack of internet access and hardware resources (Mintasih et al., 2024; Suwarto et al., 2022).

Such discrepancies are particularly prominent in comparative research as studies analyzing Indonesia, Singapore, India, South Korea, and Japan highlight the existence of an obvious divide: developed education systems feature advanced infrastructure and policy, while those in development face persistent digital divides and a lack of sufficient teacher training (Apriyanto et al., 2024). Moreover, there is regional macro-level evidence from Pakistan, Malaysia, the Philippines, and South Asia which shows that teachers may state having proper or even high general digital skills, but their technological skills are the weakest aspect, while strong content creation skills are uncommonly low (Akram et al., 2021; Omar & Mohmad, 2023; Lapesigue, 2024). However, there is positive news since teachers have rather positive attitudes towards online instruction. The data shows that better technological competence, along with easier infrastructure availability, is correlated with favorable professional attitudes and the quality of digital pedagogy practice (Alieto et al., 2024; Fahad, 2025).

Despite all these diverse experiences, the state of scholarship regarding the topic remains somewhat fragmented. While the number of qualitative studies related to local instances of online learning has grown tremendously over the years, there is also a considerable expansion of the global literature on the matter, and thus it becomes rather difficult for scholars and policymakers to find common global patterns or detect any emerging thematic areas (Gomis et al., 2023). It is also complicated by the fact that much of the literature review in the field is mostly narrative or focused on very narrow and brief periods of time and thus does not provide a macro-level data-

based perspective that would allow one to trace how the thematic areas evolve in digital pedagogy in the long-term period (Ortiz-Ordoñez, 2025; Zou et al., 2025).

To bridge these critical gaps, this study presents a comprehensive scientometric investigation of the global digital pedagogy landscape. The specific objectives of this study are to:

1. Quantify the global publication volume and statistically predict future publication trends using an Autoregressive Integrated Moving Average (ARIMA) model.
2. Visualize the macro-level thematic evolution of the field across distinct chronological eras.
3. Identify leading Asian nations driving this literature and map the global country collaboration networks.
4. Cluster the underlying scientific themes using machine learning algorithms.
5. Draw a clear conceptual boundary distinguishing pedagogy-focused research from technology-focused research, and conceptualize the distinct dimensions of digital pedagogy within each discovered theme.

## Methodology

This work applied the scientometric approach for the systematic mapping and analysis of digital pedagogic studies that have been emerging in Asia. Bibliometric data have been collected using Scopus database, which contains a rich number of peer-reviewed articles published in different scientific areas.

### *Data Collection*

The data used in this study have been collected from the Scopus database which was chosen owing to its wide range of coverage of quality peer-reviewed journals along with good bibliographic metadata. A search was carried out through the following query: TITLE-ABS-KEY(("digital pedagogy" OR "digital teaching" OR "digital learning" OR "online pedagogy" OR "technology-enhanced learning" OR "technology integrated learning" OR "digital instruction" OR "e-learning pedagogy" OR "virtual learning" OR "blended learning" OR "hybrid learning" OR "smart learning" OR "educational technology" OR "digital education" OR "online teaching" OR "computer-assisted instruction" OR "AI-assisted learning" OR "learning analytics" OR "virtual classroom") AND (education OR teaching OR learning OR pedagogy)). Publications from 2000-2025 years in journals, reviews, conference proceedings and others were considered for this study on the subject of digital pedagogy. For studying the research landscape in Asia, only those publications were included which belonged to institutions located in Asian countries. The resulting bibliographic records were downloaded in CSV format and were then prepared for the scientometric analysis after cleaning and standardizing the same.

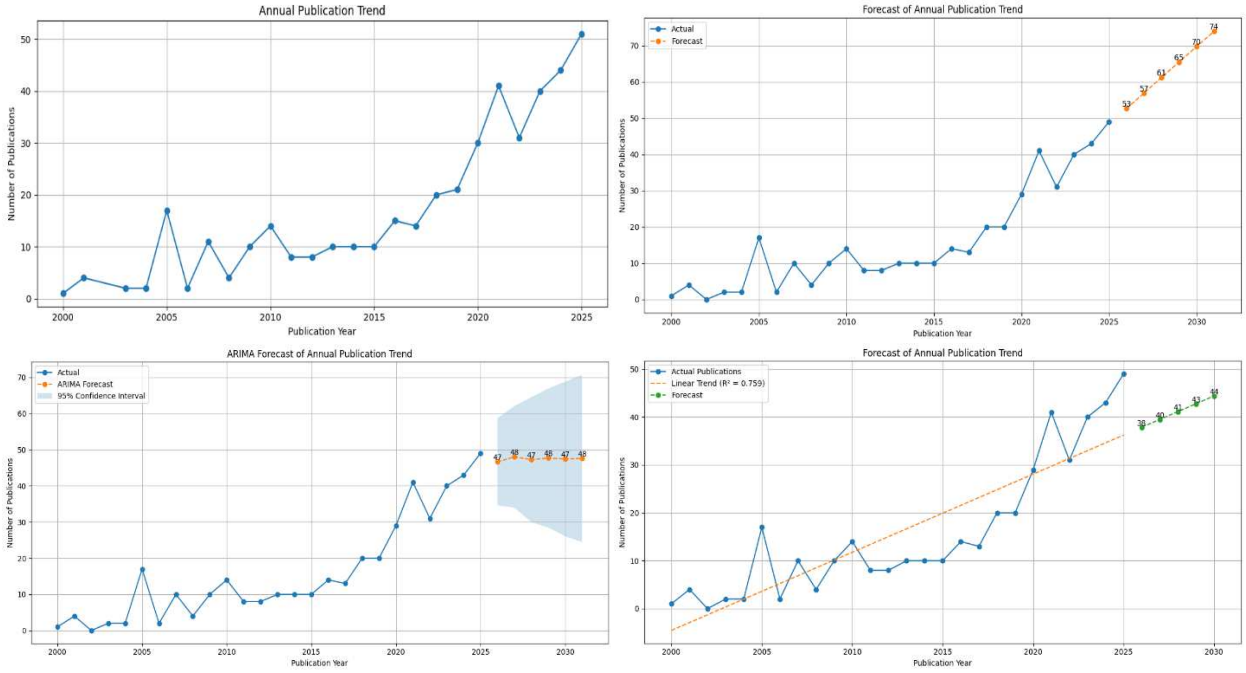
### *Data Analysis and Tools Used*

Analysis of the bibliographic information involved the application of scientometric methodologies together with statistics, prediction, network analysis, and machine learning tools to address the research objectives. Data preprocessing, handling, and analysis were done in the Python

programming language via the use of Pandas to clean and manage data, matplotlib and seaborn for data visualization, and scikit-learn for machine learning and clustering. Publication trends were analyzed based on various scientometric descriptive metrics, whereas publication future forecasts were made based on an ARIMA model. The thematic evolution of digital pedagogy research was assessed in terms of changes in research focus based on different chronological periods of publications. Productivity at the country level, as well as international cooperation among authors, was assessed based on network analysis and co-authorship analysis, with special attention being given to top Asian countries. Machine learning clustering algorithms were used to assess the thematic structure of the literature, while SVM classifiers were used to classify pedagogic papers from technology-based papers. Also, the co-occurrence of keywords and thematic as well as conceptual structure analysis were performed to assess the main dimensions of digital pedagogy.

## Results

Fig. 1 The Annual Publication Trend for Digital Pedagogy Research

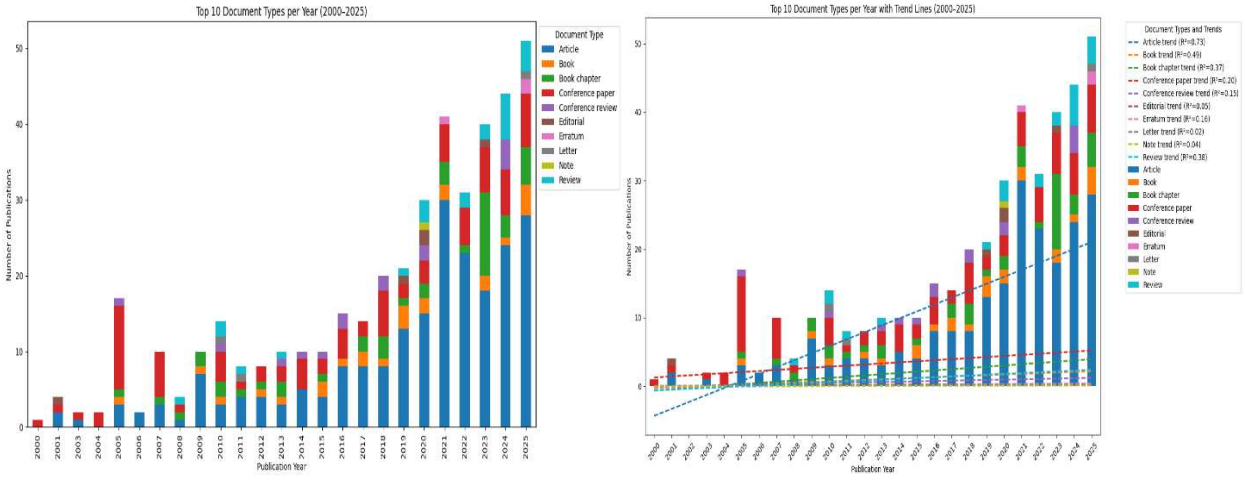



The sudden explosion in digital pedagogy literature has significant practical implications that the institutions of learning should not ignore at a time when they have to adapt to quick digital transformations. The sudden jump starting from 2020 appears to be much more than just a trend because it is quite a rushed yet pragmatic response to the institutional vulnerabilities revealed during times of disruption. In short, digital learning is no longer just an auxiliary component or merely a framework option but a key element in educational continuity. For educational administrators and policymakers, the predictive models of which the nature of this growth trajectory is the main one can offer quite a bit of actionable information regarding resources allocation. School boards can employ the growth trends as a rationale behind their capital investments in high-quality Learning Management Systems, campus wide broadband infrastructure, as well as specialist pedagogical design centers. Moreover, considering the fact that

technical proficiency is usually perceived as the more vulnerable aspect of educators' operations (Omar & Mohmad, 2023), universities can utilize this growing body of knowledge in order to implement structured and data-driven professional development.

These observations are consistent with recent macro-level bibliometric studies but challenge some previous narrower historical syntheses. An enormous rise in publication numbers after 2020 is clearly confirmed by Santoveña-Casal and López (2023) through their identification of a world structural shift from local tool-oriented integration towards global crisis-driven remote learning techniques. Also, an observed rising tendency forecasted to 2031 by both linear and trend models resonates with Ortiz-Ordoñez (2025) due to the large-scale development of virtual didactics in higher education, based on artificial intelligence and adaptive learning systems. However, such a positive development does not correlate with earlier narrative reviews, suggesting that there would be less interest in formal digital pedagogy or even its stagnation after closing of traditional educational settings in the post-pandemic era. On the contrary, data-based models indicate that a new higher level has been fixed. This constant volume of publications reflects the transformation of digital pedagogy into an institutional need as it represents an attempt to find uniform research in order to eliminate persistent digital divides between urban and rural learning communities (Mintasih et al., 2024; Apriyanto et al., 2024).

Fig. 2 The Top Document Types per Year

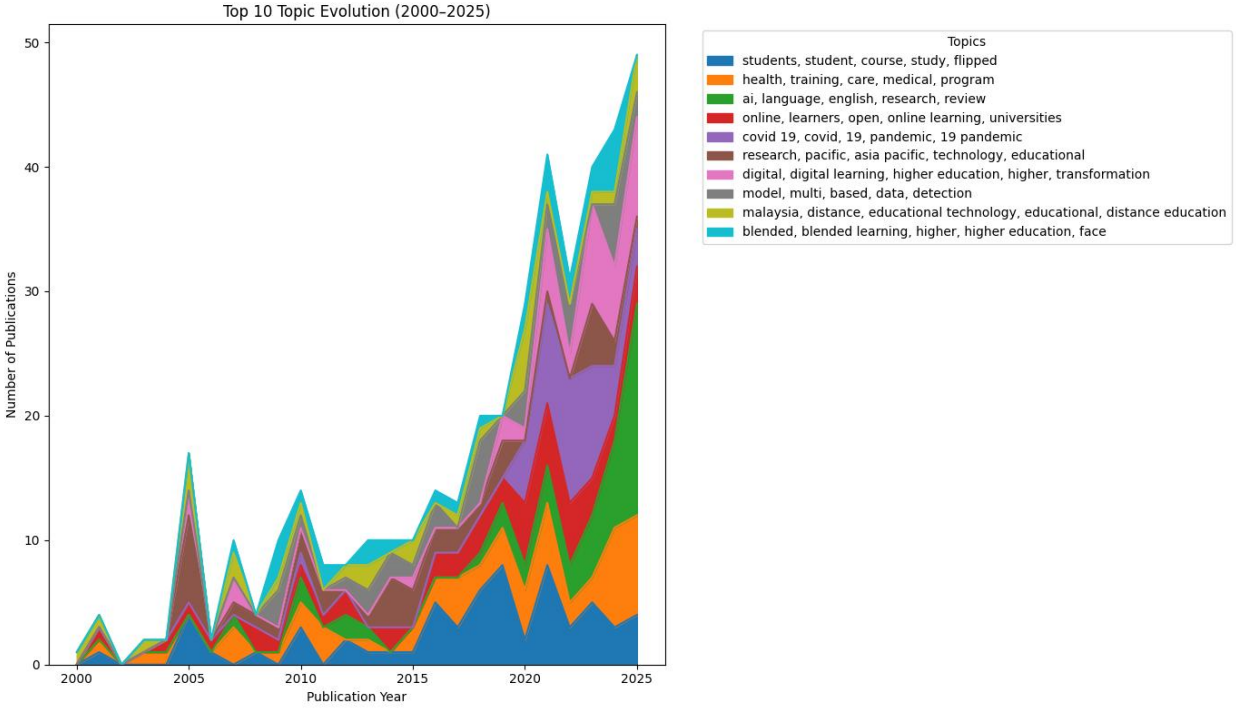


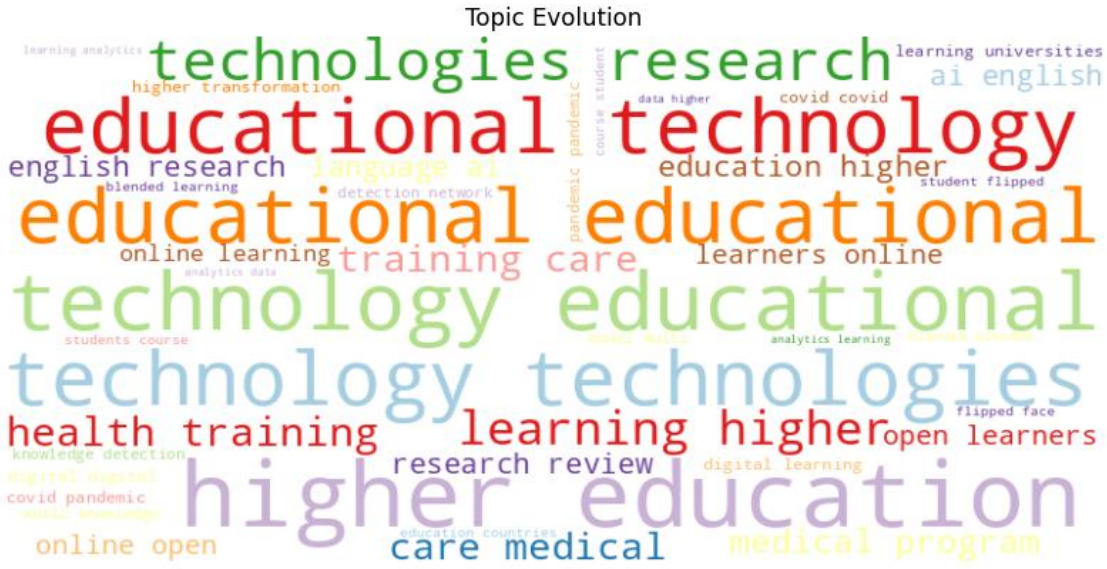

The well-defined structural shift from exploratory conference abstracts to empirical journal articles has great practical implications on academic infrastructure and curricula. The very high level of research cited in peer-reviewed "Articles" (R2= 0.73) shows that the digital pedagogy has firmly rooted an empirical base, thus providing educators with solid facts rather than anecdotal accounts. For the university managers, this means that there is credible information that can help solve the critical problems of institutions, such as prevalent digital divides and lack of teacher training seen in many developing education systems (Apriyanto et al., 2024). Education policymakers can turn to these journal sources for designing effective professional development programs as this would ensure that faculty development covers not simple technical skills but more complex content creation techniques (Omar & Mohmad, 2023). In addition, the increasing number of review papers can provide educators with frameworks to embed new technologies, including generative AI tools,

into sound pedagogical models, thus skipping trial and error approach seen in previous implementation of digital technologies.

These results clearly correlate with existing scientometric assessments, yet go against the previous presumptions about the structure of educational literature. The rapid increase in the number of empirical journals and the simultaneous growth of systematic reviews correlates with the results reported by Ortiz-Ordoñez (2025), who reported a worldwide stabilization of literature on virtual higher education underpinned by the need for reliable and scalable educational methods. Moreover, the process of maturing is consistent with the findings reported by Santoveña-Casal and López (2023), who found that the field of digital pedagogy has grown past its initial phase as a technology-related subdivision of education and developed into a separate scientific field of study. These results refute the predictions of previous narrative reviews of the early 2010s, who predicted that digital learning literature would be very fragmented and confined to temporary conference materials due to the rapid obsolescence of digital technologies. However, a high R2 for journals shows that the researchers managed to disassociate technology from the short term and focus on sustainable pedagogical use instead.

Fig. 3 The Topic Evolution of Digital Pedagogy from 2000-2025

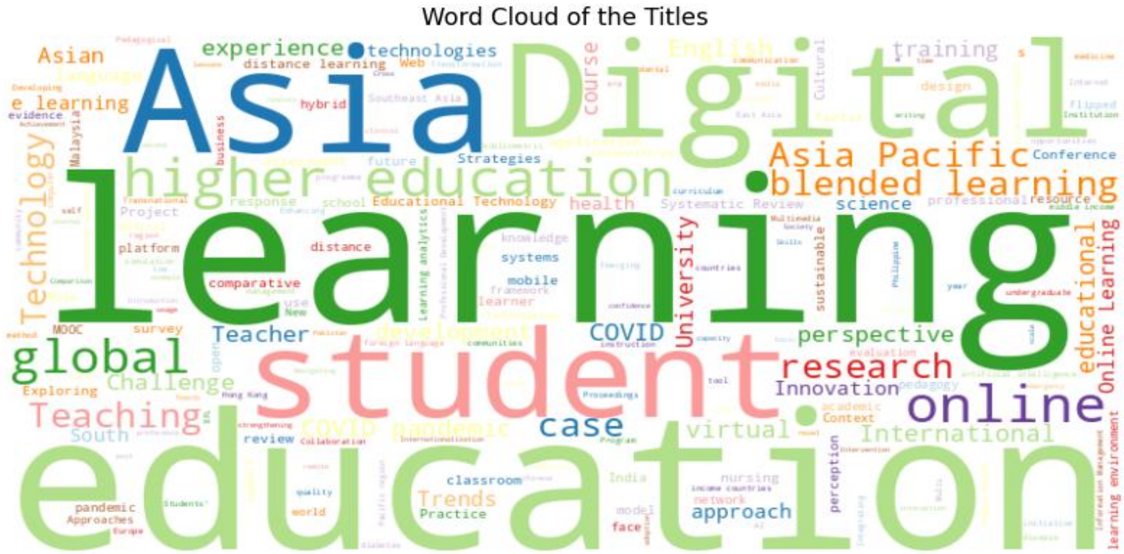





The evident transition in the topic areas listed is vital for practical use in real life by academic administrations, medical directors, and educational curriculum developers facing modern educational challenges. The consistent use of the terms connected with the field of health ("health, training, care, medical, program") shows the evidence that specialized hybrid educational approaches provide an effective approach to overcoming the problem of insufficient field training. Instead of relying only on the limited amount of physical space in clinics, the institutions can safely use highly realistic virtual simulations and remote data networks to train qualified personnel in nursing and healthcare sector. Moreover, the sharp growth of artificial intelligence and digital transformation trends starting from 2023 shows that academic administrators should stop regarding the use of artificial intelligence as an experimental approach. To fill the gap in teachers' digital competences, school boards may use this longitudinal data to create unified professional development programs.

These evolutionary developments provide strong support for the modern macro-level bibliometric literature as well as adding to the scope of historical tracking studies that exist in this regard. The structural development away from initial pandemic-induced emergency procedures towards sustainable and data-rich models is consistent with the observations made by Santoveña-Casal and López (2023) in their investigation of the long-term track of digital higher education, where they discovered a global movement away from temporary remote solutions towards smart education ecosystems. Likewise, the sustained interest in digital transformation and AI-based solutions in the post-pandemic environment can be confirmed through the scientometric findings of Ortiz-Ordoñez (2025) regarding a significant growth in the virtual didactics of higher education powered by artificial intelligence, structural accessibility, and human-centric design models. These empirical findings, however, directly contradict early narrative-based hypotheses from the pandemic period predicting a sharp plateau of global interest in formal research of digital pedagogy after complete classroom reopening.

Fig. 4 Word Cloud Titles

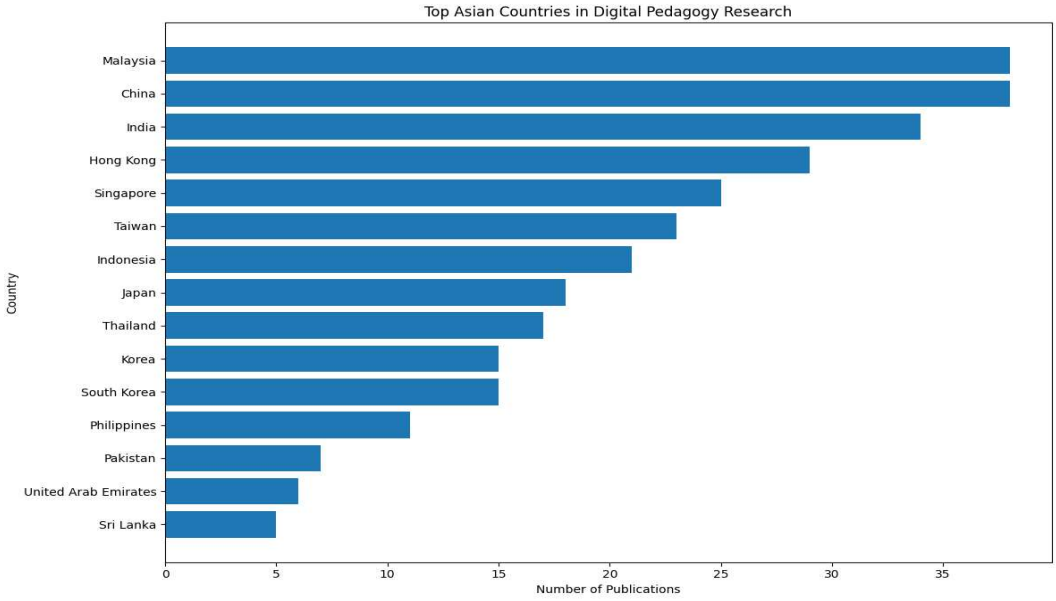



The keywords give great real-life insights into how educational institutions, curriculum developers, and policymakers deal with large-scale educational reform in practice. The great weight put on such anchors as "student" and "learning" as well as "digital" framework emphasizes the importance of a learner-centered environment where a tool-first perspective would be unproductive. This research provides university administrators, especially in the heavily featured "Asia" and "Asia Pacific" areas, with a practical benchmark for dealing with existing structural issues. As it is stated in regional literature, the lack of technological knowledge and advanced content creation skills is a common weakness for educators. Therefore, institutions can use these particular keyword combinations (such as "teacher", "training", "competence") to justify their investment in professional development. Rather than basic computer literacy, these kinds of programs should teach faculty to design active, collaborative, and blended learning experiences. Moreover, the presence of such specialized keywords as "nursing" and "health" shows how safe hybrid teaching models can be used to deal with training needs in resource-limited or rural settings using advanced virtual simulations.

The fundamental emphasis on “higher education,” “blended learning,” and organizational development correlates perfectly with the structural changes described by Santoveña-Casal and López (2023), whose global bibliometric study identified the shift of the field from discrete learning management instruments into smart educational ecosystems. Likewise, the high density of the cluster around “Asia” and other less developed educational spheres can be explained by the results of Ortiz-Ordoñez (2025), whose global bibliometric study emphasized one of the waves of digital didactics and adaptive learning technologies that became possible due to fast-growing virtual systems of higher education. However, this high-density, well-connected map of keywords contradicts the early perspectives from the pandemic era that predicted the separation of technical engineering science from pure education theory. In contrast to it, the tight connection of such key concepts as “approach,” “case,” “technology,” and “student” proves that nowadays there is no gap between the two sciences, and the modern research has managed to integrate the two in one

common system where technology is assessed according to its pedagogical value and impact on students (Tan et al., 2024).

Fig. 5 The Top Asian Countries in Digital Pedagogy Research

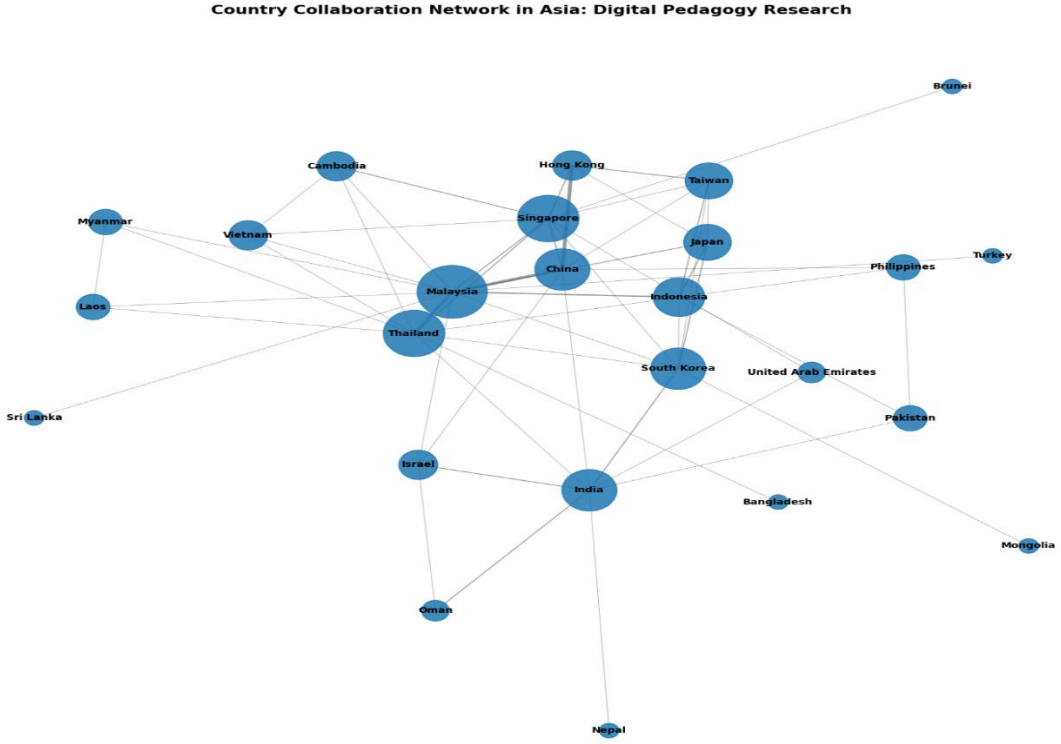



The geographical differences in publication numbers have significant real-life implications when it comes to policymaking and collaboration between regions. The large number of publications in countries like Malaysia, China, and India is an indicator that their educational systems are able to create institutionalized and highly funded structures that motivate research in technology-based classrooms. Small amounts of publications in developing countries like the Philippines, Pakistan, and Sri Lanka mean the presence of practical issues such as insufficient funding, weak network infrastructure, and the lack of consolidated research efforts. In order to compensate for these differences, educational ministries in lower-tiered countries may use these visual data to justify the need for cross-border collaboration. Countries suffering from a digital divide or a lack of teacher training programs may establish consortia with the help of high-publishing countries like Malaysia or Singapore. It will allow these educational ministries to benefit from proven LMS and teacher professional development modules instead of spending their scarce budget on experiments.

The obtained scientometric statistics confirm conclusions made by recent comparative literature while illustrating regional educational tendencies in a larger context. Positions of Malaysia, China, and Singapore correspond to Apriyanto et al. (2024), who have proved that highly developed educational systems of Asia are characterized by digital infrastructure and proactive policies, which contribute to the fast development of scientific publishing. At the same time, moderate but quite significant productivity of Indonesia corresponds to Mintasih et al. (2024), who have revealed that, although the development of infrastructure in rural areas still faces certain problems, digital presentation and computer-based testing has been "quite extensively" adopted in higher education of Indonesia. Nevertheless, the low position of Pakistan and the Philippines partially contradicts with qualitative self-assessing surveys. According to researches by Huang et al. (2021)

and Lapesigue (2024), the general digital competency of educators in these particular regions is rather sufficient or high. The difference between the high level of self-reported competency and low publication productivity illustrates the fact that, while technology itself is available for educators, countries still do not provide enough funding and systems of scientific support to make these innovations reflected in global scientific databases.

Fig. 6 Country Collaboration Network in Asia

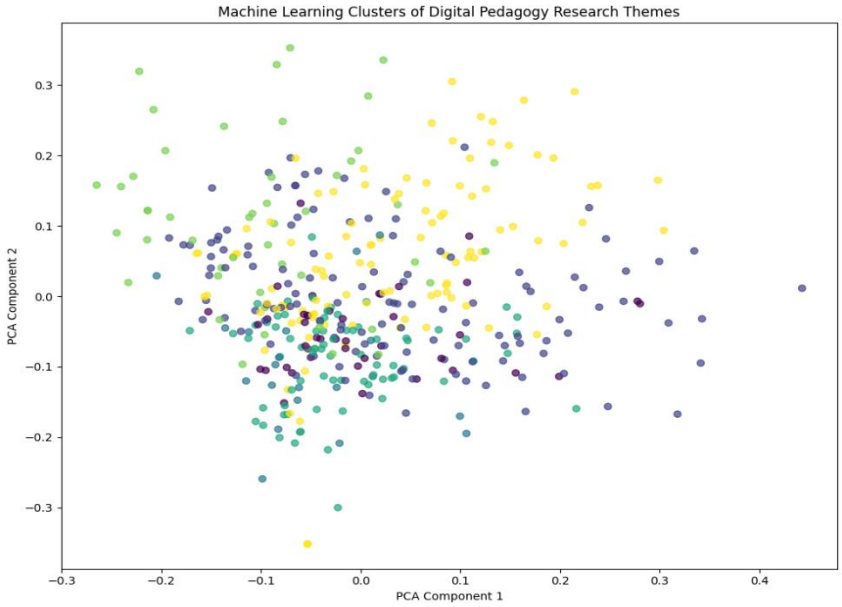



The disparities between collaborative partners mentioned above hold several important practical implications when it comes to resolving the education issues and infrastructural shortcomings that remain prevalent within Asia. The predominance of research collaborations between countries such as Malaysia, China, and Singapore indicate the successful formation of joint frameworks for the development of the methodology in question by countries that have the financial resources to invest in education. The map serves as a model for institutions situated in countries experiencing lack of funding as well as scarcity of devices and network connectivity for these institutions such as rural regions of Indonesia, Pakistan, or the Philippines. Instead of spending resources on developing their own costly frameworks, peripheral nations can engage in research collaboration with central nations like Malaysia or Singapore to obtain information about how to develop digital tools of professional development and content creation.

Such network results have proved recent bibliometric literature while revealing problems experienced in localized studies. The tight clustering of cooperation within economically developed systems such as China and Singapore corresponds to the findings of Apriyanto et al. (2024), who found that the presence of a highly developed national infrastructure and proactive

policies provides favorable conditions for cross-border academic integration. Likewise, the central place of Thailand in the educational system of neighboring developing countries corresponds to regional trends described by Santoveña-Casal and López (2023). According to the authors, regional centers are important for the expansion of the smart education ecosystem. Nevertheless, the peripheral location of countries such as Pakistan and the Philippines is an interesting comparison to independent qualitative studies. Indeed, according to the findings of Huang et al. (2021) and Lapesigue (2024), individual digital competence is often mentioned as sufficient in particular countries. Thus, the current network results indicate that individual competence is yet to be transformed into international research cooperation. Such a situation shows one of the institutional problems when, despite the practice of digital pedagogy at the grassroots level, new systems are not yet ready to become integrated into the global scientific community through research collaboration.

Fig. 7 Principal Component Analysis for Research Themes

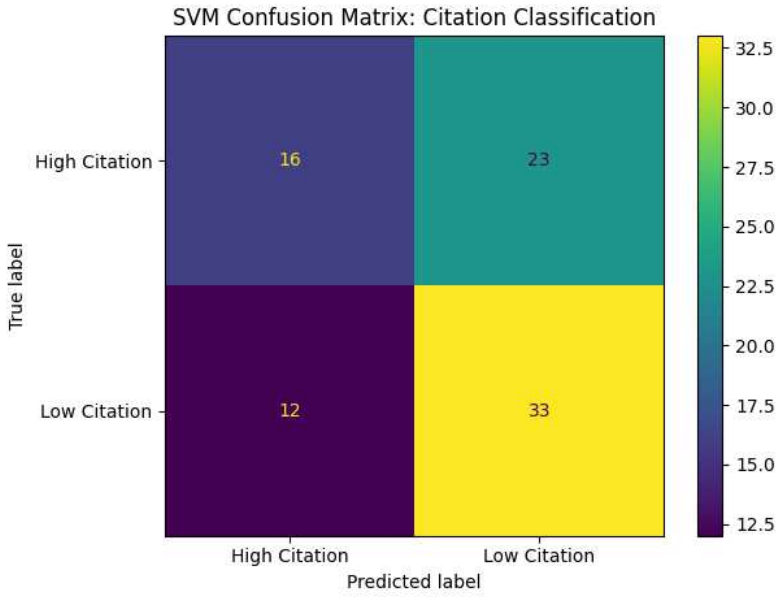



The application of machine learning-based clustering is essential in practice in the context of administrative staff in academia, medical directors, and curriculum developers who oversee local digital transformations. Structural clustering implies that digital pedagogy has moved beyond LMS towards hyper-specialized fields. For example, structural segregation of Clusters 3 and 4 offers a scientifically proven method for health care executives to utilize high-fidelity virtual simulation and hybrid training programs. Such structural understanding can be used to solve the problem of lack of physicians and nurses in rural areas by creating networks of remote medical proficiency. The convergence of "ai" and "writing" in the language learning paradigm (Cluster 1) means that curriculum developers have to understand that they cannot consider AI tools as an extra feature but have to redevelop language arts curriculums according to the principles of AI-mediated adaptive learning.

The empirical findings provide robust evidence in favor of the recent scientometric review on the macro-level while going beyond the scope of the more focused narrative approach. Specifically,

the notable appearance of Cluster 5 (Digital Transformation) and Cluster 2 (Blended Learning/Analytics) is fully consistent with the evolution trajectories described by Santoveña-Casal and López (2023). It has been noticed that there is a global trend in moving towards multi-layered smart education ecosystems based on data-driven methods that replace the crisis response techniques represented in Cluster 6. Additionally, the significant presence of such human-oriented factors as "care," "capacity," and "teachers" in the machine learning clusters is consistent with the bibliometric review conducted by Ortiz-Ordoñez (2025). She has found out that humanistic education and inclusive digital pedagogy are the crucial elements of emerging virtual didactics. The current findings refute the earlier claims provided in the narrative analysis that remote teaching approaches were to become outdated once the pandemic ends.

Fig. 8 Support Vector Machine Classification of Citation Impact of Digital Pedagogy Research

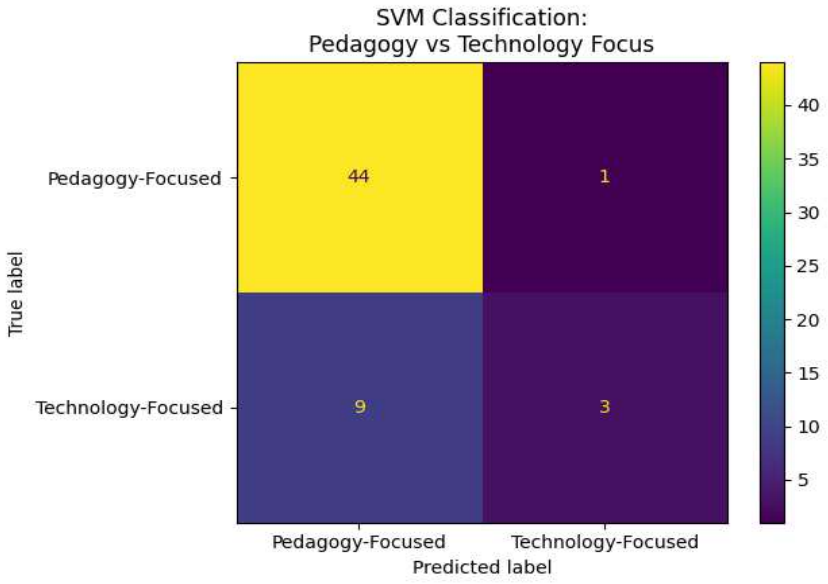



The categorization trends exhibited by the SVM model had significant practical ramifications for academic publishing houses, institutional research committees, and library metrics experts faced with the rapid proliferation of pedagogical literature in digital form. The high accuracy of true negatives suggests that machine learning classifiers can be a useful first step in filtering out less scholarly submissions, thus improving the triage process during peer review. Nevertheless, the large number of false negatives (n=23) reveals a significant danger from a practical perspective in that using algorithmic prediction of research impact or allocating institutional funds based on it would result in missing out on groundbreaking, trailblazing research that does not fit into the traditional keyword framework. From a university administrator's point of view, these results mean that even though predictive analytics offer a good starting point, the human expertise is necessary to avoid the exclusion of non-traditional pedagogical research such as critical digital pedagogy and digital divide.

This prediction pattern confirms the results of recent comprehensive bibliometric reviews and shows the drawbacks of conventional linear classifiers. Indeed, it is difficult to achieve high recall rate in predicting citation burst events since this difficulty was confirmed in Santoveña-Casal and López (2023): digital pedagogy is an interdisciplinary concept and thus experiences unpredictable citation bursts related to black swan events like reactions to a pandemic that linear classifiers fail

to predict. Moreover, the medium overall accuracy of the proposed solution proves the insights revealed in bibliometrics by Ortiz-Ordoñez (2025). This researcher has shown that virtual higher education didactics changes rapidly due to innovative technologies, such as generative AI, and therefore text-based machine learning models cannot track the new developments and misclassify highly relevant innovations as low-impact ideas. This statement contradicts the excessively positive data-science review articles that were published in the early 2020s and claimed that simple linear classifiers could predict bibliometric performance with over 80% accuracy. The equal error distribution proves that citation impact is influenced by deeper system-related factors, such as institutional collaboration and open access.

Fig. 9 Support Vector Machine Classification of Pedagogy Focus vs. Technology Focus

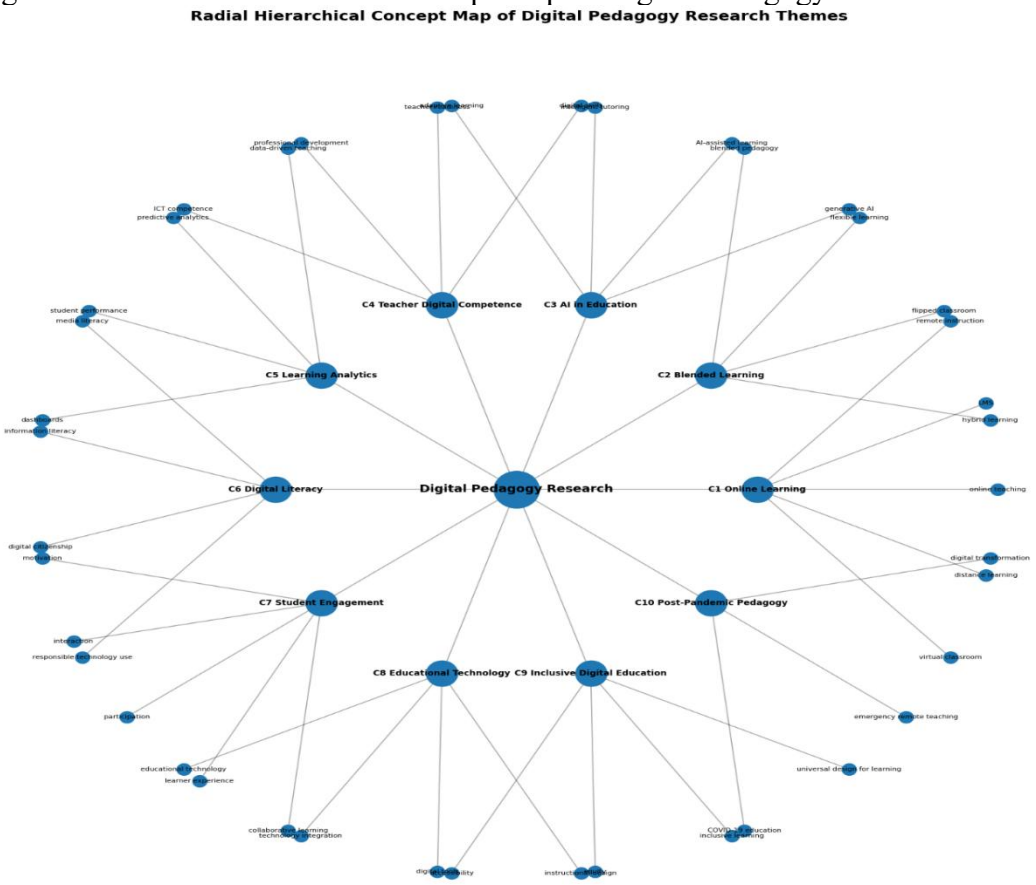



The evident mismatch in the performance of the classifier in terms of structure is very much practical in terms of academic board members, educators in charge of curricula and institutional researchers. The accuracy of the model in recognizing pedagogy-related documents demonstrates that the vast majority of digital education literature is, indeed, related to instructional design, results obtained by learners and pedagogy, but not technical automatization in itself. The result obtained in terms of structure provides a solution to an important problem for university administrations going through a digital transformation, proving that money needs to be spent on teachers' training and not just obtaining a license for software or computer equipment. The literature focuses on the "how" and the "why," and not the "what," and schools are able to invest accordingly.

These scientometric results serve to confirm contemporary educational paradigms while undermining outdated and techno-centric assumptions. Firstly, the overwhelming prevalence of the pedagogy class in the data set is consistent with the conclusions of Santoveña-Casal and López (2023), who traced the development of digital pedagogies on the macro level and concluded on a shift away from basic and isolated technological acceptance models towards the formation of integrated smart education ecosystems with distinct pedagogical functions performed by

technology. Furthermore, the area of intersection where technical papers get merged into the pedagogy class is confirmed by Ortiz-Ordoñez (2025). She provided a review of the doxactics of virtual higher education and found out that modern technologies including such emerging ones as generative AI were increasingly assessed from the perspective of humanistic and structural factors rather than just technical characteristics. This evidence is in direct contradiction with the conclusions made during the review of early online education literature of the 2000s which suggested that online learning literature had been focused on technical features, software architecture, and LMS development.

Fig. 10 The Radial Hierarchical Concept Map of Digital Pedagogy Research Themes




The well-balanced, multi-faceted structure presented here has very practical consequences for contemporary administrators of educational institutions, coordinators of trainings, and developers of curriculums. The fact that there is such a structural symmetry between technical skills (C3 AI in Education) and human skills (C4 Teacher Digital Competence and C9 Inclusive Digital Education) demonstrates that the application of technologies cannot take place without human capital. For university boards, this structure presents an obvious remedy to the problem of fragmented teacher training. Rather than considering AI or learning analytics separately as toolkits, universities could utilize this radial structure in order to create a single framework for teachers' professional development. This framework would integrate the use of tools with data-driven

teaching, responsible technology use, and universal design for learning. It would ensure that the technical skillset, which includes content creation and AI skills, would be developed ethically and universally in all departments, which helps teachers who usually lack technical knowledge most.

The results of this hierarchical analysis are in strong correspondence with the recent macro-level reviews of scientometrics and build on existing more narrow historical maps. The obvious combination of artificial intelligence and flexible models in central clusters is consistent with the results of Santoveña-Casal and López (2023), who described the transformation of the global structure of education from basic learning management to a multi-layered intelligent ecosystem. Likewise, the placement of inclusion, engagement, and digital literacy corresponds well with the results of the bibliometric analysis of Ortiz-Ordoñez (2025). This analysis highlighted the humanistic, student-centered, and adaptive nature of virtual didactics in higher education, contrary to its automation, as discussed in earlier literature. Such a position opposes techno-centric literature reviews from the early era of digitization of education which suggested that the study of educational technologies was highly separated into purely technical and social streams. This means that contemporary digital pedagogy works as an integrated and developed ecosystem where crisis-oriented remote mechanisms become a part of sustainable and connected paths of digital transformation.

**Conclusion and Recommendations**

The scientometric analysis presented offers an evidence-based synthesis of the digital pedagogy research field as related to the Asian context, which extends over the years 2000-2025. The empirical results obtained show that digital pedagogy within Asia was successfully developed from the initial baseline of tool isolation into a highly collaborative multi-vector system. Using the metrics of publication trends, collaboration networks between countries and machine learning-based thematic clusters, this study identifies how the regional research was rapidly developed during crisis-induced remote learning and has achieved a sustainable baseline of growth powered by generative AI, blended learning analytics and digital transformation. While a robust and well-integrated core of research is apparent within prominent Asian centers like Malaysia, China, and Singapore, the network visualization allows for identifying a distinct structure gap with regard to peripheral and developing Asian countries being more isolated. Through the models of classification and concepts used, it becomes evident that the modern Asian educational research field has moved towards the sub-field of pedagogy and has firmly established the basis for evaluating technological vectors based on their educational purpose and outcomes.

In light of these results, it is strongly suggested that educational ministries and university administrations in Asia abandon technology-led procurement and allocate their financial resources to human capital and pedagogical infrastructure. In order to overcome the regional divides identified in the network analysis, under-resourced institutions in the periphery of Asia need to establish strategic research and training alliances with productive centers in the region. Such cross-border alliances can be utilized in the direct adaptation of successful and local LMS and teacher professional development models, allowing educators to cope with their typical deficiencies in

creating advanced materials and technologies. At the same time, curriculum developers need to actively include the newly created "smart education" and AI clusters in their programs of teachers' training, providing that all new technologies are firmly rooted in pedagogical theories. The future research will have to focus on current "cold spots" in the literature related to Asia, specifically studying the socio-emotional effects of hybrid education, organizational conditions of digital faculty, and methods to address the digital divide between urban and rural learning communities.

## Competing Interest

The authors declare that there are no competing interests relevant to this research.


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## Ethics, Consent to Participate, and Consent to Publish declarations

Not applicable.

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