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Mapping Research Trends In Technology-Enhanced Learning In Higher Education: A Bibliometric Study

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The integration of technology in higher education has significantly transformed the landscape of learning and teaching methodologies, leading to the rise of Technology-Enhanced Learning (TEL). This study employs bibliometric analysis to map the research trends in TEL and it is relation to differentiated instruction implementation from 2008 to 2024. By examining 108 documents sourced from Scopus, the study reveals key thematic areas, the growing impact of artificial intelligence (AI), and the proliferation of personalized learning approaches in higher education. The findings indicate that research output in TEL has increased by 22.58% annually, with a notable focus on AI and blended learning technologies. Co-authorship networks and keyword co-occurrence analysis further highlight the interdisciplinary nature of TEL research. These insights are valuable for educators, policymakers, and researchers seeking to understand the trajectory of technology integration in higher education. The study concludes by identifying potential areas for future inquiry, including the need for longitudinal studies on the impact of AI and digital equity in TEL.

Keywords—*Technology-Enhanced Learning, Differentiated Instruction, Higher Education, Bibliometric Analysis.*

I. INTRODUCTION

In recent years, the integration of technology in higher education has transformed pedagogical practices and learning environments, leading to the emergence of Technology-Enhanced Learning (TEL) as a pivotal area of research. The proliferation of digital tools and online platforms has not only redefined the educational landscape but has also prompted scholars to investigate the implications of these technologies on learning outcomes, student engagement, and instructional methodologies. This bibliometric study aims to map the research trends in TEL and it is relation to differentiated instruction implementation within higher education, providing a comprehensive overview of the current state of the field, identifying key

contributors, and highlighting emerging themes and future research directions. The study suggested that integrating technology could enhance the effectiveness of differentiated instruction implementation by providing diverse learning resources and facilitating personalized learning experiences [1].

The significance of TEL in higher education cannot be overstated. As educational institutions increasingly adopt digital technologies, understanding the dynamics of this field becomes essential for educators, policymakers, and researchers alike. Bibliometric analysis serves as a robust method for quantitatively assessing the scholarly output in this domain, allowing for the identification of influential publications, authors, and institutions. By employing bibliometric techniques, researchers can visualize the intellectual structure of TEL, revealing patterns of collaboration and the evolution of research themes over time [2][3].

Recent studies have demonstrated the effectiveness of bibliometric analysis in various fields, including education, where it has been used to examine trends, citation patterns, and the impact of specific research contributions [4][5]. For instance, bibliometric methods have been applied to explore the relationship between digital transformation and educational practices, highlighting the role of intellectual capital in shaping TEL initiatives [2][6]. Furthermore, the use of advanced visualization tools, such as VOSviewer has facilitated the mapping of research networks and the identification of key research clusters within the TEL landscape [4][5].

The current study will focus on publications indexed in reputable databases Scopus, ensuring that the analysis is grounded in high-quality scholarly work. By synthesizing data from a wide range of sources, this research will provide insights into the most cited articles, influential authors, and the geographical distribution of research efforts in TEL. Additionally, it will explore the thematic evolution of TEL research, identifying key areas of focus such as online learning, blended learning, and the use of emerging technologies like artificial intelligence and virtual reality in educational settings [7][3][8].

The findings of this bibliometric study will contribute to the existing body of knowledge by offering a detailed analysis of the trends and patterns in TEL research. It will serve as a valuable resource for educators and researchers seeking to understand the current landscape of technology-enhanced learning and to identify potential avenues for future inquiry. As the field continues to evolve, ongoing research will be crucial in addressing the challenges and opportunities presented by technological advancements in higher education [9][10].

In conclusion, this bibliometric study aims to provide a comprehensive mapping of research trends in Technology-Enhanced Learning and it is relation to differentiated instruction implementation in higher education. By employing rigorous bibliometric methods, the study will illuminate the current state of the field, identify key contributors, and highlight emerging themes that warrant further exploration. The insights gained from this analysis will not only enhance our understanding of TEL but also inform future research directions and educational practices in an increasingly digital world.

II. LITERATURE REVIEW

A. Technology Enhance Learning

The landscape of higher education has undergone a significant transformation with the advent of Technology-Enhanced Learning (TEL), particularly through the integration of blended

learning models. Blended learning, which combines traditional face-to-face instruction with online learning components, has emerged as a prominent pedagogical approach that caters to diverse learning styles and enhances student engagement Cabauatan et al. [11][12]. Research indicates that the flexibility inherent in blended learning allows institutions to tailor educational experiences to meet the needs of contemporary learners, thereby fostering a more personalized learning environment [12][13].

A critical aspect of TEL is the readiness of both students and educators to embrace blended learning methodologies. Studies have shown that students' access to technological tools and their digital literacy significantly influence their willingness to engage in blended learning environments [14][15]. For instance, Adams et al. found that students in Malaysian private higher education institutions expressed a strong preference for blended learning, provided they had adequate access to necessary technological resources [14]. Conversely, challenges such as insufficient digital skills and inadequate institutional support can hinder the effective implementation of blended learning [16][17].

Moreover, the psychological impact of blended learning on students cannot be overlooked. Research has highlighted that while blended learning can enhance motivation and satisfaction, it may also lead to feelings of isolation or boredom if not implemented thoughtfully [18][19]. The balance between online and face-to-face interactions is crucial in maintaining student engagement and fostering a sense of community within the learning environment [20][21]. For example, Vaksalla et al. emphasized the importance of instructor involvement in designing blended courses that effectively capture student interest and promote active participation [22].

The COVID-19 pandemic has further accelerated the adoption of blended learning, prompting institutions worldwide to adapt their teaching strategies rapidly. This shift has underscored the necessity for robust digital infrastructure and comprehensive training for educators to facilitate effective blended learning experiences [23][24]. Studies conducted during this period have revealed that students' perceptions of blended learning have evolved, with many recognizing its potential to enhance their learning outcomes [24][25]. However, the transition also highlighted disparities in access to technology, raising concerns about equity in education [26][27].

B. Differentiated Instruction

Differentiated Instruction (DI) has emerged as a pivotal pedagogical approach in contemporary education, aimed at addressing the diverse learning needs of students within heterogeneous classrooms. The essence of DI lies in its flexibility, allowing educators to tailor their teaching strategies based on students' varying readiness levels, interests, and learning profiles Brown & Wentworth [28][29]. This adaptability not only fosters an inclusive learning environment but also enhances student engagement and academic achievement [30][31].

Research indicates that DI can significantly improve learning outcomes across various educational contexts. For instance, a systematic review by Smale-Jacobse et al. highlights the positive effects of DI on student performance, particularly in secondary education settings [32]. Similarly, studies have shown that implementing DI strategies in mathematics education leads to increased student motivation and achievement [33]. The effectiveness of DI is further supported by evidence from Krishan and Al-Rsa'i, who found that technology-oriented DI positively influenced students' motivation to learn science [34].

However, the implementation of DI is not without challenges. Teachers often face obstacles such as limited resources, insufficient training, and the complexity of managing diverse

learning needs within a single classroom [35]. For example, Alhamuddin emphasizes the necessity for teachers to adopt multiple intelligence-based approaches to effectively engage students with different learning styles [29]. Furthermore, research by Suson et al. indicates that while DI can enhance reading comprehension, its success largely depends on teachers' understanding and application of differentiated strategies [36].

Moreover, cultural and contextual factors play a crucial role in shaping the effectiveness of DI. Awofala and Lawani's study reveals that the cultural background of students can influence their responses to differentiated teaching methods, necessitating a culturally responsive approach to DI [33]. This highlights the importance of contextualizing DI practices to align with the unique characteristics of the student population [37].

III. METHOD

This study utilized bibliometric analysis as its core research design to explore and map trends in Technology-Enhanced Learning (TEL) within higher education. Bibliometric analysis, a quantitative method, applies mathematical and statistical techniques to examine patterns in academic publications. By focusing on scholarly works within the TEL domain, the study sought to reveal underlying structural patterns, thematic developments, and the intellectual networks that shape the research landscape. The selection of bibliometric analysis was driven by its ability to systematically process vast amounts of data, providing insights that conventional qualitative literature reviews may overlook, such as citation networks, co-authorship dynamics, and research clusters.

Data collection was centered around the Scopus databases, which were chosen for their extensive coverage of peer-reviewed journals and conference proceedings. These databases offered rich metadata crucial for a comprehensive bibliometric study, including citation counts, authorship, institutional affiliations, and keywords. The study focused on publications from 2008 to 2024, a period reflecting the evolution of TEL technologies like Learning Management Systems (LMS), mobile learning, and artificial intelligence (AI). A carefully crafted Boolean search query was developed, incorporating terms such as “Technology,” “Personalized Learning,” “Higher Education,” and “University” to capture the broad spectrum of TEL research. Publications were filtered to include only those directly related to TEL in higher education, excluding works that focused on K-12 education or unrelated technical discussions.

Following data retrieval, the study entered a data preprocessing phase to enhance accuracy. This involved removing duplicate records and eliminating incomplete entries. A critical step was the standardization of keywords to address terminological inconsistencies. Subsequent analysis employed a descriptive bibliometric approach to examine publication trends, followed by co-authorship analysis to uncover collaboration networks, and citation analysis to identify influential works. Additionally, co-citation and bibliographic coupling techniques were applied to explore thematic clusters, facilitating a deeper understanding of TEL's intellectual foundations and emerging research trends.

IV. RESULT

A. Main Information

The data presented reveals several critical insights into the trends of research on

Technology-Enhanced Learning (TEL) in higher education, aligning with the objective of mapping its research landscape. The Annual Growth Rate of 22.58% signifies a strong upward trend in research output, highlighting the rapid proliferation of academic interest in TEL. This growth can be linked to the increasing global adoption of digital tools and learning platforms in higher education, driven by the demand for flexible and scalable educational solutions. Additionally, the Document Average Age of 3.62 years reflects the relatively recent nature of the studies being published, suggesting that research in this field is emerging in response to technological advancements such as AI-driven learning systems, mobile education, and virtual learning environments. The Average Citations per Document, at 15.85, signals that the body of work being produced is impactful, and researchers in this area are building on each other's work, contributing to a growing and highly interconnected field.

These findings hold significant implications for the future of TEL in higher education. The rapid growth in publications suggests that TEL is becoming an essential area of study, driven by societal and technological changes, especially the widespread adoption of online and blended learning during and post-pandemic. However, the relatively recent focus on these technologies indicates a potential gap in longitudinal studies that explore the long-term effects of TEL on educational outcomes. Furthermore, the high citation averages suggest that the field is still consolidating foundational research, but future studies may need to delve into more nuanced aspects of TEL, such as its impact on diverse student populations and how these technologies can be further personalized to enhance learning outcomes. The data, while reflective of strong growth, also points toward areas for future exploration and deeper study.

TABLE 1. MAIN INFORMATION

Description	**Results**
MAIN INFORMATION ABOUT DATA	
Timespan	2008:2024
Sources (Journals, Books, etc)	88
Documents	108
Annual Growth Rate %	22.58
Document Average Age	3.62
Average citations per doc	15.85
References	3955
DOCUMENT CONTENTS	
Keywords Plus (ID)	519
Author's Keywords (DE)	365
AUTHORS	
Authors	292
Authors of single-authored docs	20
AUTHORS COLLABORATION	
Single-authored docs	20
Co-Authors per Doc	2.72
International co-authorships %	15.74
DOCUMENT TYPES	
Article	62

Description	**Results**
Book	1
Book chapter	7
Conference paper	31
Conference review	4
Review	3

B. Research Growth

The data demonstrates a clear upward trend in publications related to Technology-Enhanced Learning in Higher Education from 2008 to 2024, with a notable peak in 2024 where the number of documents reached 26. This increase highlights a strong and sustained academic focus on the integration of technology into educational practices. The modest output in 2020 and 2021 could reflect a transitional phase where researchers were adjusting to the rapid changes in educational technology spurred by the COVID-19 pandemic. However, the subsequent surge in 2023 and 2024 shows a dramatic shift, likely driven by advancements in online learning platforms, artificial intelligence, and adaptive learning technologies. These innovations, combined with the ongoing demand for scalable, flexible educational models, have spurred significant scholarly attention and publication activity in the field.

This pattern suggests that Technology-Enhanced Learning is now seen as a critical area for research, particularly as higher education institutions continue to explore ways to enhance student engagement, personalization, and learning outcomes through technology. The sharp growth in publications from 2022 onwards may reflect the increased deployment of AI-based tools, immersive learning technologies like virtual and augmented reality, and the integration of data analytics in monitoring student progress. However, the relatively low output in 2021 indicates that there is still room for more comprehensive, longitudinal studies that explore the long-term impacts of these technological advancements. Future research should also focus on evaluating the effectiveness of these innovations, addressing potential disparities in access to technology, and exploring strategies for fostering digital literacy among both students and educators.

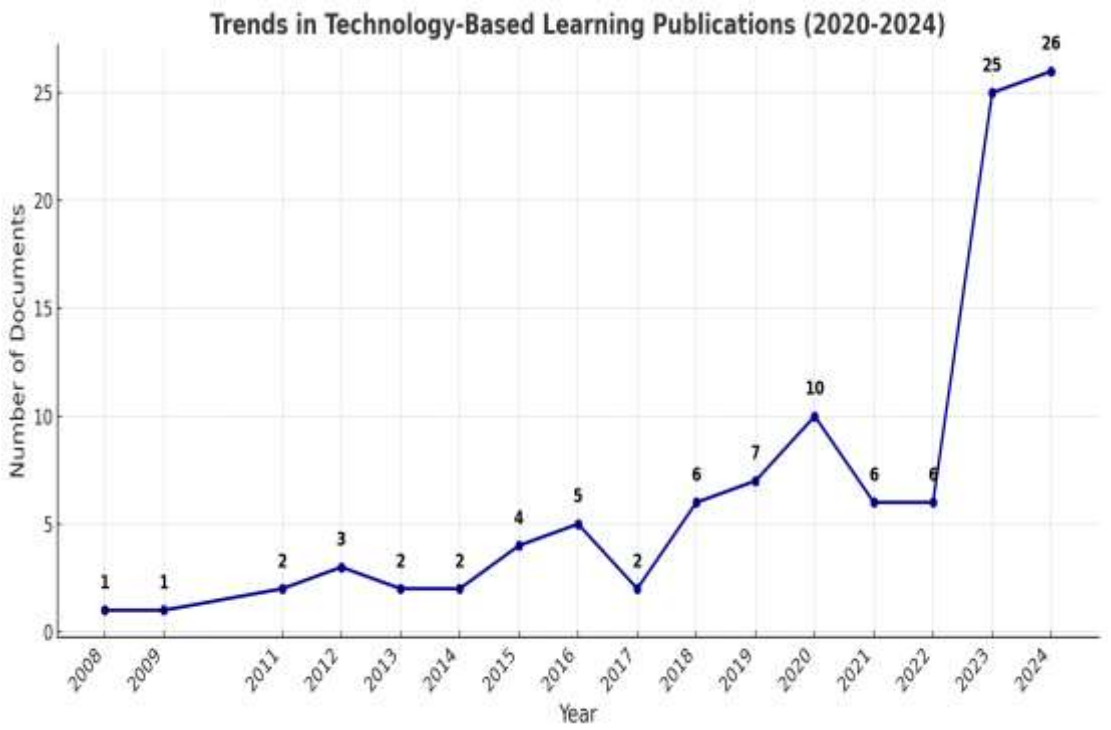

Figure 1. Documents by Year

C. Most Impactful Article

The table presents a rich set of data on key research papers related to Technology-Enhanced Learning in Higher Education, focusing on total citations, annual citation averages (TC per year), and normalized citation scores (Normalized TC). The paper "Students' voices on generative AI: perceptions, benefits, and challenges in higher education" stands out with the highest TC per year (84.50) and the most significant normalized TC (10.25), reflecting its strong relevance and impact in the emerging area of generative AI in higher education. This suggests a growing focus on AI's role in transforming educational practices, as scholars and educators explore the implications and potential of these technologies. Similarly, "What ChatGPT means for universities: Perceptions of scholars and students" highlights how generative AI tools like ChatGPT are gaining significant attention, as evidenced by its high TC per year (58.50) and normalized TC (7.10). These figures indicate that AI is a rapidly emerging area within the research landscape of technology-enhanced learning.

Additionally, papers such as "An adaptive hybrid MOOC model" (21.29 TC per year) and "University teachers' perception of barriers to the use of digital technologies" (22.40 TC per year) underscore the ongoing interest in adaptive learning models and the challenges educators face when integrating technology into teaching practices. However, lower-cited papers like "Informing and Performing: A Study Comparing Adaptive Learning to Traditional Learning" (8.00 TC per year) and "Using PDA for undergraduate student incidental vocabulary testing" (4.59 TC per year) suggest that while these topics contribute to the field, they may not be driving the latest innovations or conversations in the same way AI and hybrid MOOC models are. These trends indicate a critical shift toward exploring more dynamic, technology-driven

learning environments, with AI standing out as a key future area of research.

TABLE 2. THE MOST GLOBAL CITED DOCUMENTS

Paper	**Total Citations**	**TC per Year**	**Normalized TC**
Personalising learning: Exploring student and teacher perceptions about flexible learning and assessment in a flipped university course [38]	308	30.80	2.98
Students' voices on generative AI: perceptions, benefits, and challenges in higher education [39]	169	84.50	10.25
An adaptive hybrid MOOC model: Disrupting the MOOC concept in higher education [40]	149	21.29	4.68
What ChatGPT means for universities: Perceptions of scholars and students [41]	117	58.50	7.10
University teachers' perception of barriers to the use of digital technologies: the importance of the academic discipline [42]	112	22.40	4.03
Informing and Performing: A Study Comparing Adaptive Learning to Traditional Learning [43]	80	8.00	0.77
Using PDA for undergraduate student incidental vocabulary testing [44]	78	4.59	1.00
Empowering learners with personalised learning approaches? Agency, equity and transparency in the context of learning analytics [45]	57	11.40	2.05
Teaching students using technology: Facilitating success for students from low socioeconomic status backgrounds in Australian universities [46]	56	6.22	2.98
Managing the Strategic Transformation of Higher Education through Artificial Intelligence [47]	45	22.50	2.73

D. Most Impactful Authors

The table provides bibliometric data on various authors contributing to the field of Technology-Enhanced Learning in Higher Education, using key metrics such as h-index, Total

Citations (TC), Number of Publications (NP), and the year of first publication (PY_start). Notably, Al Farsi G stands out with the highest total citations (33) despite having only one publication (h-index of 1), indicating that their contribution has had a considerable impact. Angelov D follows closely with 25 citations and a PY_start of 2023, suggesting that recent work is receiving immediate attention. The fact that these researchers have such a high number of citations despite their low h-index indicates that their individual publications have resonated significantly within the academic community. This could point to the importance of their research topics, likely aligning with trending discussions in technology-enhanced learning, such as artificial intelligence or digital transformation in education.

On the other hand, several other authors like Alaghbari M.A., Ali M, and Alzoraiki M have minimal citations (2 or fewer), despite recently entering the research field with publications in 2024. This suggests that while these researchers are contributing to emerging areas, their work may not have yet garnered widespread recognition or could be focused on niche topics within the broader scope of technology-enhanced learning. The variety of PY_start years, ranging from 2019 to 2024, suggests that the field is attracting new researchers every year, further indicating that Technology-Enhanced Learning remains a dynamic and growing area of interest. However, it also suggests the need for continued research output and collaboration among authors to boost individual impact and cumulative knowledge in the field.

TABLE 3. AUTHORS' LOCAL IMPACT

Element	**h_index**	**TC**	**NP**	**PY_start**
Wang L	2	5	2	2019
Adamovsky A	1	2	1	2023
Al Farsi G	1	33	1	2019
Al-Sowi A.M.	1	19	1	2022
Alaghbari M.A.	1	2	1	2024
Ali M	1	1	1	2024
Almeida L	1	1	1	2023
Alzoraiki M	1	2	1	2024
Amenduni F	1	13	1	2019
Angelov D	1	25	1	2023

E. Keyword Co-occurrences Analysis

The table presents keyword occurrences and total link strength, illustrating the most commonly used terms in Technology-Enhanced Learning in Higher Education research. The most prominent keyword, "students" (36 occurrences, 272 total link strength), highlights the focus on learner-centered studies within the context of technology-enhanced education. Following closely are terms like "higher education" (38 occurrences, 202 total link strength) and "personalized learning" (33 occurrences, 196 total link strength), which reflect the increasing importance of tailoring educational experiences to individual needs. The high link strength associated with these keywords suggests that they are deeply interconnected in the research landscape, pointing to a convergence of studies on how personalized learning systems can better serve students in higher education. Other important terms such as "learning systems" and "e-learning" emphasize the technical infrastructure behind delivering these

personalized learning experiences.

Further down the list, we see rising trends in areas like "artificial intelligence" (17 occurrences, 124 total link strength) and "machine-learning" (2 occurrences, 19 total link strength). These keywords reflect the growing integration of advanced technologies into higher education, specifically in how AI is being leveraged to create adaptive, personalized learning environments. Notably, keywords like "ChatGPT" (5 occurrences, 19 total link strength) signal recent and significant interest in conversational AI technologies, which are rapidly shaping the future of education. However, terms like "adaptive learning" and "gamification" (5 and 3 occurrences, respectively) suggest these pedagogical approaches, while relevant, have not gained the same level of integration or exploration as AI and personalized learning systems. The variety of keywords also points to the interdisciplinary nature of the research, with connections spanning from education to engineering, health sciences, and data technologies. These trends indicate that the field is evolving, with emerging areas like AI promising to further transform learning experiences in the years ahead.

TABLE 4. KEYWORD CO-OCCURENCES ANALYSIS

Keyword	**Occurrences**	**Total Link Strength**
Students	36	272
Higher education	38	202
Personalized learning	33	196
Learning systems	22	193
E-learning	20	160
Teaching	21	159
Artificial intelligence	17	124
Education computing	12	113
High educations	13	99
Engineering education	12	97

V. DISCUSSION

The bibliometric analysis of Technology-Enhanced Learning (TEL) research and it is relation to differentiated instruction implementation in higher education reveals several critical trends and insights. From 2008 to 2024, there has been a significant rise in research output, driven largely by the increasing integration of advanced technologies such as artificial intelligence, personalized learning systems, and blended learning models. Notably, AI has emerged as a pivotal theme, with strong co-occurrence with keywords such as "students" and "personalized learning." This reflects the growing interest in leveraging AI to create adaptive learning environments that cater to individual student needs. The high occurrence and link strength of keywords like "students" (36 occurrences, 272 total link strength) and "personalized learning" (33 occurrences, 196 total link strength) further demonstrate the focus on learner-centric approaches.

Moreover, the emergence of AI-related keywords such as "ChatGPT" (5 occurrences) indicates the rising influence of conversational AI tools in educational settings. These technologies are rapidly transforming how instruction is delivered and consumed, fostering more interactive and flexible learning environments. Despite these advancements, there

remain areas that require further exploration, such as the long-term impact of AI-driven systems on educational equity and access. While the data highlights a strong interest in AI, personalized learning, and blended models, future research should delve deeper into understanding the barriers and facilitators of these innovations, particularly for marginalized groups in higher education.

CONCLUSION

The findings from this bibliometric study indicate that Technology-Enhanced Learning (TEL) is a rapidly growing field within higher education, with artificial intelligence playing an increasingly prominent role. The rise of AI tools, such as ChatGPT, in educational settings reflects a shift towards more personalized and adaptive learning environments. However, while there has been significant growth in TEL research, the relatively recent emergence of AI-driven studies suggests that further longitudinal research is needed to fully understand the impact of these technologies on student outcomes and educational equity. Additionally, there is a clear need for more comprehensive studies that examine how these technologies can be effectively scaled to meet the diverse needs of students across different socioeconomic and geographic contexts. This study provides a foundational understanding of the key trends in TEL and offers valuable insights for future research in this evolving field.

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REFERENCES

[1] Y. Tirizite, "Use of differentiated instruction in lsp courses in moroccan higher education", Eiki Journal of Effective Teaching Methods, vol. 1, no. 3, 2023. https://doi.org/10.59652/jetm.v1i3.30

[2] A. Yilmaz, "The relation between intellectual capital and digital transformation: a bibliometric analysis", International Journal of Innovation Science, vol. 16, no. 2, p. 244-264, 2023. https://doi.org/10.1108/ijis-08-2022-0145

[3] A. Haleem, M. Khan, S. Khan, & A. Jami, "Research status in halal: a review and bibliometric analysis", Modern Supply Chain Research and Applications, vol. 2, no. 1, p. 23-41, 2020. https://doi.org/10.1108/mscra-06-2019-0014

[4] K. Abdullah, "Mapping of literature on safety knowledge research using scientopy and vosviewer", Journal of Metrics Studies and Social Science, vol. 1, no. 1, p. 36-49, 2022. https://doi.org/10.56916/jmsss.v1i1.75

[5] N. Ellili, "Bibliometric analysis and systematic review of environmental, social, and governance disclosure papers: current topics and recommendations for future research", Environmental Research Communications, vol. 4, no. 9, p. 092001, 2022. https://doi.org/10.1088/2515-7620/ac8b67

[6] N. Slyvkanyč, "Bibliometric study of the conceptual approach of intellectual capital", Tem Journal, p. 2564-2572, 2023. https://doi.org/10.18421/tem124-68

[7] R. Modem, S. Lakshminarayanan, R. Pillai, & N. Prabhu, "Twenty-five years of career growth literature: a review and research agenda", Industrial and Commercial Training, vol. 54, no. 1, p. 152-182, 2021. https://doi.org/10.1108/ict-04-2021-0030

[8] K. Çiki, "Bibliometric analysis of diaspora tourism studies", Deturope - The Central European Journal of Tourism and Regional Development, vol. 14, no. 2, p. 62-81, 2022. https://doi.org/10.32725/det.2022.014
[9] C. Aigbavboa, "A bibliometric analysis and visual review of housing policy framework development research", The Thinker, vol. 85, no. 3, p. 51-62, 2020. https://doi.org/10.36615/thethinker.v85i3.382
[10] K. Kamaludin, "Two decades of bibliometric research in indonesia", The Light Journal of Librarianship and Information Science, vol. 3, no. 1, p. 32-43, 2023. https://doi.org/10.20414/light.v3i1.7034
[11] R. Cabauatan, C. Uy, R. Manalo, & B. Castro, "Factors affecting intention to use blended learning approach in the tertiary level: a quantitative approach", Higher Education for the Future, vol. 8, no. 2, p. 239-255, 2021. https://doi.org/10.1177/23476311211011934
[12] D. Putri, M. Adha, & B. Pitoewas, "The problems of implementing blended learning class in civic education students, university of lampung", Universal Journal of Educational Research, vol. 8, no. 3D, p. 106-114, 2020. https://doi.org/10.13189/ujer.2020.081715
[13] X. Cheng, W. Mo, & Y. Duan, "Factors contributing to learning satisfaction with blended learning teaching mode among higher education students in china", Frontiers in Psychology, vol. 14, 2023. https://doi.org/10.3389/fpsyg.2023.1193675
[14] D. Adams, M. Tan, & B. Sumintono, "Students' readiness for blended learning in a leading malaysian private higher education institution", Interactive Technology and Smart Education, vol. 18, no. 4, p. 515-534, 2020. https://doi.org/10.1108/itse-03-2020-0032
[15] S. Irum, "Blended learning: innovative challenge faced by students at university level in pakistan", Indian Journal of Science and Technology, vol. 13, no. 42, p. 4386-4395, 2020. https://doi.org/10.17485/ijst/v13i42.1212
[16] Organization of individual work of students in blended learning of foreign languages at higher educational institutions", Journal of Higher Education Theory and Practice, vol. 21, no. 14, 2021. https://doi.org/10.33423/jhetp.v21i14.4805
[17] F. Han and R. Ellis, "Identifying consistent patterns of quality learning discussions in blended learning", The Internet and Higher Education, vol. 40, p. 12-19, 2019. https://doi.org/10.1016/j.iheduc.2018.09.002
[18] J. Manghano, E. Magbanua, & A. Besa, "Psychological effects of blended learning to the faculty of sultan kudarat state university, philippines", Indonesian Journal of Educational Research and Technology, vol. 2, no. 1, p. 71-74, 2022. https://doi.org/10.17509/ijert.v2i1.41381
[19] I. Assali, "A blended model of interior design studio practice due to covid-19", F1000research, vol. 12, p. 411, 2023. https://doi.org/10.12688/f1000research.128478.3
[20] Z. Mohebbi, A. Haftador, B. Tehranineshat, & Z. Keshtkaran, "A study of the effects of blended learning on university students' critical thinking: a systematic review", Journal of Education and Health Promotion, vol. 12, no. 1, 2023. https://doi.org/10.4103/jehp.jehp_665_22
[21] K. Νικολοπούλου and G. Zacharis, "Blended learning in a higher education context: exploring university students' learning behavior", Education Sciences, vol. 13, no. 5, p. 514, 2023. https://doi.org/10.3390/educsci13050514
[22] A. Vaksalla, N. Saat, I. Ishak, S. Hanawi, H. Amin, S. Kamsanet al., "The students' perceptions and attitudes towards blended learning among undergraduate students in kuala lumpur", Education in Medicine Journal, vol. 14, no. 4, p. 19-28, 2019. https://doi.org/10.21315/eimj2019.11.4.2
[23] G. Ali, B. Buruga, & T. Habibu, "Swot analysis of blended learning in public universities of uganda: a case study of muni university", J — Multidisciplinary Scientific Journal, vol. 2, no. 4, p. 410-429, 2019. https://doi.org/10.3390/j2040027
[24] N. Rudhumbu, "Applying the utaut2 to predict the acceptance of blended learning by university students", Asian Association of Open Universities Journal, vol. 17, no. 1, p. 15-36, 2022. https://doi.org/10.1108/aaouj-08-2021-0084

[25] Z. Sharif, A. Ariff, Z. Abdullah, & F. Bakar, "Blended learning readiness and its way forward: the case of undergraduates of universiti utara malaysia",, vol. 3, p. 99-120, 2021. https://doi.org/10.32890/pr2021.3.5

[26] D. Dwikoranto, W. Surasmi, B. Kurniawan, I. Dawana, & L. Bergsma, "Utilization of universities' massive online open courses in learning management system: research trends and bibliometric analysis", Ijorer International Journal of Recent Educational Research, vol. 4, no. 3, p. 383-398, 2023. https://doi.org/10.46245/ijorer.v4i3.380

[27] P. Moodley, R. Singh, & J. Cloete, "Exploring student perceptions of using the learning management system and social media for blended learning at a rural university", Progressio South African Journal for Open and Distance Learning Practice, vol. 37, no. 1, p. 68-82, 2015. https://doi.org/10.25159/0256-8853/573

[28] L. Brown and R. Wentworth, "Differentiating instruction in the pre-service science education classroom", SHS Web of Conferences, vol. 98, p. 01007, 2021. https://doi.org/10.1051/shsconf/20219801007

[29] A. Alhamuddin, "Multiple intelligence-based differential learning on critical thinking skills of higher education students", International Journal of Advanced and Applied Sciences, vol. 10, no. 8, p. 132-139, 2023. https://doi.org/10.21833/ijaas.2023.08.015

[30] M. Suprayogi, "The effectiveness of differentiated instruction, implementation in indonesia higher education: a literature review",, p. 374-389, 2023. https://doi.org/10.2991/978-2-38476-108-1_37

[31] F. Mardiyah, "Differentiated instruction analysis on the topic of cell reproduction in 12th grade of senior high school", Assimilation Indonesian Journal of Biology Education, vol. 6, no. 2, p. 109-116, 2023. https://doi.org/10.17509/aijbe.v6i2.58538

[32] A. Smale-Jacobse, A. Meijer, M. Helms-Lorenz, & R. Maulana, "Differentiated instruction in secondary education: a systematic review of research evidence", Frontiers in Psychology, vol. 10, 2019. https://doi.org/10.3389/fpsyg.2019.02366

[33] A. Awofala and A. Lawani, "Increasing mathematics achievement of senior secondary school students through differentiated instruction", Journal of Educational Sciences, vol. 4, no. 1, p. 1, 2020. https://doi.org/10.31258/jes.4.1.p.1-19

[34] I. Krishan and M. Al-rsa'i, "The effect of technology-oriented differentiated instruction on motivation to learn science", International Journal of Instruction, vol. 16, no. 1, p. 961-982, 2023. https://doi.org/10.29333/iji.2023.16153a

[35] K. Iterbeke, K. Witte, K. Declercq, & W. Schelfhout, "The effect of ability matching and differentiated instruction in financial literacy education. evidence from two randomised control trials", Economics of Education Review, vol. 78, p. 101949, 2020. https://doi.org/10.1016/j.econedurev.2019.101949

[36] R. Suson, C. Baratbate, W. Anoos, E. Ermac, A. Aranas, N. Malabagoet al., "Differentiated instruction for basic reading comprehension in philippine settings", Universal Journal of Educational Research, vol. 8, no. 9, p. 3814-3824, 2020. https://doi.org/10.13189/ujer.2020.080904

[37] M. AM, "Does differentiated instruction affect learning outcome systematic review and meta-analysis", Journal of Pedagogical Research, 2023. https://doi.org/10.33902/jpr.202322021

[38] T. Wanner and E. Palmer, "Personalising learning: Exploring student and teacher perceptions about flexible learning and assessment in a flipped university course," Computers & Education, vol. 88, pp. 354–369, Oct. 2015, doi: 10.1016/j.compedu.2015.07.008.

[39] C. K. Y. Chan and W. Hu, "Students' voices on generative AI: perceptions, benefits, and challenges in higher education," International Journal of Educational Technology in Higher Education, vol. 20, no. 1, Jul. 2023, doi: 10.1186/s41239-023-00411-8.

[40] F. J. García-Peñalvo, Á. Fidalgo-Blanco, and M. L. Sein-Echaluce, "An adaptive hybrid MOOC model: Disrupting the MOOC concept in higher education," Telematics and Informatics, vol. 35, no. 4, pp. 1018–1030, Sep. 2017, doi: 10.1016/j.tele.2017.09.012.

[41] M. Firat, "What ChatGPT means for universities: Perceptions of scholars and students," Journal of Applied Learning & Teaching, vol. 6, no. 1, Apr. 2023, doi: 10.37074/jalt.2023.6.1.22.
[42] C. Mercader and J. Gairín, "University teachers' perception of barriers to the use of digital technologies: the importance of the academic discipline," International Journal of Educational Technology in Higher Education, vol. 17, no. 1, Mar. 2020, doi: 10.1186/s41239-020-0182-x.
[43] M. C. Murray and J. Pérez, "Informing and Performing: A Study Comparing Adaptive Learning to Traditional Learning," Informing Science the International Journal of an Emerging Transdiscipline, vol. 18, pp. 111–125, Jan. 2015, doi: 10.28945/2165.
[44] Y. Song and R. Fox, "Using PDA for undergraduate student incidental vocabulary testing," ReCALL, vol. 20, no. 3, pp. 290–314, Aug. 2008, doi: 10.1017/s0958344008000438.
[45] Y.-S. Tsai, C. Perrotta, and D. Gašević, "Empowering learners with personalised learning approaches? Agency, equity and transparency in the context of learning analytics," Assessment & Evaluation in Higher Education, vol. 45, no. 4, pp. 554–567, Nov. 2019, doi: 10.1080/02602938.2019.1676396.
[46] M. Devlin and J. McKay, "Teaching students using technology: Facilitating success for students from low socioeconomic status backgrounds in Australian universities," Australasian Journal of Educational Technology, vol. 32, no. 1, Mar. 2016, doi: 10.14742/ajet.2053.
[47] B. George and O. Wooden, "Managing the Strategic Transformation of Higher Education through Artificial Intelligence," Administrative Sciences, vol. 13, no. 9, p. 196, Aug. 2023, doi: 10.3390/admsci13090196.