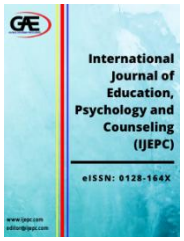
International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 63 (June 2026) PP. 858-877



INTERNATIONAL JOURNAL OF EDUCATION, PSYCHOLOGY AND COUNSELLING (IJEPC)
https://gaexcellence.com/ijepc

A BIBLIOMETRIC ANALYSIS OF AFFECTIVE, PSYCHOLOGICAL, AND PEDAGOGICAL FACTORS IN UNIVERSITY MATHEMATICS EDUCATION

Foo Fong Yeng[1]*, Shamsatun Nahar Ahmad[2], Shafaruniza Mahadi[3]

[1]Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Cawangan Johor, Kampus Pasir Gudang, Jalan Purnama, Bandar Seri Alam, 81750 Masai, Johor
foofo931@uitm.edu.my https://orcid.org/0000-0001-9949-4730

[2]Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Cawangan Johor, Kampus Segamat, Jalan Universiti Km 12 Off Jalan Muar, 85000 Segamat, Johor
shams551@uitm.edu.my https://orcid.org/0000-0002-5238-0055

[3]Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Cawangan Johor, Kampus Segamat, Jalan Universiti Km 12 Off Jalan Muar, 85000 Segamat, Johor
shafa669@uitm.edu.my https://orcid.org/0000-0001-9549-4514

*Corresponding Author

Article Info:

Article history:
Received date: 07.05.2026
Revised date: 31.05.2026
Accepted date: 21.06.2026
Published date: 29.06.2026

To cite this document:

Foo, F. Y., Ahmad, S. N., & Mahadi, S. (2026). A Bibliometric Analysis of Affective, Psychological, And Pedagogical Factors in University Mathematics Education. *International Journal of Education, Psychology and Counselling, 11*(63), 858-877.

Abstract:

Mathematics at the university level is challenging as it requires intense logical reasoning, and the content is delivered in a fast-paced environment. Over the decades, researchers have devoted themselves to improving the effectiveness of teaching and learning mathematics through different techniques, investigating the influences of affective, psychological, and pedagogical factors on the students' performance. This study aims to provide a comprehensive understanding of this field by conducting a bibliometric analysis on data retrieved from Scopus, which contains bibliographic data of publications published between 2001 and 2025. The analysis provides information about the publication trends, the most active contributors, the most cited publications, and research themes. The findings show that existing research could be grouped into technology-integrated learning, psychological and policy factors, cognitive development in mathematics, teacher-related factors, educational pressures and artificial intelligence adoption, and anxiety-related constructs. Among these, motivation and self-efficacy received high attention, showing that psychological and cognitive factors are important. The findings also suggest that problem-based learning, educational policy, collaborative learning, teaching confidence, formative assessment, stress, working memory, and depression could be possible future research directions. This study contributes an integrated perspective on mathematics education by connecting pedagogical

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 63 (June 2026) PP. 858-877

practices with learner-related psychological and affective factors. The findings offer valuable implications for educators, researchers, and policymakers in enhancing student learning and success in university-level mathematics education.

DOI: 10.35631/IJEPC.1163051

Keyword:

Bibliometric Analysis, Mathematics Education, Pedagogical Factors, Psychological Factors, Review

Introduction

Mathematics serves as a common language that connects several fields, including science, technology, engineering and mathematics (STEM). Mathematics involves methods or techniques that can be used to analyze and explain many movements or phenomena. Mathematics provides the logic and structure for programming algorithms. Mathematics is also used in the design and construction of structures in the engineering field. In other words, mathematics helps to solve many problems in real-world situations.

At the university level, Mathematics remains an important subject that prepares students to develop many skills, including problem-solving and logical thinking (Sehrawat, 2024; Asare et al., 2025). Several studies have examined pedagogical practices and factors that affect students' achievement in mathematics (Chiu & Seah, 2024; Gbormittah et al., 2025; Ovat et al., 2026).

Pedagogy has a vital role in education. It can be described as the process of teaching preparation and design, and the delivery of teaching to facilitate the learning process. Different practices of teaching methods and classroom productive environments represent the main components in pedagogy. The traditional teaching method is still being used in education. The old approach was to impart the knowledge using a passive learning approach with lecture techniques (Arsad et al., 2018). Content delivery is the main purpose of these practices. However, Lee and Paul (2023) suggest that lecture-based teaching may be insufficient for fostering critical thinking skills. In higher education, there is a trend to the student-centered approach such as problem based learning and active learning. They are sometimes presented as a 'false dichotomy' between them and traditional lectures, possibly even suggesting that one or the other approach is more effective than the others (Dietrich & Evans, 2022).

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 63 (June 2026) PP. 858-877

Affective and psychological factors have also received increasing attention in mathematics education research. Students tend to experience difficulties in problem-solving and exhibit lower academic achievement in higher education when the difficulty level of mathematics increases. Students faced anxiety and depression when learning mathematics (McCurdy et al., 2022). Low motivation is also another key factor associated with students' struggle in mathematics (Saha et al., 2024). Among these factors, mathematics anxiety is a main concern as it is often associated with avoidance behavior, reduced performance, and negative attitudes toward mathematics.

Motivation is a key factor that sustains students' behavior in effort and focus to achieve excellent performance. There are two types of motivation which are intrinsic and extrinsic. Intrinsic motivation comes from within students, increasing their interest and enjoyment. Meanwhile, extrinsic comes from outside, such as grades or rewards received from their educator or others. Students' self-efficacy and confidence level have a relation with motivation in psychology perspective. These lead to how student shape their interest in mathematics. According to Noreen & Rana (2019), students' interest and understanding the mathematical concept can be improved in activity-based teaching.

Recently, teaching and learning approaches have shifted to student-centered learning that uses technology and artificial intelligence (AI) to foster active engagement and computational thinking skills, especially in STEM education (Ayanwale & Omeh, 2026). The relation between pedagogy and AI has been discussed in Shen et al. (2026). With the aid of digital technologies, students can learn through game-based learning (Held et al., 2025; Liu & Ldokova, 2026; Yaqoubi et al., 2025), and problem-based learning (Boom-Cárcamo et al., 2024; Meiliati, 2026). Virtual reality (VR) and deep learning (DL) have been increasingly applied, and the study has been discussed in the context of bibliometric trends to deepen understanding of mathematical concepts through visual exploration of geometry (Hidajat, 2026). As discussed by Ardeleanu (2019), modern teaching practices change the mathematics paradigm toward active learning. Through these practices, students' attention, participation, and motivation will increase, thus leading to the achievement of learning outcomes.

Previously, the bibliometric studies in mathematics education have focused on mathematics psychology and also teaching practices at the primary and secondary levels. There are fewer studies that examine pedagogy and affective practices at the university level that focus on mathematics. Due to this gap, the systematic mapping of previous studies focused on pedagogy and psychology to see their relationship in mathematics education at the higher level is needed.

This paper discusses and presents the trends in research on mathematics affective, psychology, and pedagogy in higher education. The objective of this study is to address this gap by conducting a bibliometric analysis to identify research trends and thematic structures in the field. This paper is divided into several sections which are discussion on previous studies in the literature review, methodology, analysis of trends, analysis of the most influential authors, universities and countries and also an analysis on most cited related articles. Lastly, the findings of the study are discussed in the last section.

Literature Review

Recent bibliometric publications in mathematics education have provided valuable insights into global publication trends at the macro level. Krishnan and Raman (2024) framed their

work around sustainable education and academic achievement. They touched on equity and learning but only briefly mentioned affective factors. Chkana et al. (2025) conducted an analysis spanning all educational levels but strictly limited to a four-year window, identifying dominant trends in cognitive development, equality, and early childhood education. The research of Thi-nga et al. (2024) focuses on cognitive processing in mathematics learning across all age levels. They mapped the evolution of metacognition and investigated how self-regulated learning relates to academic achievement. Ultimately, the findings of these studies are likely skewed by the high volume of primary and secondary school literature, leaving higher education relatively under-represented. Further, the affective factors in learning tertiary mathematics remain largely unaddressed.

Liu et al. (2025) addressed a different dimension of mathematics education by exploring the instructional side of the classroom. Their work examined the pedagogical development and knowledge of mathematics instructors, highlighting that recent research trends are centered on teacher professional development and technology integration. However, while the knowledge base of the mathematics educator is well-documented, the psychological and affective dimensions of the university-level mathematics learner remain critically under-mapped.

While the aforementioned studies tend to obscure the affective dimension, there are bibliometric analyses that focus on a single affective variable, such as math anxiety. For instance, Sagarduy et al. (2024) specifically examined how math anxiety develops in primary education, focusing on the gender stereotypes and pedagogical strategies. Ersozlu and Karakus (2019) found that math anxiety is frequently studied alongside motivation, self-efficacy, achievement, gender differences, and numeracy skills. Furthermore, the analysis by Wahyuni et al. (2025) indicates that math anxiety is a common problem from elementary school through university, acting as a key factor that influences mathematical mastery. Their research also demonstrates that math anxiety affects not only students but also prospective teachers. Since these studies typically focus on early education or broad age ranges, the psychological landscape of university students is poorly understood. Further, as these studies narrow the scope to anxiety, the intersection of multiple psychological factors is overlooked.

A bibliometric analysis restricting its scope to tertiary education is found in the work of Kasim et al. (2025) who recently mapped the landscape of academic stress and mental illness among university students in Malaysia. Because their work examines the general pressure of being a university student, it might obscure the unique psychological friction found in highly demanding mathematics subjects. Furthermore, since their study is explicitly localized to Malaysia, it might not capture global research trends in higher education mathematics. Their investigation also might not capture positive drivers such as motivation.

The work of Zheng et al. (2025) is the recent bibliometric literature mapping individual affective drivers, where they look at learning motivation across all disciplines within blended learning environments. However, their focus isolated a single positive driver which is motivation and their study remains subject agnostic. A student might be highly motivated in a blended history class but experience severe anxiety and zero motivation in a blended calculus class. As mathematics in higher education presents a uniquely rigorous cognitive landscape, their research might not be able to provide a holistic psychological mapping, where high motivation is often directly combated by academic stress or math anxiety. A more comprehensive bibliometric mapping of affective factors was presented by Taştepe and Özkaya (2026), which investigated the impact of motivation, self-efficacy, and anxiety in mathematics

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 63 (June 2026) PP. 858-877

education. Nevertheless, their demographic scope blends primary, secondary, and tertiary levels, which may obscure the unique psychological pressures of higher education.

In this study, we bridge the gap in the literature by expanding the scope to psychological barriers and drivers in learning mathematics. By isolating the demographic scope to the higher education level, we can more precisely map the intersection of teaching, learning, and psychological factors within higher level mathematics.

Methodology

We chose Scopus as the source for extracting bibliographic data because it is well known for its comprehensive coverage of literature from variety fields. Table 1 shows all the steps in the data search process, including the search string and refinement steps. At first, there were 7,704 documents in the search. To make sure that the quality of the literature was consistent, the search was limited to English-language journal articles (4,272 articles). To ensure the analysis reflects current research trends, only articles published between 2001 and 2025 were retained where articles published earlier than that were removed.

Table 1: Data Search Process

Steps	Details	Number of Publications
Conduct search using search string	TITLE-ABS-KEY ((teach* OR learn* OR educat* OR instruct* OR pedagogy) AND math* AND (universit* OR "higher education" OR college* OR undergrad* OR tertiary) AND (psychology OR anxiety OR depression OR motivation OR stress OR emotion* OR "self-efficacy" OR "mental health" OR affect*))	7,704
Refine the Literature Type and Language	Journal Article, English	4,272
Refine the Timeline	2001 to 2025	3,837
Refine the Subject Area	Social Sciences, Psychology, Arts and Humanities, Mathematics, Decision Sciences, Computer Science, and Multidisciplinary fields	3,354

Source: Scopus

The subject area filters were then applied to ensure the publications are highly relevant. Social Sciences, Arts and Humanities, and Psychology were selected as literature related to education, pedagogy, and affective factors are commonly grouped under these categories. The inclusion of Mathematics and Decision Sciences attempts to capture math-specific educational journals that might not be tagged under general social sciences and literature related to academic and psychological relationship modeling. Computer Science was included to capture literature in relation to the integration of educational technology, which may include digital mathematics platforms and applications. The multidisciplinary category is also in the inclusion criteria as it

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 63 (June 2026) PP. 858-877

might be the place for journals reflecting the intersection of psychology factors, pedagogical design, and modern technological learning environments. As a result, a total of 3,354 articles were retained for the bibliometric analysis.

Result Analysis

Publication Trends

Table 2 below shows the number of related documents published from 2001 to 2025. The total number of documents in 25 years is 3354. Around 39 documents were reported twice (mode) in 2005 and 2006. The highest number of documents is recorded in 2025, an increase of 58 from 2024. Meanwhile, 2003 recorded the smallest number documented for the study, with only 15. The data in Table 2 is also illustrated in Figure 1 as a bar chart to show the study's trend. The mean score is 134.16 documents per year. On average, about 134 documents were published per year.

The period from 2020 to 2025 shows a higher number of publications compared to the mean value while the volume in earlier years was lower. These data show the strong upward publication trend over time. In statistics, the median is a measure of central tendency, which is the middle value of the data when sorted in ascending order. According to the data, the median is 96, which is lower than the mean value (median = 96 < mean = 134). It shows that there is a significant growth in the research activity during the most recent years.

Table 2: The Number of Documents Published Related to Pedagogy, Mathematics, Higher Education, and Psychology

Year	Number of Documents	Year	Number of Documents
2001	16	2014	96
2002	19	2015	133
2003	15	2016	129
2004	35	2017	133
2005	39	2018	145
2006	39	2019	197
2007	47	2020	237
2008	57	2021	249
2009	67	2022	293
2010	76	2023	273
2011	77	2024	363
2012	71	2025	421
2013	127		

Source: Scopus

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 63 (June 2026) PP. 858-877

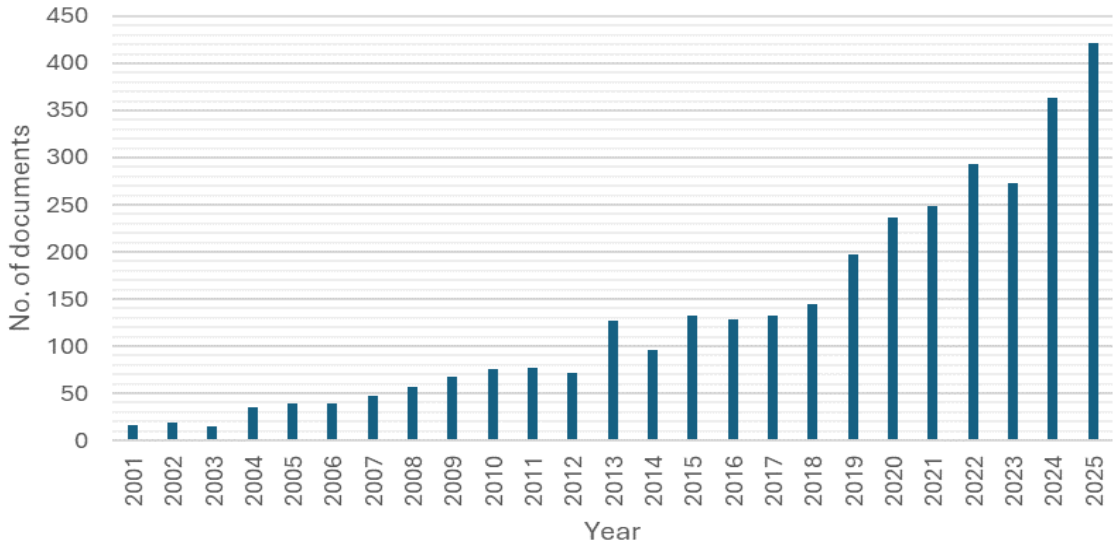


Figure 1: The Number of Documents Published Related to Pedagogy, Mathematics, Higher Education, and Psychology

Source: Scopus

Table 3 below shows the differences in the documents between each year. The largest increase in the number of studies is from 2023 to 2024, which is 90 documents. However, some decreases in the number were recorded in 2003, 2012, 2014, 2016 and 2023.

Table 3: Difference in the Number of Documents within Each Year from 2001 to 2025

Year	Different Number of Documents	Year	Different Number of Documents
2001 – 2002	3	2013 - 2014	-31
2002 – 2003	-4	2014 – 2015	37
2003 – 2004	20	2015 – 2016	-4
2004 – 2005	4	2016 – 2017	4
2005 – 2006	0	2017 – 2018	12
2006 – 2007	8	2018 – 2019	52
2007 – 2008	10	2019 – 2020	40
2008 – 2009	10	2020 – 2021	12
2009 – 2010	9	2021 – 2022	44
2010 – 2011	1	2022 – 2023	-20
2011 – 2012	-6	2023 – 2024	90
2012 – 2013	56	2024 – 2025	58

Source: Scopus

Most Productive Countries, Universities and Authors

The most productive countries, universities and authors are shown in Table 4, Table 5 and Table 6, and Figure 2 respectively. The analysis at the country level validates that research output is concentrated among a few developed countries (Table 4 and Figure 2). The United States leads the field by far, as it is the leader in terms of the number of publications and citations, and high

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 63 (June 2026) PP. 858-877

international collaboration connections. This leadership coincides with the dominance observed at the author and institutional levels (Tables 5 and 6).

Table 4: Top Five Most Productive Countries Based on Scopus Database

Rank	Country	Total Publications	Citations	Connect to Number of Countries
1	United States	1344	51,561	15
2	United Kingdom	212	7,363	16
3	Canada	89	4,825	10
4	Germany	121	3,640	10
5	Australia	123	3,084	10

Source: Scopus

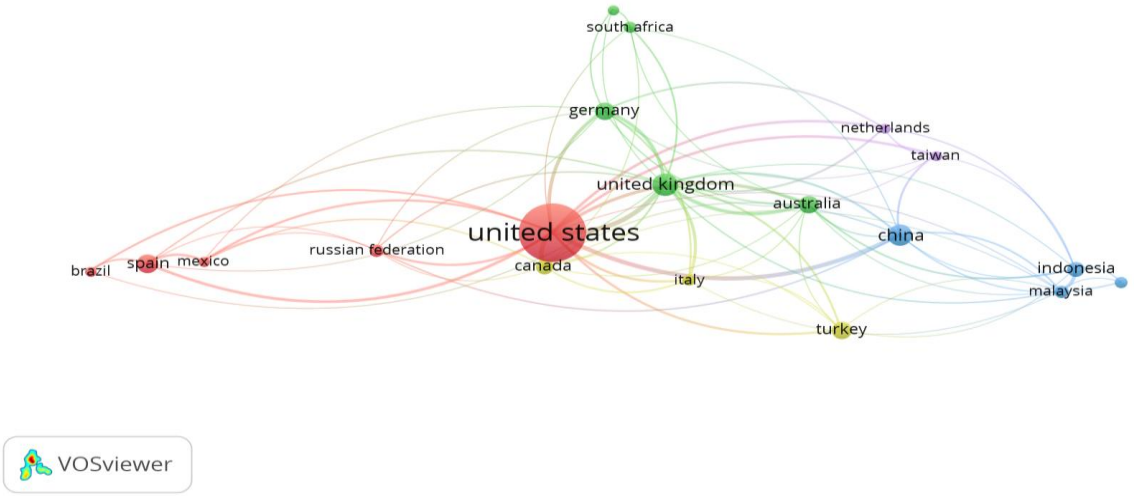


Figure 2: The Research Collaboration Network among Countries

Source: Scopus

Table 4 and Figure 2 also show that the United Kingdom, Canada, Germany, and Australia are other influential countries that portray significant citation impact and networks of active collaboration. Having a considerable number of international connections to countries like the United Kingdom and the United States, it is possible to state that collaborative research is an important factor to increase the appearance and citation effects. On the other hand, new economies like Malaysia, Indonesia and Philippines are increasingly active engaging in the field. Nevertheless, their citation influence is relatively less, which indicates the inequality in research exposure and international impact.

The institutional level indicates that there is a high level of concentration of research output in the top universities of the United States (Table 5). The University of Wisconsin-Madison has the highest number of publications, as well as citations, through the efforts of highly cited researchers like Judith M. Harackiewicz and Janet S. Hyde (Tables 5 and 6). Other leading institutions are Washington State University, University of Virginia and University of Minnesota.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 63 (June 2026) PP. 858-877

Table 5: Top Five Most Productive Universities Based on Scopus Database

Rank	University	Total Publications	Citations	Country
1	University of Wisconsin-Madison	19	2,686	United States
2	Washington State University	6	1,048	United States
3	University of Virginia	6	872	United States
4	University of Minnesota	6	626	United States
5	American University of Sharjah	6	12	United Arab Emirates

Source: Scopus

Table 6: Top Five Most Productive Authors Based on Scopus Database

Rank	Author	Total Publications	Citations	H-index	Affiliation	Country
1	Judith M. Harackiewicz	114	11,401	59	University of Wisconsin–Madison	United States
2	Elizabeth A. Canning	38	2,028	25	Washington State University	United States
3	Janet S. Hyde	195	28,902	77	University of Wisconsin–Madison	United States
4	Chris S. Hulleman	65	6,379	31	Motivate Lab, Charlottesville	United States
5	Yoi Tibbetts	26	1,122	14	University of Virginia	United States

Source: Scopus

These organizations are also typified by highly interdisciplinary research settings especially at the nexus of education, psychology, and learning sciences. Their dominance implies that meaningful studies in mathematics education are usually generated in well-established academic ecosystems that facilitate collaboration and innovativeness. Having the American University of Sharjah in the top five means that contributions are beginning to be made by non-Western institutions, but there is still a low representation of them.

The review of the most influential authors has shown that the research in the field of mathematics education, especially the research concerning motivation, anxiety, and pedagogy, is mostly influenced by scholars with a background in educational and social psychology (Table 6). Judith M. Harackiewicz appears as the most influential writer among the identified ones since she is the most cited author, and next come Elizabeth A. Canning, Janet S. Hyde, Chris S. Hulleman, and Yoi Tibbetts.

Another trend of these authors that can be distinguished is that they pay much attention to motivation and engagement of students. They point out in their work that the involvement and achievement of students in mathematics are not only a cognitive ability but also greatly affected

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 63 (June 2026) PP. 858-877

by perceived relevance and a sense of belonging. This marks a paradigm shift in the research in mathematics education to the affective and socio-cultural aspects.

Most Cited Articles

We summarized the result findings of top five most cited articles in Table 7. The review of the most productively cited articles indicates that the studies of mathematics education are defined by three prevailing dimensions: cognitive bases, motivation, and technology-enhanced learning environments. Although earlier research focuses on innate numerical skills (like approximate number systems), newer research has pointed to the importance of intrinsic motivation, engagement and digital learning spaces. Simultaneously, social-psychological contributors like the sense of belonging and gender stereotypes play a major role in determining student engagement in mathematics. The results indicate that mathematics learning is multidimensional in nature, but the current research is inclined to study the different dimensions separately. This shows that there is an urgency to integrate frameworks in the future that would involve cognitive, affective, and pedagogical approaches.

Table 7: Top Five Most Cited Articles Based on Scopus Database

Authors / year	Title of Article / Source	Summary of issues highlighted	Citations
Halberda et al., 2008	Individual differences in non-verbal number acuity correlate with maths achievement. Nature	This article correlates the approximate number system acuity of students with the achievement in mathematics. The key point raised is the possibility of the existence of foundational, evolutionarily older, number sense correlates to performance in mathematics.	1234
Voyer & Voyer, 2014	Gender Differences in Scholastic Achievement: A Meta-Analysis. Psychological Bulletin	This meta-analysis demonstrates a significant albeit small female difference in school marks, including mathematics, although the difference is significantly smaller in math than in language subjects. It brings out the problem of gender disparity, patterns of grading, moderating factors, and comparison of grades and test performance.	1006
Lee et al., 2005	Acceptance of Internet-based learning medium: The role of extrinsic and intrinsic motivation Information & Management	This research involves the acceptance of internet-based learning among the students based on motivation-extended Technology Acceptance Model (TAM) framework. These points of concern include intrinsic motivation (perceived enjoyment), extrinsic motivation (perceived	892

Authors / year	Title of Article / Source	Summary of issues highlighted	Citations
		usefulness), student intention to use online learning systems.	
Good et al., 2012	Why Do Women Opt Out? Sense of Belonging and Women's Representation in Mathematics. Journal of Personality and Social Psychology	The paper confirms the sense of belonging in mathematics as a determinant in the intention of women to persist in mathematics. It also points out the ability of fixed-ability messages and gender stereotypes to decrease the belonging, future participation, and even grades of women, and how growth-oriented messages can be protective.	884
Saadé & Bahli, 2005	The impact of cognitive absorption on perceived usefulness and perceived ease of use in online learning: an extension of the technology acceptance model Information & Management	This article studies online learning acceptance through cognitive absorption, perceived usefulness, and perceived ease of use using TAM.	797

Source: Scopus

Keyword Co-Occurrence Analysis and Research Clusters

We conducted a keyword co-occurrence analysis using VOSviewer to explore the research structure of university-level mathematics education, selecting a minimum of ten occurrences for a keyword to be included in the map construction. Figure 3 shows that "mathematics", "higher education", and "STEM" are the keywords with high occurrences. This indicates that the literature is strongly centered around higher education mathematics content and its integration into STEM. "Motivation" and "self-efficacy" are also noticeable with high frequency, and they share most of their linkage keywords, including "learning strategies", "game-based learning", and "teacher education". This suggests that researchers have explored methods to enhance these affective factors through various learning and pedagogical strategies. Interestingly, these two keywords have also linked to "mathematics anxiety" and "mathematics achievement" which means that the psychological landscape of learning higher level math is unique and complex where the motivation, self-efficacy, mathematics anxiety, and achievement are not separable.

There are six distinct research clusters, where each represents a distinct yet interconnected research theme. The red cluster suggests a shift from traditional lectures toward technology-supported learning, evidenced by the appearance of "blended learning" and "online learning".

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 63 (June 2026) PP. 858-877

The keywords "gamification", "flipped classroom", and "active learning" indicate that this group of research also emphasizes innovative pedagogical environments that integrate modern teaching methods and student-centered strategies. Nonetheless, the lower frequency keywords "computational thinking", "problem-based learning", and "virtual reality" might represent innovative pedagogical areas that remain underexplored.

The research in the green cluster mainly examines the "motivation" and factors of "persistence" and "retention" in STEM. This cluster also investigates the relationships of psychological drivers with "educational policy" and "curriculum" design. The education policy is associated with "equity" in mathematics education, where it needs to ensure that students with different backgrounds ("diversity") have equal opportunities to success. Nevertheless, the low occurrences of these two keywords indicate that they are not the dominant research topics.

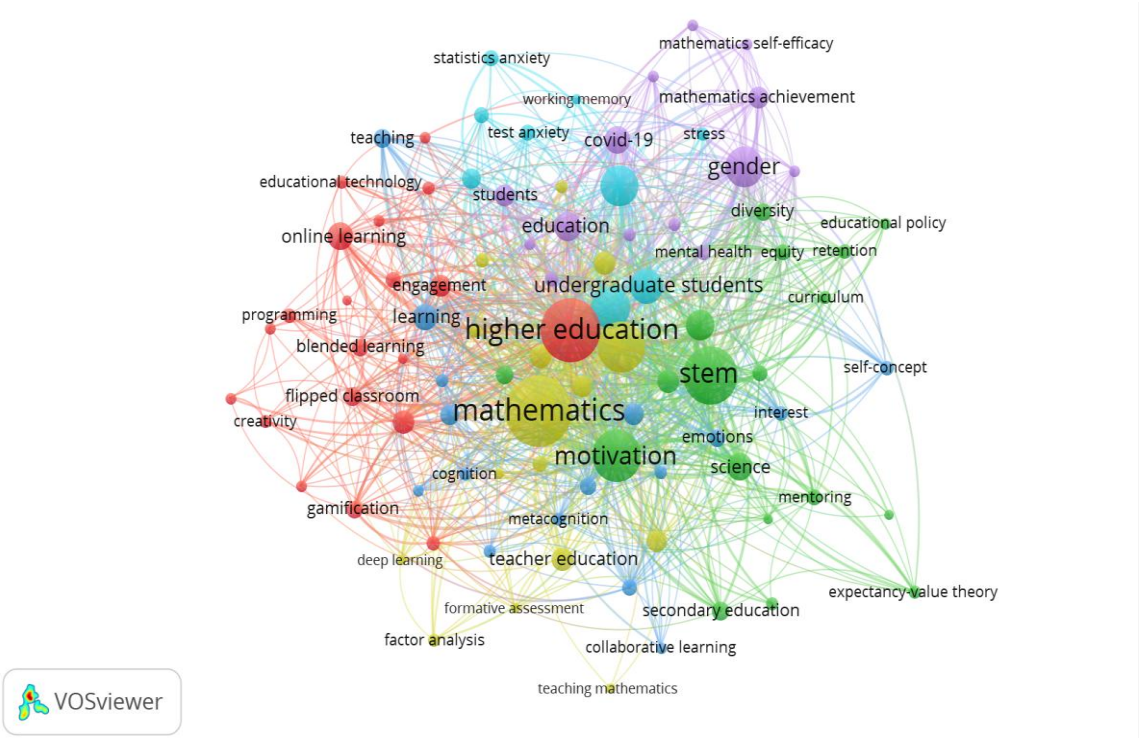


Figure 3: A Map for University-level Mathematics Education Research Using Keyword Co-occurrence

Source: Scopus

The blue cluster maps the cognitive development in learning mathematics, including "metacognition", "problem solving", and "critical thinking". This thematic group also explores how students handle learning challenges through "self-regulation" and "collaborative learning". The inclusion of "affect", "emotions", and "interest" suggests that cognitive processes are closely related to students' emotional experiences. Within this cluster, the less frequent terms are "collaborative learning" and "critical thinking", suggesting that future researchers may further explore these cognitive and learning processes.

The research theme of the yellow cluster is associated with teacher development, affective constructs, and assessment practices. This theme highlights the importance of "teacher education" in shaping mathematics education, particularly "teacher training" for "pre-service" and "prospective teachers". We also found that "beliefs", "attitudes", "self-efficacy",

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 63 (June 2026) PP. 858-877

"confidence", "assessment", and "formative assessment" appear in this cluster, showing that these affective factors and assessment practices are significant for instructional and learning quality in mathematics education. The node size of "confidence" and "formative assessment" in this cluster indicates that these topics have not been adequately addressed.

The purple cluster discusses macro level educational pressures and the adoption of artificial intelligence in mathematics education research. This group of researchers investigates issues relating to "gender", "perception", and "stereotype threat". They also examine "mental health" and "educational psychology" pressures in mathematics learning during the COVID-19 pandemic. Research on the adoption of artificial intelligence in mathematics education is divided into two categories. One group uses "artificial intelligence" to predict "mathematics achievement" while the other utilizes artificial intelligence applications to improve "mathematics self-efficacy".

Finally, the light blue cluster shows that researchers treat specific severe anxieties, such as "mathematics anxiety", "test anxiety", and "statistics anxiety", as distinct phenomena, linking them to their direct impact on "academic achievement". While the current literature strongly emphasizes anxiety, the relative scarcity of "stress" and "working memory", and the absence of "depression", point to a significant oversight in the field.

Discussion

The findings of this study provide an overview of research on mathematics education at the university level. There are 3354 publications recorded over the past 25 years that are related to pedagogy, mathematics, higher education and psychology. According to the statistical view, the median of the data is 96, while the mean score is 134. It shows that the publication volume of recent years has dominated the dataset of this study. This suggests that there is a significant growth in the research activity. There are some years, which are in 2003, 2012, 2014, 2016 and 2023 that have a decrease in publications. The highest number of publications was recorded in 2024.

The combined investigation of the authors, institutions, countries, and highly cited publications gives an in-depth view of the intellectual framework of research in mathematics education. The results show that the contributions of scholars are systematically aligned on various levels of analysis and that some constant patterns of themes are manifested in the field. The most productive authors such as Judith M. Harackiewicz, Janet S. Hyde and Chris S. Hulleman are basically based in the field of educational and social psychology with focus on motivation and student engagement. This is in line with the most cited articles, which point out three prevailing dimensions: cognitive foundations (e.g., approximate number system), motivational processes (intrinsic and extrinsic motivation) and technology-enhanced learning environments (e-learning and cognitive absorption).

At the institutional level, major universities like the University of Wisconsin-Madison and University of Virginia take center stage in generation of high impact research, with the assistance of robust interdisciplinary environments. Likewise, the country level analysis demonstrates that the United States and other western countries control both productivity and citation impact, which is supported by the wide network of international collaboration. Combined, these results suggest a multi-level concentration of power, in which the major research themes found in the highly cited articles are always motivated by a comparatively

small number of authors and institutions in the developed world. This implies that although the field has made great progress on realizing mathematics learning as a multidimensional process, there is still a necessity of representation of a wider global representation and more integrative frameworks that bridge cognitive, motivational, and pedagogical views.

The keyword analysis shows that research themes in university level mathematics education are interdisciplinary and interconnected. One of the findings shows the research strongly emphasizes technology integration and interactive platforms. In contrast to previous bibliometric studies that mainly concentrated on general mathematics education trends, our analysis highlights the important of pedagogical innovation. This observation consistent with the investigation of Liu et al. (2025), but our study goes beyond this earlier bibliometric study as they did not mention in detail technology-enhanced pedagogical approaches. Our investigation shows that student centered, and digitally supported teaching practices include active learning, flipped classroom, blended learning, online learning, and gamification. Through our analysis, we found that computational thinking, problem based learning, and virtual reality might be possible areas for future research.

Our findings show that motivation and persistence are important for student retention in mathematics. The strong presence of STEM indicates that mathematics education is frequently studied within interdisciplinary contexts. The inclusion of curriculum, educational policy, equity, and diversity highlights the growing concern with inclusive practices and the need to provide equal opportunities to students from different backgrounds in higher education mathematics. This broader perspective extends beyond previous bibliometric studies that primarily focus on affective constructs as seen in Sagarduy et al. (2024), Ersozlu and Karakus (2019), Wahyuni et al. (2025), Kasim et al. (2025), Zheng et al. (2025) and Taştepe and Özkaya (2026). Nevertheless, research regarding the role of curriculum and educational policy in shaping student engagement remains relatively underexplored.

The analysis also reveals the importance of cognitive and self-regulated learning processes and further indicates that current research is not only concerned with metacognition, problem solving, and self-regulation, but also collaborative learning. The inclusion of emotion and interest within this theme suggests that cognitive and positive emotional processes are interconnected in mathematics learning. Our analysis demonstrates an overlap between cognitive and affective domains, which made our findings differ from the study by Thi-nga et al. (2024) that focused primarily on metacognition. The lower frequency instructional terms such as collaborative learning and critical thinking suggest opportunities to further examine collaborative and higher-order thinking processes in mathematics learning.

We found that factors related to teachers such as professional development and assessment represent another significant area of research, which consistent with Liu et al. (2025). Teacher education, especially for future teacher, is critical because it equips them with pedagogical strategies to improve student performance and engagement. Meanwhile, assessments are necessary and unavoidable in mathematics education, as they are tools for educators to measure student performance and adjust their teaching techniques. Although Liu et al. (2025) also stated that professional beliefs affect teaching efficiency, our study demonstrates that beliefs, attitudes, personal efficacy, and confidence collectively serve as vital psychological factors that foster enjoyment of mathematics and promote persistence during the learning process. Teaching confidence and the implications of different formative assessment types would be the potential research directions.

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 63 (June 2026) PP. 858-877

Our analysis indicates that gender and stereotypes remain significant concerns within mathematics education at the university level. Sagarduy et al. (2024) reported a similar observation in their analysis investigating research related to mathematics anxiety at the primary level. Both bibliometric studies suggest that gender stereotypes are persistent issues across all educational stages. Beyond gender related issues, the field also addresses other social challenges including the psychological pressures of mathematics learning during the covid 19 pandemic. The discipline is also evolving in the era of artificial intelligence. Current research employs artificial intelligence either as predictive analytics to forecast student achievement at the macro level or as digital applications to improve mathematics self-efficacy.

A particularly important finding is the strong representation of anxiety-related constructs, including mathematics anxiety, test anxiety, and statistics anxiety along with their association with academic achievement. Although Ersozlu and Karakus (2019) noted that mathematics anxiety is often researched in conjunction with test anxiety and working memory, our study clarifies these trends within higher education. Our results also demonstrate that researchers categorize mathematics, test, and statistics anxieties as independent and distinct phenomena for mathematics education at the university level. Despite the anxiety-related constructs, the analysis shows that stress, working memory, and depression might be the possible directions for further investigation.

Conclusion

This study provides a comprehensive understanding of the intellectual landscape of research investigating the impacts of affective, psychological, and pedagogical factors in teaching and learning at the university level. A total of 3,354 publications pertaining to the field of pedagogy, mathematics, higher education, and psychology have been documented in the last 25 years, indicating an ever-growing and more multidisciplinary research field. Statistical analysis reveals the median of 96 publications per year, and a higher mean of 134, which suggests that publications of recent years have played a significant role in the development of the field, although fluctuations in the number of publications can be observed in 2003, 2012, 2014, 2016, and 2023 with the highest number of publications in 2024.

An in-depth analysis of authors, institutions, countries, and highly cited publications also helps to see the intellectual framework that informs this area, with the contributions being systemically dispersed on various levels and regular thematic patterns forming. Most of the influential authors like Judith M. Harackiewicz, Janet S. Hyde and Chris S. Hulleman are mainly based on the educational and social psychology area of research and are focused on the topics of motivation and student engagement, which are also the major themes of the highly cited publications, including cognitive foundations (e.g., approximate number system), motivational processes (intrinsic and extrinsic motivation) and technology-enhanced learning environments (e-learning and cognitive absorption).

On the institutional level, major research institutions, including University of Wisconsin-Madison and University of Virginia, are leading in creating high-impact research due to robust interdisciplinary environments, whereas the country-level analysis stresses the dominance of the United States and other Western countries in both productivity and citation impact, backed by large international collaboration networks. On the whole, these results imply that the scholarly influence is multi-tiered with a comparatively limited number of authors and institutions in developed countries determining the key themes of research and implying that

International Journal of Education, Psychology and Counseling
IJEPC
EISSN : 0128-164X
Volume 11 Issue 63 (June 2026) PP. 858-877

despite the significant achievements of the field in defining mathematics learning as a multidimensional process, it is still necessary to expand the global scope of representation and incorporate more integrative frameworks that would combine cognitive, motivational, and pedagogical approaches.

The keyword co-occurrence analysis shows that the existing studies have oriented toward technology-enhanced pedagogical approaches, policies, cognitive development, artificial intelligence adoption, and affective constructs. Among them, motivation and self-efficacy have high occurrences, indicating that psychological and cognitive factors are important in mathematics education.

The analysis also identifies several possible directions for future research. Integration of artificial intelligence, virtual reality, computational thinking, or problem-based learning in mathematics and their impacts on learning motivation and student engagement would be one of the future research directions. One may investigate the influence of teacher beliefs and confidence in improving student performances or the interactions of psychological emotions, cognitive factors, working memory, and academic performance. Future research may also explore the longitudinal studies that investigate the impact of curriculum design and educational policy in addressing gender and diversity gaps or improving motivation and persistence in learning mathematics in higher education.

The following are the implications brought by the findings:

Implications for research: This study provides a structured understanding of the interdisciplinary research themes reflecting the interplay between pedagogy, psychology, and university mathematics. Additionally, it identifies potential future research directions. Consequently, these findings may serve as a foundation that orients researchers within the state of the art of this field while guiding them toward emerging areas for further investigation.

Implications for educators: From a pedagogical perspective, educators could integrate various teaching strategies with traditional teacher-led classroom lecturing based on the suitability of topics and content. After traditional lecturing, educators might use the flipped classroom, active learning, or problem-based learning as part of teaching activities to promote deeper understanding and active participation. Educators might also consider the use of gamification and virtual reality to help students understand abstract topics. From a psychological perspective, educators could create a positive, interactive, and supportive learning environment to promote positive learning experiences and reduce student anxiety through collaborative learning among peers, encouraging students to ask questions, and helping them believe that making mistakes is part of the learning process.

Implications for educational policy and curriculum design: Government and institutions should implement policies that address disparities in participation and achievement. Programs, teacher training, and curricula under the policies need to provide ongoing support to the learning journey for boosting student confidence and improving mathematics retention. When designing the curriculum, they might also need to include real-world problems and technology-enhanced tools in their syllabus to align the learning with current development.

There are some limitations in this study. Since this study only extracted data from the Scopus database, the result analysis might be incomplete, as some literature might be indexed in other databases. Although bibliometric analysis is a scientific publication measure, there may be a certain degree of subjectivity in defining the thresholds of keyword occurrence and result interpretation.

Acknowledgements:	The authors would also like to express their sincere gratitude to Universiti Teknologi MARA (UiTM) for the support and assistance during the research period.
Funding Statement:	No Funding.
Conflict of Interest Statement:	The authors declare that there is no conflict of interest regarding the publication of this paper. All authors have contributed to this work and approved the final version of the manuscript for submission to the International Journal of Education, Psychology and Counseling (IJEPC).
Ethics Statement:	This study did not involve any human participants, animals, or sensitive data requiring ethical approval. The authors confirm that the research was conducted in accordance with accepted academic integrity and ethical publishing standards.
Author Contribution Statement:	All authors contributed significantly to the development of this manuscript. Foo Fong Yeng was responsible for the project administration, conceptualization, literature review, data collection, methodology, analysis, and interpretation of results, as well as drafting, writing, reviewing, and editing the original draft. Shamsatun Nahar Ahmad was responsible for the methodology, analysis, and interpretation of results, as well as drafting, writing, reviewing, and editing the original draft. Shafaruniza Mahadi was responsible for the methodology, analysis, and interpretation of results, as well as drafting, writing, reviewing, and editing the original draft. All authors read and approved the final version of the manuscript prior to submission.

References

Ardeleanu, R. (2019). Traditional and modern teaching methods in mathematics. *Journal of Innovation in Psychology, Education and Didactics*, 23(2), 133-140. https://jiped.ub.ro/wp-content/uploads/2019/12/JIPED_23_2_2019_1.pdf

Arsad, R., Wan Abdul Aziz, W. N. H., Abdul Rahman, A., Md Said, J., & Baharun, N. (2018). The discussion of teaching and learning styles in mathematics subject: a traditional versus interactive-engagement approach. *Multidisciplinary Informatics Journal*, 1(2), 119-126. https://ir.uitm.edu.my/id/eprint/39813/

Asare, B., Dissou Arthur, Y., & Adu Obeng, B. (2025). Mathematics self-belief and mathematical creativity of university students: the role of problem-solving skills. *Cogent Education*, 12(1), 2456438. https://doi.org/10.1080/2331186X.2025.2456438

Ayanwale, M. A., & Omeh, C. B. (2026). AI-Supported Problem-Based Learning for Enhancing Computational Thinking Skills in STEM Education. *Computers in Human Behavior: Artificial Humans*, 7, 100263. https://doi.org/10.1016/j.chbah.2026.100263

Boom-Cárcamo, E., Buelvas-Gutiérrez, L., Acosta-Oñate, L., & Boom-Cárcamo, D. (2024). Gamification and problem-based learning (PBL): Development of creativity in the teaching-learning process of mathematics in university students. *Thinking Skills and Creativity*, 53(5), 101614. https://doi.org/10.1016/j.tsc.2024.101614

Chiu, M. S., & Seah, W. T. (2024). Values and valuing pedagogies in affect-focused mathematics teaching. *Social Sciences & Humanities Open*, 10, 101050. https://doi.org/10.1016/j.ssaho.2024.101050

Chkana, Y., Martynenko, Olena Yurchenko, A., Gorovoy, I., & Semenikhina, O. (2025). A bibliometric exploration of research in mathematics education (2020 – 2024). *EURASIA Journal of Mathematics, Science and Technology Education*, 21(7), em2659. https://doi.org/10.29333/ejmste/16561

Dietrich, H., & Evans, T. (2022). Traditional lectures versus active learning--a false dichotomy?. *STEM Education*, 2 (4), 275–292. https://doi.org/10.3934/steme.2022017

Ersozlu, Z., & Karakus, M. (2019). Mathematics Anxiety: Mapping the Literature by Bibliometric Analysis. *EURASIA Journal of Mathematics, Science and Technology Education*, 15(2), em1673. https://doi.org/10.29333/ejmste/102441

Gbormittah, D., Yarkwah, C., Osiakwan, J. K., & Adom, G. (2025). Culturally responsive pedagogy model integration in mathematics education: Perceptions and practices among Ghanaian teachers. *Social Sciences & Humanities Open*, 12, 102036. https://doi.org/10.1016/J.SSAHO.2025.102036

Good, C., Rattan, A., & Dweck, C. S. (2012). Why do women opt out? Sense of belonging and women's representation in mathematics. *Journal of Personality and Social Psychology, 102*(4), 700–717. https://doi.org/10.1037/a0026659

Halberda, J., Mazzocco, M. M. M., & Feigenson, L. (2008). Individual differences in non-verbal number acuity correlate with maths achievement. *Nature, 455*(7213), 665–668. https://doi.org/10.1038/nature07246

Held, T., Putwain, D. W., & Hascher, T. (2025). A serious game-based social-psychological intervention to promote mathematics motivation: Effects and individual differences. *Contemporary Educational Psychology*, 84, 102439. https://doi.org/10.1016/j.cedpsych.2025.102439

Hidajat, F. A. (2026). Integration of virtual reality technology and deep learning in mathematics research and education: A creative bibliometric analysis. *Social Sciences & Humanities Open*, 13, 102487. https://doi.org/10.1016/j.ssaho.2026.102487

Kasim, N. A., Elias, N. H., Ghazali, S. F., Ismail, S., Najib, N. W. M., Abdullah, N. K., Basaruddin, S. K., Muhamad, F. N., Abd Rahim, N., & Mustafa, W. A. (2025). A bibliometric analysis on academic stress among undergraduates in Malaysian public universities. *International Journal of Education, Psychology Research, and Counselling*, 10(59), 428–444. https://doi.org/10.35631/IJEPC.1059031

Krishnan, S., & Raman, A. (2024). A Bibliometric Analysis on Sustainable Research in Mathematics Education. *International Journal of Academic Research in Progressive Education & Development*, 13(1), 274–290. https://doi.org/10.6007/IJARPED/v13-i1/20417

Lee, J. & Paul, N. (2023). A Review of Pedagogical Approaches for Improved Engagement and Learning Outcomes in Mathematics. *Journal of Student Research*, 12(3), 1-8. https://pdfs.semanticscholar.org/fea4/78a306ebda394cc0546bf2bafdd86a6188c3.pdf

Lee, M. K. O., Cheung, C. M. K., & Chen, Z. (2005). Acceptance of Internet-based learning medium: The role of extrinsic and intrinsic motivation. *Information & Management, 42*(8), 1095–1104. https://doi.org/10.1016/j.im.2003.10.007

Liu, Y., Kamarudin, N., & Sulaiman, T. (2025). Research hotspots and trends in mathematics pedagogical content knowledge from a Citespace perspective：an analysis of SSCI literature over the past decade. *International Journal of Education, Psychology Research, and Counselling*, 10(61), 377–389. https://doi.org/10.35631/IJEPC.1061029

Liu, Z., & Ldokova, G. (2026). The impact of GPT-powered video games on early adolescents' academic achievement in distance learning environments. *International Journal of Educational Research*, 137, 102967. https://doi.org/10.1016/j.ijer.2026.102967

McCurdy, B. H., Scozzafava, M. D., Bradley, T., Matlow, R., Weems, C. F., & Carrion, V. G. (2023). Impact of anxiety and depression on academic achievement among underserved school children: evidence of suppressor effects. *Current psychology*, 42, 26793-26801 https://doi.org/10.1007/s12144-022-03801-9

Meiliati, R., Djodding, I. M., Salido, A., Husain, D. S., & Hidayati, U. (2026). Exploration problem-based learning in mathematics learning in higher education: A bibliometric review. *Social Sciences & Humanities Open*, 13, 102345. https://doi.org/10.1016/j.ssaho.2025.102345

Noreen, R., & Rana, A. M. K. (2019). Activity-Based Teaching versus Traditional Method of Teaching in Mathematics at Elementary Level. *Bulletin of Education and Research*, 41(2), 145-159. https://files.eric.ed.gov/fulltext/EJ1229426.pdf

Ovat, S. V., Ofem, U. J., Neji, H., Undie, S., Ukatu, J. O., Nnaji, E. S., Madukwe, E., Nwanunnu, B., Adie, J., Ebaye, A., & Egu, A. (2026). Revisiting pedagogical frameworks for enhancing multidimensional learning outcome among students. A hierarchical multiple regression analysis. *Social Sciences & Humanities Open*, 13, 102306. https://doi.org/10.1016/j.ssaho.2025.102306

Saadé, R. G., & Bahli, B. (2005). The impact of cognitive absorption on perceived usefulness and perceived ease of use in on-line learning: An extension of the technology acceptance model. *Information & Management, 42*(2), 317–327. https://doi.org/10.1016/j.im.2003.12.013

Sagarduy, A., Arrieta, N., & Antón, A. (2024). A Bibliometric Study on Mathematics Anxiety in Primary Education. *Education Sciences*, 14(7), 678. https://doi.org/10.3390/educsci14070678

Saha, M., Islam, S., Akhi, A. A., & Saha, G. (2024). Factors affecting success and failure in higher education mathematics: Students' and teachers' perspectives. *Heliyon*, 10(7), e29173. https://doi.org/10.1016/j.heliyon.2024.e29173

Sehrawat, A. (2024). The role of mathematics in enhancing critical thinking skills among college students. *Innovative Research Thoughts*. 10(4), 141-149. https://doi.org/10.36676/irt.v10.i4.1616

Shen, W., Chai, C. S., Chiu, T. K., Yau, K. W., Meng, H., King, I., Wong, S., & Yam, Y. (2026). Pedagogy first, technology second: Cross-level relationships between teacher professional knowledge and student learning in artificial intelligence (AI) education. *Computers and Education: Artificial Intelligence*, 10, 100564. https://doi.org/10.1016/j.caeai.2026.100564

Taştepe, M., & Özkaya, A. (2026). A bibliometric exploration of affective factors in mathematics education: research trends, thematic evolution, and topic modeling. *Frontiers in Psychology*, 16, 1746934. https://doi.org/10.3389/fpsyg.2025.1746934

Thi-nga, H., Thi-Binh, V., & Tien-Trung, N. (2024). Metacognition in mathematics education: From academic chronicle to future research scenario – A bibliometric analysis with the Scopus database. *EURASIA Journal of Mathematics, Science and Technology Education*, 20(4), em2427. https://doi.org/10.29333/ejmste/14381

Voyer, D., & Voyer, S. D. (2014). Gender differences in scholastic achievement: A meta-analysis. *Psychological Bulletin, 140*(4), 1174–1204. https://doi.org/10.1037/a0036620

Wahyuni, R., Juniati, D., & Wijayanti, P. (2025). Mathematics anxiety in mathematics education: a bibliometrics analysis. *Journal of Education and Learning*, 19(1), 380–393. https://doi.org/10.11591/edulearn.v19i1.21768

Yaqoubi, R. M., Rezaei-Zadeh, M., Vahidi-Asl, M., Ramezani, D., Mohammadi, S., & Oskouei, E. R. (2025). Developing a serious game for enhancing student problem-solving: a three-layers effectiveness model. *Entertainment Computing*, 56, 101072. https://doi.org/10.1016/j.entcom.2025.101072

Zheng, Y., Mohamad, M. M., & Mafarja, N. (2025). A bibliometric analysis of learning motivation in blended teaching environment (2014-2024). *International Journal of Education, Psychology Research, and Counselling*, 10(60), 240–256. https://doi.org/10.35631/IJEPC.1060016