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Mapping trends in mathematics graduate theses

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ABSTRACT

Despite the increasing use of thesis archives to study research trends, there is still limited work that closely examines what graduate research in mathematics education focuses on within specific institutional contexts. This study explores the research trends and thematic orientations of Master of Arts (MA) in mathematics theses to inform curriculum development and future research directions. Using a qualitative content analysis approach, 129 theses completed between 2000 and 2024 were examined through their titles, abstracts, and statements of the problem. Through inductive coding and thematic synthesis, five major domains emerged: predictive and correlational studies (PCS) (31.78%); instructional interventions and innovations (III) (28.68%); assessment of mathematics readiness, achievement, and curriculum (AMRAC) (24.81%); cultural and contextual dimensions of mathematics learning (CCDML) (8.53%); and affective, motivational, and self-regulated learning in mathematics (AMSRLM) (6.20%). The findings point to a strong concentration on performance-oriented and quantitatively driven studies, particularly those using correlational and intervention-based approaches. This pattern reflects both the accessibility of quantitative methods and the program's emphasis on measurable outcomes. In contrast, studies that explore affective and sociocultural aspects of learning remain limited, although there are signs of gradual growth in more recent years, especially in work that adopts qualitative and culturally grounded perspectives. These patterns suggest that graduate research is shaped not only by educational priorities but also by the structure of the program and the type of methodological training students receive. Overall, the study highlights the need to broaden the scope of inquiry toward more context-sensitive and interdisciplinary approaches, and it offers insight into how thesis work reflects the evolving directions of mathematics education research.

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1. INTRODUCTION

Graduate theses offer a clear window into what a program values and where it is heading. As the culminating requirement, they reflect students' academic interests, the questions they choose to pursue, and the kinds of knowledge the program helps them build. For research in higher education to meaningfully support institutional priorities and respond to broader societal needs, these student outputs need to connect with the university's research agenda. When this alignment is present, it helps build a more focused and sustained research culture, brings greater coherence to scholarly work, and increases the likelihood that findings will be useful beyond the academic setting. Looking closely at graduate theses, therefore, provides valuable insight into how knowledge is produced and how research directions take shape within a particular institutional context especially in mathematics education, where studies are expected to inform both theory and classroom practice.

Content analysis has been extensively utilized as a methodical framework for investigating trends in scholarly study. It makes it possible to find the most important areas of research, common methods, and new gaps in a group of papers [1], [2]. Prior research indicates that graduate theses frequently align with dominant disciplinary frameworks and institutional agendas, typically shaped by faculty expertise and the professional environments of researchers [3], [4]. In mathematics education, research results often focus on classroom-related issues, including teaching methods and student performance, which is a sign of how practical the topic is [5]. Although these studies furnish significant descriptive narratives, they frequently depend on pre-defined categories and provide insufficient understanding of how research trajectories are formulated from the fundamental issues that investigations aim to resolve.

A more meaningful way to understand graduate research is to look at how studies are framed through their central research problems. The problem statement, in particular, captures what the study is trying to address, along with its key variables and direction, making it a strong basis for classification. When these are grouped in this way, patterns tend to emerge naturally from the data rather than being imposed, offering a more grounded view of how knowledge is developed within the program. This approach is especially relevant in mathematics education, where research questions are often shaped by classroom realities, policy shifts, and the evolving needs of learners-highlighting the ongoing interplay between theory and practice.

It is equally important to consider how these research focuses change over time. Looking at trends makes it possible to trace shifts, continuities, and emerging priorities within the program. In many cases, graduate research reflects broader contextual influences, such as curriculum reforms, technological developments, or changing educational demands. For instance, periods of curricular change or disruption often coincide with increased attention to instructional approaches or learner-related factors. Understanding these patterns provides a clearer sense of how responsive and adaptive a program's research agenda is, while also pointing to areas that may benefit from deeper exploration or new directions.

Despite the growing body of bibliometric and trend analyses in education, existing studies have largely focused on publication databases such as journal articles indexed in Scopus or Web of Science, often overlooking graduate theses as a significant source of emerging scholarly work. Moreover, many prior analyses rely heavily on pre-established classification frameworks or keyword co-occurrence, which may not fully capture the conceptual intentions embedded in research problem statements. Recent studies emphasize that thesis-level research reflects localized academic priorities and emerging scholarly directions not yet visible in formal publication systems [6], [7]. However, limited studies integrate problem-based thematic classification with longitudinal trend analysis, particularly in mathematics education. This gap constrains a deeper understanding of how research priorities evolve within institutional contexts.

This study contributes to mathematics education by introducing a problem-based thematic classification of graduate theses grounded in research problem statements, abstracts, and methodological orientations, rather than relying solely on pre-established categories or keyword-based bibliometric approaches commonly used in prior trend analyses. It further integrates this classification with longitudinal trend analysis spanning more than two decades of graduate research within a localized institutional context. Through this combined analytical approach, the study provides a more context-sensitive understanding of how research priorities evolve over time and how methodological traditions shape knowledge production in mathematics education. At the program level, the findings may help refine research agendas, strengthen alignment with institutional priorities, and improve the overall quality of graduate research. In this sense, graduate theses are viewed not merely as individual academic outputs but as indicators of evolving scholarly directions within mathematics education.

Although there is a substantial body of research on mathematics education, there is still limited localized evidence showing how graduate research develops within a specific institutional setting over time. This study addresses that gap by offering a systematic and analytically grounded mapping of Master of Arts (MA) mathematics theses, combining problem-based thematic classification with longitudinal trend analysis. Specifically, this study sought to answer the following questions:

- What dominant thematic domains emerge from the problem statements and methodological orientations of MA mathematics theses from 2000–2024?
- How have research focuses and subthemes within these thematic domains evolved over time?
- What implications do the observed research trends have for curriculum development, research mentoring, and future mathematics education research?

2. METHOD

2.1. Research design

This study employed a qualitative content analysis design to examine the thematic patterns of MA in mathematics theses and to develop an integrative framework that may inform curriculum enhancement. Content analysis is widely recognized in educational research as a systematic and flexible method for analyzing textual data, allowing researchers to identify patterns, trends, and meanings embedded in documents [1], [2]. In this study, the approach extended beyond simple categorization to include thematic synthesis, enabling not only the identification of recurring themes but also the interpretation of relationships among them. Such an approach reflects contemporary views of content analysis as both descriptive and interpretive, capable of generating higher-order conceptual insights from textual corpora [8], [9].

2.2. Corpus of the study

The corpus of the study consisted of 129 MA in mathematics theses completed at Benguet State University from 2000, corresponding to the program's first graduating cohort, through 2024. A total enumeration approach was employed, whereby all available theses within the specified period were included. The theses were retrieved from department and the graduate studies office of the college offering the program.

Each thesis was treated as a single unit of analysis. For consistency and comparability, the study focused on thesis titles, abstracts, and statements of the problem, as these sections provide concise and reliable representations of the study's focus, variables, and intended contributions. This approach is commonly used in documentary and trend analyses where large datasets require systematic yet feasible examination [6]. To facilitate longitudinal analysis, the corpus was organized into five-year intervals across the period 2000–2024.

2.3. Data analysis

The analysis focused on thesis titles, abstracts, and statements of the problem, as these components encapsulate the central focus, variables, and intent of each study. In large-scale documentary and bibliometric analyses, these sections are widely regarded as valid indicators of research direction and thematic orientation, particularly when full-text examination is not feasible [2], [6], [10]. As illustrated in Figure 1, a multi-phase inductive coding process was employed. Phase 1 involved open coding to identify key concepts and research foci from the textual data. In phase 2, axial coding was conducted to group related codes into analytical categories or sub-themes. These categories were then synthesized into broader thematic domains during phase 3 through constant comparison, allowing patterns to emerge directly from the dataset [1], [8].

The coding and classification process was conducted collaboratively by the researchers. Using common coding criteria derived from the problem statements and methodological characteristics of the theses, the researchers independently examined and initially classified the studies. The preliminary classifications were then compared and reviewed to identify overlapping interpretations and inconsistencies. In cases where a thesis could reasonably align with multiple thematic domains, classification decisions were guided by the study's primary research problem, dominant variables, and methodological orientation.

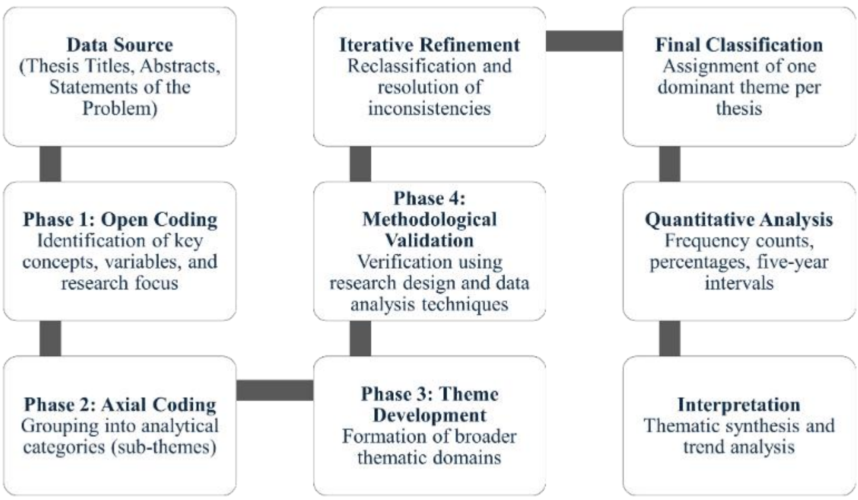

Figure 1. Data analysis procedure

To strengthen classification validity, a second layer of analysis examined methodological characteristics, particularly research design and data analysis techniques. This step was done to verify the thematic classification when cross-checked with the methodology implemented in the study. Where inconsistencies were identified, iterative reclassification was conducted until conceptual coherence was achieved, consistent with recommended practices for rigorous thematic analysis [11]. Each thesis was assigned to a single dominant theme based on its primary research problem and methodological focus. This approach supports the use of mutually exclusive categories in content analysis, facilitating clearer aggregation and more stable trend interpretation [2], [6], [12]. While some studies may span multiple areas, assigning a dominant theme enables consistent classification for large-scale analysis.

Following the final classification, the categorized data were analyzed using frequency and percentage distributions and organized into five-year intervals to examine longitudinal trends. Temporal grouping allows the identification of shifts in research priorities while minimizing short-term variability [10]. The integration of quantitative frequency analysis with thematic synthesis supports more meaningful interpretation of research patterns [13]. To ensure transparency and consistency, coding decisions were guided by explicit criteria and iteratively reviewed. The rigor was supported through systematic coding procedures, iterative validation, and alignment between textual and methodological features, consistent with trustworthiness criteria in qualitative research [11]. To further enhance methodological transparency and auditability, supplementary coding materials consisting of a coding manual and coding guide were prepared detailing the coding procedures, validation process, coding criteria, and illustrative classification examples used in the study.

Ethical considerations were carefully observed throughout the study. All these were accessed through the institutional archives and used solely for academic purposes, with no disclosure of personal identifiers. In addition, the study adhered to emerging ethical guidelines regarding the use of artificial intelligence (AI) in research. AI-assisted tools were utilized in a limited and supportive capacity, particularly for organizing data and improving clarity of presentation/narration. Recent scholarship emphasizes that while generative AI can enhance efficiency, it also introduces concerns related to bias, transparency, and academic integrity [14], [15]. As such, AI tools should function only as assistive technologies and must not replace the researcher's analytical judgment [16], [17]. Consistent with these principles, all AI-assisted outputs in this study were critically reviewed, validated, and substantially refined by the researcher. AI was not used to generate primary data, conduct independent analysis, or make interpretive decisions. This approach ensures accountability and adherence to current standards for responsible AI integration in research [18].

3. RESULTS AND DISCUSSION

3.1. Thematic classification of MA mathematics theses

The content analysis yielded five major thematic domains derived from the central research problems and methodological orientations of the theses: i) assessment of mathematics readiness, achievement, and curriculum (AMRAC); ii) affective, motivational, and self-regulated learning in mathematics (AMSRLM); iii) predictive and correlational studies (PCS); iv) instructional interventions and innovations (III); and v) cultural and contextual dimensions of mathematics learning (CCDML). These themes emerged through an iterative and systematic coding process, ensuring conceptual clarity, mutual exclusivity, and alignment with both the substantive focus and methodological characteristics of each study.

Figure 2 presents an integrated visualization of both thematic distribution and sub-theme composition. Overall, the distribution is notably uneven. PCS constitute the largest proportion (31.78%), followed by III (28.68%) and AMRAC (24.81%). In contrast, CCDML (8.53%) and AMSRLM (6.20%) remain comparatively underrepresented. Presenting both frequencies and percentages allows clearer interpretation of relative emphasis across domains, addressing calls for more transparent reporting in trend analyses [6].

A closer examination of the internal composition of each theme reveals important distinctions. Within PCS, the dominance of correlational studies (56.10%) indicates a strong preference for examining relationships among variables, while predictive studies (31.71%) and performance linkages (12.20%) are less prominent. This pattern suggests that graduate research is primarily oriented toward identifying associations rather than developing explanatory or causal models. Such dominance can be attributed to the accessibility of correlational designs and their alignment with commonly taught statistical techniques in graduate programs, reflecting broader patterns in educational research [19], [20].

Within the III domain, instructional interventions (45.95%) and teaching strategies (27.03%) account for the majority of studies, with fewer studies focusing on technology-enhanced learning (16.22%) and instructional innovations (10.81%). The distribution shows a strong practice-oriented research agenda aimed at improving classroom instruction. While this aligns with evidence emphasizing the impact of teaching quality on student outcomes [21], the relatively limited attention to innovation-oriented research suggests that studies done by graduate students tend to test existing approaches rather than developing new instructional models. Research on digital learning further indicates that effective technology integration requires alignment with pedagogy rather than mere adoption [22].

The AMRAC domain highlights a diagnostic orientation, with readiness and entry skills (34.38%) and learning difficulties and error analysis (25.00%) as dominant sub-themes. This reflects a strong emphasis on understanding learners' starting points and identifying barriers to achievement. Such focus is consistent with formative assessment principles, which stress the importance of prior knowledge in shaping instruction [23]. However, the relatively low representation of curriculum evaluation (9.38%) and problem-solving (12.50%) suggests that systemic and higher-order dimensions of learning receive comparatively less attention, despite their recognized importance in mathematics education [24]. Curriculum alignment is critical in ensuring coherence between intended learning outcomes, instructional practices, and assessment systems [25].

The AMSRLM domain, though comprising only 6.20% of the dataset, reflects emerging attention to affective and self-regulatory dimensions of learning. The limited volume of studies in this area suggests that such constructs have only recently gained prominence within the program. This trend mirrors broader shifts in educational research toward recognizing the role of motivation, self-efficacy, and anxiety in shaping learning outcomes [26], [27]. The relatively low representation indicates an opportunity to further integrate these dimensions into future research.

In contrast, PCS slightly declined during this period, while affective and contextual themes began to grow. By 2020–2024, a rebalancing is evident: PCS and III decreased but remained prominent, while AMSRLM and CCDML reached their highest levels. This points to a gradual shift toward more holistic perspectives that consider motivation, identity, and context in learning. Emerging studies on culturally grounded mathematics, including ethnomathematics and contextualized instruction, reflect efforts to make learning more relevant and inclusive [28], [29].

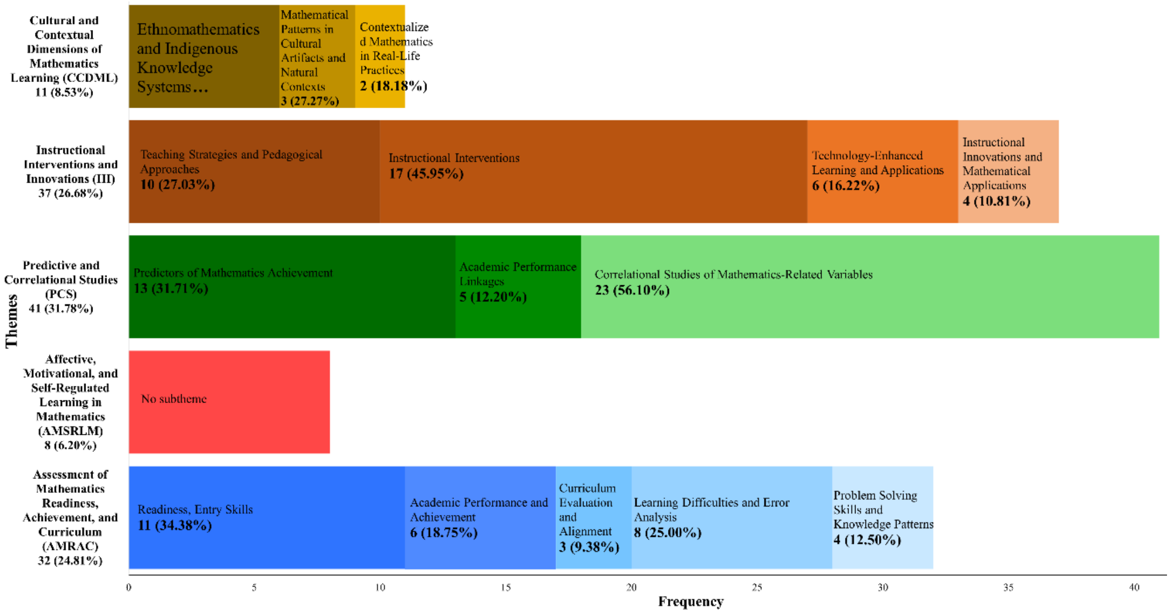

Figure 2. Thematic distribution and sub-theme composition of MA mathematics theses

Similarly, the CCDML domain (8.53%) remains underdeveloped, with ethnomathematics (54.55%) as the dominant sub-theme. While this indicates growing recognition of cultural perspectives, the limited presence of contextualized and applied mathematics studies suggests that sociocultural approaches remain peripheral. This is noteworthy given that mathematics learning is increasingly understood as situated within cultural and social contexts, and integrating these perspectives has been shown to enhance relevance and engagement [28], [30].

Taken together, the findings indicate a research landscape that is strongly grounded in quantitative and intervention-based approaches but relatively limited in affective and sociocultural inquiry. This pattern reflects not only research interests but also institutional and methodological influences shaping graduate research production. As noted in studies of knowledge production, research trends are often shaped by methodological accessibility, training, and institutional expectations [19], [30]. Expanding research into underrepresented domains-particularly affective, contextual, and interdisciplinary areas-may contribute to a more balanced and holistic understanding of mathematics learning.

3.2. Trends in research focus of MA mathematics theses

Figure 3 shows how MA mathematics thesis topics evolved across five periods. In the early years (2000 to 2004), research output was limited and concentrated mainly on PCS and III, with minimal attention to affective AMSRLM and contextual CCDML dimensions. This suggests that early work was still developing and had not yet diversified. From 2005 to 2009, research activity increased, particularly in PCS, AMRAC, and III, reflecting a growing focus on student performance, assessment, and classroom interventions. However, affective and contextual themes remained marginal.

The period 2010-2014 marked a clear shift, with PCS reaching its peak. This dominance reflects a strong emphasis on examining relationships among classroom variables, an approach widely used in education due to its practicality [31]. It also aligns with the rise of evidence-based and data-driven practices, which favored statistical approaches like correlation and regression [19], [32], as well as large-scale syntheses linking variables to student achievement [21].

Between 2015 and 2019, there was a significant movement toward intervention-based and practice-oriented research, as seen by the sharp increase in III. This is in line with growing calls for curricular changes and evidence-based instruction, as structured interventions have been demonstrated to raise arithmetic achievement [21], [33]. AMRAC also peaked during this time, demonstrating the ongoing significance of assessment in directing instruction. While curriculum alignment-though less studied-remains essential for coherent learning outcomes [25], diagnostic assessment and error analysis in particular continue to be crucial for identifying learning gaps and misconceptions [23], [34], [35] stronger program completion rates also corresponded with this boom, indicating stronger graduate output. Although still less represented, AMSRLM highlights important factors such as self-efficacy, motivation, and anxiety, which are known to influence achievement and engagement [26], [36], [37]. The inclusion of self-regulated learning also signals growing recognition of learners as active participants in their learning processes [38].

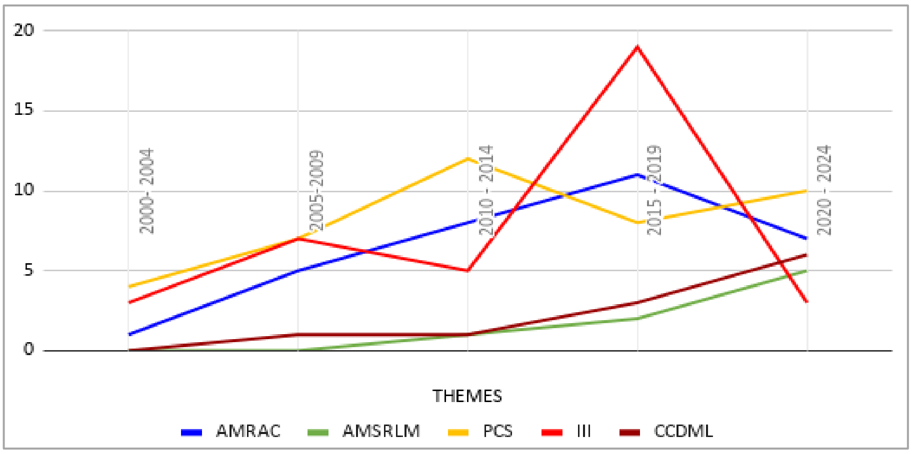

Figure 3. Trends of research topics of theses in MA in mathematics

Overall, while PCS and III have long dominated, the trend shows a gradual diversification of research themes. The program remains strongly anchored in performance- and intervention-focused studies but is increasingly opening to affective and sociocultural dimensions. This shift suggests both continuity and change, while also pointing to opportunities for broader and more balanced research directions moving forward.

The observed shifts in research focus can be understood in relation to broader educational and institutional developments. The early dominance of correlational and assessment-oriented studies reflects the strong influence of quantitative research training and the emphasis on measurable academic outcomes. The subsequent rise of instructional intervention studies corresponds with increasing attention to classroom effectiveness and pedagogical improvement in response to curriculum reforms. More recently, the emergence of affective and sociocultural themes aligns with global trends in mathematics education that emphasize learner diversity, equity, and contextualized learning. These patterns suggest that graduate research agendas are not only shaped by individual interests but are also influenced by evolving educational priorities, methodological exposure, and institutional expectations [6], [19].

3.3. Trends in research topics across thematic domains

The analysis of the theses reveals clear and evolving patterns in the research priorities of MA mathematics graduates. When viewed across the five thematic domains, the findings suggest that research is not static; rather, it reflects a dynamic interplay between enduring concerns in mathematics education and emerging issues shaped by educational reforms, technological developments, and broader societal changes. The following discusses the trend of research topics of MA mathematics graduates along each thematic domain.

3.3.1. Assessment of mathematics readiness, achievement, and curriculum

The trend under AMRAC shows a sustained emphasis on readiness and entry skills as well as learning difficulties and error analysis, both of which appear consistently across all time periods. This is evident in Figure 4, suggesting that graduate researchers continue to grapple with a fundamental question: what do students bring into the mathematics classroom, and where do they struggle most?

In contrast, areas such as curriculum evaluation and alignment remain relatively underexplored, appearing only occasionally. This imbalance indicates that while much attention is given to diagnosing learner-level issues, fewer studies engage with broader, system-level concerns such as curriculum coherence and alignment. The relatively stable existence of assessment-focused studies across time strengthens the idea that assessment remains important to mathematics education. Beyond simply measuring achievement or performance, assessment serves as a critical tool for informing instruction and guiding curriculum decisions. Effective assessment practices, particularly formative assessment, play a pivotal role in improving student learning by making thinking visible and actionable [23]. Similarly, large-scale educational frameworks highlight the role of assessment in shaping both policy and classroom practice [39].

The prominence of readiness and error analysis also reflects a long-standing recognition that students' misconceptions are not random but are often systematic and rooted in prior knowledge. Understanding these misconceptions is essential for designing instruction that meaningfully supports conceptual change [35]. At the same time, the limited attention to curriculum evaluation suggests an opportunity for future research to engage more deeply with how curricular structures influence learning outcomes, particularly in contexts undergoing reform.

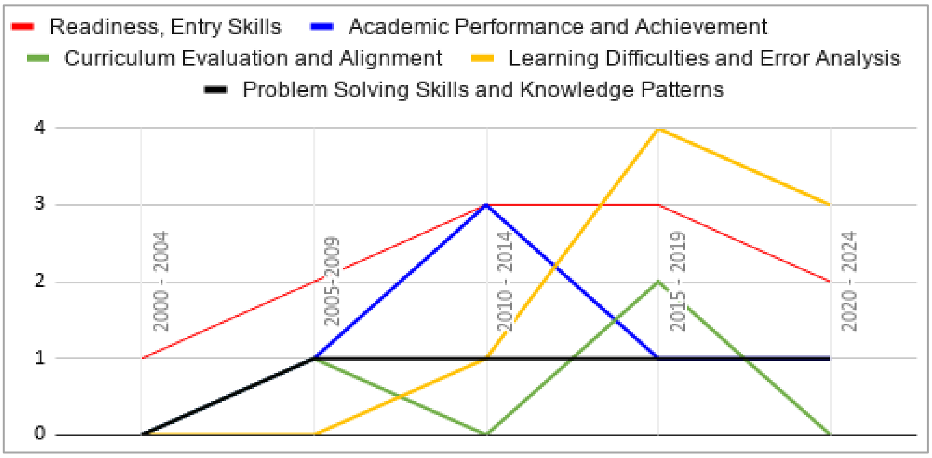

Figure 4. Trends of research topics categorized under AMRAC

3.3.2. Affective, motivational, and self-regulated learning in mathematics

Research under the AMSRLM theme remains relatively limited in earlier periods but shows a noticeable increase in recent years, particularly from 2020 to 2024, as shown in Figure 5. This shift is not surprising. The disruptions brought about by the COVID-19 pandemic forced educators and researchers alike to confront the emotional and psychological dimensions of learning more directly. As learning environments became more flexible and, at times, more isolating, issues such as motivation, anxiety, and self-regulation moved to the forefront.

This growing attention to affective factors is strongly supported by existing literature. Mathematics anxiety, for instance, has been shown to interfere with working memory and hinder performance [37], while self-efficacy plays a crucial role in shaping students' persistence and achievement [26]. More recent studies further underscore that students' emotional well-being is closely tied to their academic engagement, particularly in times of uncertainty [40], [41]. Most of the research in this field employs correlational methodologies, associating affective variables with academic results. Although these studies yield significant insights, they also underscore the necessity for more comprehensive and intervention-oriented research that investigates how these affective dimensions can be effectively facilitated in educational practice. Still, the growing number of AMSRLM studies shows that there is a significant shift toward a more complete understanding of how people learn math. This includes not only how well they do on tests but also their experiences and personalities.

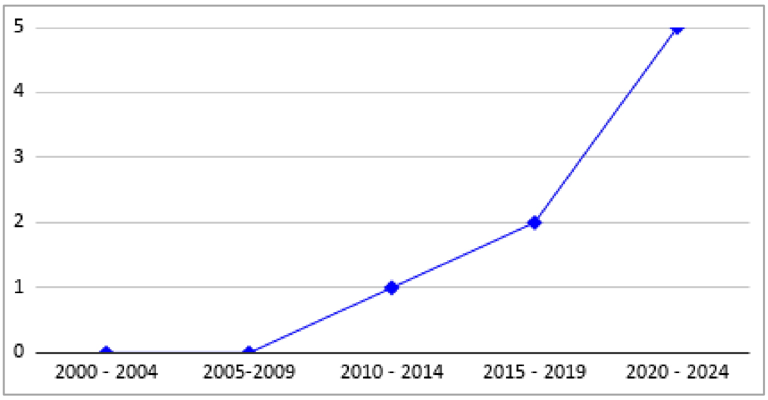

Figure 5. Trend of research categorized under AMSRLM

3.3.3. Predictive and correlational studies

The PCS dominate the research landscape across most time periods, particularly in the earlier and middle years. The strong presence of these studies, as shown in Figure 6, reflects a sustained interest in describing relationships among variables, and explaining differences in student achievement. Correlational studies remain to dominate even up to the last five years. This trend aligns with broader patterns in educational research, where correlational designs are widely used due to their methodological accessibility and ability to handle large datasets [42]. Influential syntheses of educational research have also reinforced the importance of identifying key factors that influence learning outcomes [21].

However, while these approaches are valuable, their dominance also raises important considerations. Correlational studies, by nature, focus on relationships rather than deeper contextual or causal explanations. An overreliance on variable-centered approaches may limit the field's ability to fully capture the complexity of teaching and learning processes [43].

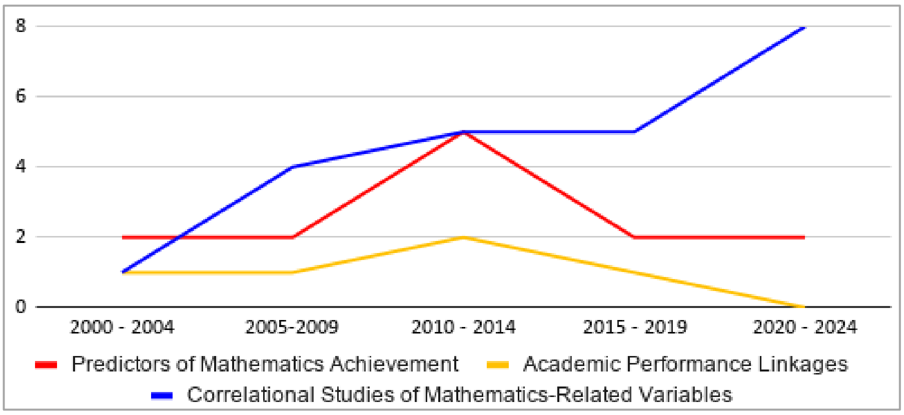

Figure 6. Trends of research topics categorized under PCS

The slight decline in PCS studies in more recent years may indicate a gradual diversification of research interests, with graduate students beginning to explore alternative approaches such as intervention-based or contextually grounded studies. Still, the persistence of predictive research, particularly those linked to academic performance and licensure outcomes, reflects institutional priorities related to accountability and measurable success. Indeed, prior research has shown that academic indicators such as GPA remain strong predictors of future performance [44], which helps explain the continued relevance of this line of inquiry.

3.3.4. Instructional interventions and innovations

Figure 7 illustrates the trend in III revealing a clear responsiveness to educational reforms and changing instructional contexts. The marked increase in studies during the 2014–2019 period coincides with the implementation of the K–12 reform in the Philippines, a time when educators were actively seeking effective teaching approaches and strategies to adapt to new curricular demands. What stands out in this domain is the strong emphasis on instructional interventions, suggesting that graduate researchers are not only interested in understanding learning but also in improving it. These studies often test specific interventions in existing teaching strategies, materials, or programs, reflecting a practical orientation toward classroom improvement.

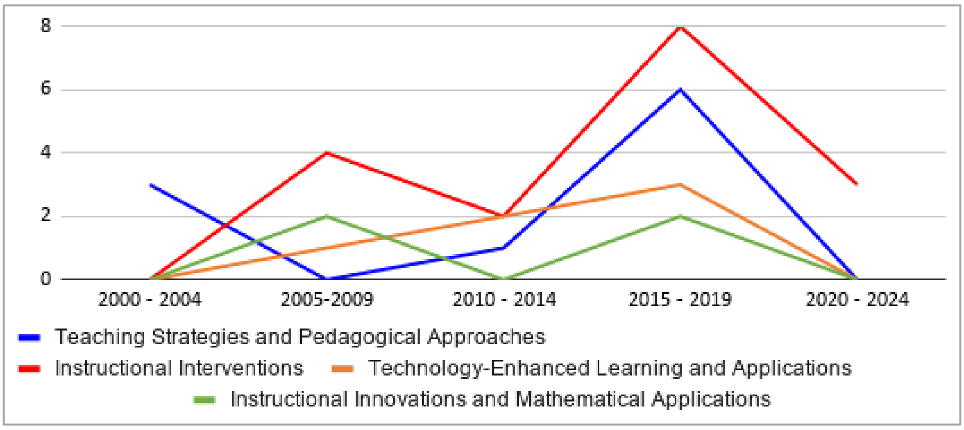

Figure 7. Trends of research topics categorized under III

This trend is consistent with global shifts toward learner-centered and evidence-based instruction, where teaching practices are continuously refined through research [45]. The growing presence of technology-enhanced learning further reflects the increasing integration of digital tools in education. Research has shown that when used effectively, technology can enhance conceptual understanding and student engagement [22], [46]. Interestingly, while intervention studies are abundant, fewer studies focus on more exploratory or design-based innovations. This suggests that while teaching strategies are being tested, there may be room to further expand research into more transformative approaches to mathematics instruction.

Studies focusing on III demonstrate a marked increase during the 2015-2019 period, coinciding with the implementation of the K-12 reform in the Philippines. This period saw a surge in research examining teaching strategies, including strategic intervention materials, the dynamic learning program, and other pedagogical innovations introduced in response to curricular changes. The most significant finding is the rise in instructional interventions reflecting global shifts toward learner-centered and technology-enhanced education. Research has shown that digital tools and structured interventions can enhance conceptual understanding and engagement [46]. This trend may also be influenced by the increasing integration of flexible and modular learning systems in both basic education and higher education. Earlier, from 2005-2009, intervention studies were primarily centered on computer-assisted instruction, reflecting the growing integration of technology in teaching. These patterns are consistent with international findings that educational reforms and technological advancements often stimulate intervention-based research [22], [45].

3.3.5. Cultural and contextual dimensions of mathematics learning

The CCDML theme, although the least represented, demonstrates a gradual but meaningful increase over time. As shown in Figure 8, studies within this domain become more visible in recent years, particularly from 2019 onward. Earlier works related to cultural and contextual aspects of mathematics were present but were predominantly framed within quantitative or correlational designs, often examining contextual variables as predictors of achievement rather than as sources of meaning-making. It is only in the more recent period that these studies have been more explicitly conceptualized and classified as qualitative or interpretive inquiries, reflecting a methodological shift within the program.

This transition can be attributed, in part, to the increasing integration of qualitative approaches within a program that nurtures a quantitative research environment. As qualitative methodologies gained wider acceptance in education research and in the field of mathematics, they enabled deeper exploration of learners' experiences, cultural practices, and contextualized forms of knowledge [47]. The emergence of CCDML as a distinct thematic domain therefore signals not only a change in research topics but also an expansion in epistemological orientation, moving beyond measurement toward interpretation and meaning-making. The presence of studies on ethnomathematics and contextualized learning reflects a broader shift toward recognizing that mathematics is not merely abstract but is deeply embedded in cultural and social contexts. This perspective is strongly supported by sociocultural theories of learning, which emphasize that knowledge is constructed through participation in culturally situated practices [30]. Similarly, research in culturally responsive mathematics education highlights the importance of connecting mathematical concepts to students' lived experiences to enhance engagement, identity development, and conceptual understanding [48].

Despite this positive trend, the relatively low number of studies in CCDML suggests that sociocultural and contextual approaches remain at the margins of the program's research agenda. This pattern is not uncommon in programs with strong quantitative traditions, where research is often shaped by established methodological training and expectations [49]. Moreover, even in studies that integrate cultural elements-such as the use of indigenous materials, local contexts, or language in mathematics instruction-these are frequently framed as instructional strategies and evaluated primarily in terms of their effects on student performance. As a result, culture is often treated as a supporting variable within intervention or correlational designs rather than as a central lens of inquiry in its own right.

Nevertheless, the increasing presence of CCDML studies is significant. It reflects a growing openness to qualitative and interpretive approaches and a broader reconceptualization of what constitutes meaningful mathematical knowledge. In this sense, the rise of CCDML represents an important step toward a more inclusive and holistic understanding of mathematics education-one that values not only performance and intervention, but also culture, identity, and context.

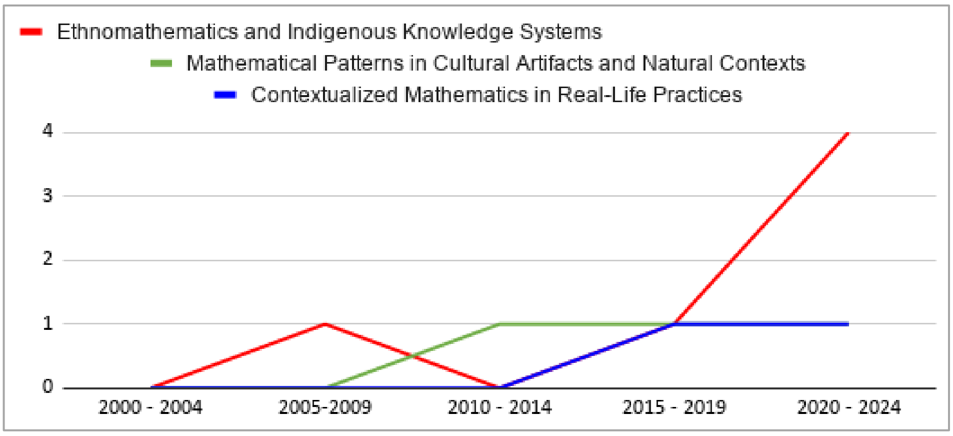

Figure 8. Trends of research topics categorized under CCDML

3.4. Implications for curriculum development, research mentoring, and future research

The study's conclusions offer a number of suggestions for improving graduate research development in mathematics education. Predictive, correlational, and intervention-based studies predominate, indicating that the program's research training has been heavily focused on quantitative approaches and performance-based inquiry. This has given empirical and statistically grounded research a strong foundation, but it also shows that methodological exposure needs to be expanded to include qualitative, mixed-methods, and design-based approaches. Expanding methodological training may allow graduate students to engage more thoroughly with complicated, context-sensitive aspects of mathematics learning, which are frequently better captured through interpretive and contextually grounded approaches [47], [49].

The unequal distribution of themes in curriculum development draws attention to areas that could need more focus. The need to more clearly include emotional, sociocultural, and contextual perspectives into coursework and research requirements is shown by the comparatively little attention given to these aspects. Research agendas that are more inclusive and comprehensive may benefit from incorporating subjects like learner identity, culturally responsive teaching, and practical applications of mathematics [30], [48].

The results highlight the crucial role advisers play in determining thesis directions for research mentoring. It has been demonstrated that graduate supervision has a substantial impact on students' methodological decisions and research focus, frequently mirroring the knowledge and preferences of faculty mentors [50]. In order to diversify research outputs and link them with new goals in mathematics education, it may be beneficial to encourage students to investigate underrepresented areas, especially those associated with affective and contextual dimensions. Students can be further assisted in going beyond traditional methods by receiving structured advice in topic selection, study design, and theoretical framing.

Lastly, the study suggests a number of avenues for future investigation. Research that incorporates multidisciplinary views and looks at mathematics learning through sociocultural and interpretive lenses is needed. Future studies might also look into how curriculum design, faculty expertise, and institutional structures affect research trends across time. Examining how research environments affect what is examined and how it is studied is crucial since research on knowledge production indicates that scholarly outputs are impacted by both institutional contexts and epistemological orientations [6], [49]. Graduate research can help create a more comprehensive and balanced knowledge of mathematics education by filling in these gaps.

4. CONCLUSION

Over more than two decades, the MA mathematics program has developed a distinct research profile centered on mathematics education-particularly on improving instruction, assessing learning, and understanding student performance. Much of this work reflects the experiences of graduate students who are also classroom practitioners, which keeps their studies closely tied to real teaching contexts. The findings show that most theses fall within predictive, correlational, and instructional domains, pointing to a strong emphasis on intervention-based research and measurable outcomes. While these areas offer valuable insights, their dominance also suggests a narrowing of perspective that may limit a fuller understanding of the more complex, contextual, and affective dimensions of learning mathematics.

At the same time, there are signs of change. The gradual rise of affective and sociocultural topics-along with an increase in qualitative and culturally grounded studies-indicates a shift in what is being explored. This trend reflects broader developments in mathematics education that recognize learning as not only cognitive, but also social and cultural. Still, the relatively small number of studies in these areas suggests that such perspectives are only beginning to take hold and remain underdeveloped within the program.

These patterns carry important implications for how graduate research can be strengthened. Broadening methodological training to include qualitative, mixed-methods, and design-based approaches could open up more diverse and theoretically grounded lines of inquiry. Encouraging work that engages with culture, identity, and real-world applications of mathematics may also help build a more inclusive and relevant body of knowledge. At the program level, the findings can inform curriculum design, thesis advising, and the shaping of research agendas by highlighting both areas of strength and gaps that need attention.

This study is not without its limitations. It draws on theses from a single institution and focuses on titles, abstracts, and problem statements rather than full-text analysis. While these elements are generally accepted as reliable indicators of research focus, they may not capture the full depth of each study. Future research could build on this work by incorporating full-text analysis, comparing findings across institutions, or applying more advanced bibliometric approaches. It would also be useful to examine how factors such as curriculum structure, institutional expectations, and supervision practices influence research outputs. Despite these limitations, the study shows that graduate theses can serve as meaningful indicators of knowledge production, offering insight into how research priorities evolve in response to changing educational contexts and broader societal developments.

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AUTHOR CONTRIBUTIONS STATEMENT

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare no potential conflicts of interest.

ETHICAL APPROVAL

This study did not involve human participants. The research utilized existing graduate theses that were publicly accessible for academic use. Ethical standards were observed by ensuring confidentiality, proper data handling, and appropriate attribution of sources.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [JAB], upon reasonable request.

REFERENCES

[1] H. F. Hsieh and S. E. Shannon, "Three approaches to qualitative content analysis," *Qualitative Health Research*, vol. 15, no. 9, pp. 1277–1288, Nov. 2005, doi: 10.1177/1049732305276687.
[2] K. Krippendorff, *Content analysis: an introduction to its methodology*. Thousand Oaks, CA: SAGE Publications, Inc., 2022, doi: 10.4135/9781071878781.
[3] H. Akkus, S. N. Sari, and S. Uner, "The content analysis of graduate theses written between 2000 and 2010 in the field of chemistry education," *Procedia - Social and Behavioral Sciences*, vol. 47, pp. 729–733, 2012, doi: 10.1016/j.sbspro.2012.06.725.
[4] M. Dirlikli, K. Aydın, and L. Akgün, "Cooperative learning in Turkey: a content analysis of theses," *Kuram ve Uygulamada Eğitim Bilimleri*, vol. 16, no. 4, pp. 1251–1273, 2016, doi: 10.12738/estp.2016.4.0142.
[5] R. Julius *et al.*, "Bibliometric analysis of research in mathematics education using Scopus database," *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 17, no. 12, pp. 1–12, Nov. 2021, doi: 10.29333/EJMSTE/11329.
[6] N. Donthu, S. Kumar, D. Mukherjee, N. Pandey, and W. M. Lim, "How to conduct a bibliometric analysis: an overview and guidelines," *Journal of Business Research*, vol. 133, pp. 285–296, Sep. 2021, doi: 10.1016/j.jbusres.2021.04.070.
[7] I. Zupic and T. Čater, "Bibliometric methods in management and organization," *Organizational Research Methods*, vol. 18, no. 3, pp. 429–472, Jul. 2015, doi: 10.1177/1094428114562629.
[8] S. Elo and H. Kyngäs, "The qualitative content analysis process," *Journal of Advanced Nursing*, vol. 62, no. 1, pp. 107–115, Apr. 2008, doi: 10.1111/j.1365-2648.2007.04569.x.
[9] M. Schreier, *Qualitative content analysis in practice*. London, U.K.: SAGE Publications Ltd, 2024, doi: 10.4135/9781529682571.
[10] H. D. White and K. W. McCain, "Visualizing a discipline: an author co-citation analysis of information science, 1972-1995," *Journal of the American Society for Information Science*, vol. 49, no. 4, pp. 327–355, 1998, doi: 10.1002/(SICI)1097-4571(19980401)49:4<327::AID-ASI4>3.0.CO;2-W.
[11] L. S. Nowell, J. M. Norris, D. E. White, and N. J. Moules, "Thematic analysis: striving to meet the trustworthiness criteria," *International Journal of Qualitative Methods*, vol. 16, no. 1, pp. 1–13, Dec. 2017, doi: 10.1177/1609406917733847.
[12] K. A. Neuendorf, *The content analysis guidebook*. Thousand Oaks: SAGE Publications, 2017, doi: 10.4135/9781071802878.
[13] J. Thomas and A. Harden, "Methods for the thematic synthesis of qualitative research in systematic reviews," *BMC Medical Research Methodology*, vol. 8, no. 1, p. 45, Dec. 2008, doi: 10.1186/1471-2288-8-45.
[14] S. Bjelobaba, L. Waddington, M. Perkins, T. Foltýnek, S. Bhattacharyya, and D. Weber-Wulff, "Maintaining research integrity in the age of GenAI: an analysis of ethical challenges and recommendations to researchers," *International Journal for Educational Integrity*, vol. 21, no. 1, pp. 1–23, Jul. 2025, doi: 10.1007/s40979-025-00191-w.
[15] A. Dabis and C. Csáki, "AI and ethics: Investigating the first policy responses of higher education institutions to the challenge of

generative AI," *Humanities and Social Sciences Communications*, vol. 11, no. 1, Aug. 2024, doi: 10.1057/s41599-024-03526-z.
[16] K. H. Arar, H. Özen, G. Polat, and S. Turan, "Artificial intelligence, generative artificial intelligence and research integrity: a hybrid systemic review," *Smart Learning Environments*, vol. 12, no. 1, pp. 1–29, Jul. 2025, doi: 10.1186/s40561-025-00403-3.
[17] K. Bittle and O. El-Gayar, "Generative AI and academic integrity in higher education: a systematic review and research agenda," *Information*, vol. 16, no. 4, p. 296, Apr. 2025, doi: 10.3390/info16040296.
[18] A. Yusuf, N. Pervin, and M. Román-González, "Generative AI and the future of higher education: a threat to academic integrity or reformation? Evidence from multicultural perspectives," *International Journal of Educational Technology in Higher Education*, vol. 21, no. 1, p. 21, Mar. 2024, doi: 10.1186/s41239-024-00453-6.
[19] G. Biesta, "Why 'what works' won't work: evidence-based practice and the democratic deficit in educational research," *Educational Theory*, vol. 57, no. 1, pp. 1–22, Feb. 2007, doi: 10.1111/j.1741-5446.2006.00241.x.
[20] L. Cohen, L. Manion, and K. Morrison, *Research methods in education*. London, U.K.: Routledge, 2017, doi: 10.4324/9781315456539.
[21] J. Hattie, *Visible learning: a synthesis of over 800 meta-analyses relating to achievement*. London, U.K.: Routledge, 2008, doi: 10.4324/9780203887332.
[22] D. Hillmayr, L. Ziernwald, F. Reinhold, S. I. Hofer, and K. M. Reiss, "The potential of digital tools to enhance mathematics and science learning in secondary schools: a context-specific meta-analysis," *Computers and Education*, vol. 153, p. 103897, Aug. 2020, doi: 10.1016/j.compedu.2020.103897.
[23] P. Black and D. Wiliam, "Developing the theory of formative assessment," *Educational Assessment, Evaluation and Accountability*, vol. 21, no. 1, pp. 5–31, Feb. 2009, doi: 10.1007/s11092-008-9068-5.
[24] J. Kilpatrick, J. Swafford, and B. Findell, *Adding it up: helping children learn mathematics*. Washington, D.C.: National Academies Press, 2001, doi: 10.17226/9822.
[25] W. H. Schmidt and R. T. Houang, "Curricular coherence and the common core state standards for mathematics," *Educational Researcher*, vol. 41, no. 8, pp. 294–308, Nov. 2012, doi: 10.3102/0013189X12464517.
[26] A. Bandura, "Self-efficacy: toward a unifying theory of behavioral change," *Psychological Review*, vol. 84, no. 2, pp. 191–215, 1977, doi: 10.1037/0033-295X.84.2.191.
[27] M. S. Hannula, "Exploring new dimensions of mathematics-related affect: embodied and social theories," *Research in Mathematics Education*, vol. 14, no. 2, pp. 137–161, Jul. 2012, doi: 10.1080/14794802.2012.694281.
[28] U. D'Ambrosio, *Ethnomathematics: link between traditions and modernity*. Rotterdam: Sense Publishers, 2006.
[29] J. Lave and E. Wenger, *Situated learning: legitimate peripheral participation*, 1st ed. Cambridge, U.K.: Cambridge University Press, 1991, doi: 10.1017/CBO9780511815355.
[30] N. S. Nasir, V. Hand, and E. V. Taylor, "Culture and mathematics in school: boundaries between 'cultural' and 'domain' knowledge in the mathematics classroom and beyond," *Review of Research in Education*, vol. 32, no. 1, pp. 187–240, Feb. 2008, doi: 10.3102/0091732X07308962.
[31] J. W. Creswell and J. D. Creswell, *Research design: qualitative, quantitative, and mixed methods approaches*, 5th ed. London, U.K.: SAGE Publications, 2017.
[32] R. E. Slavin, "Evidence-based education policies: transforming educational practice and research," *Educational Researcher*, vol. 31, no. 7, pp. 15–21, Oct. 2002, doi: 10.3102/0013189X031007015.
[33] S. Freeman *et al.*, "Active learning increases student performance in science, engineering, and mathematics," *Proceedings of the National Academy of Sciences of the United States of America*, vol. 111, no. 23, pp. 8410–8415, Jun. 2014, doi: 10.1073/pnas.1319030111.
[34] J. Boaler and C. S. Dweck, *Mathematical mindsets: unleashing students' potential through creative math, inspiring messages and innovative teaching*, 1st ed. Hoboken, NJ: John Wiley & Sons, 2015.
[35] J. P. Smith, A. A. DiSessa, and J. Roschelle, "Misconceptions reconceived: a constructivist analysis of knowledge in transition," *Journal of the Learning Sciences*, vol. 3, no. 2, pp. 115–163, Apr. 1994, doi: 10.1207/s15327809jls0302_1.
[36] F. Pajares and M. D. Miller, "Role of self-efficacy and self-concept beliefs in mathematical problem solving: a path analysis," *Journal of Educational Psychology*, vol. 86, no. 2, pp. 193–203, Jun. 1994, doi: 10.1037/0022-0663.86.2.193.
[37] M. H. Ashcraft and J. A. Krause, "Working memory, math performance, and math anxiety," *Psychonomic Bulletin and Review*, vol. 14, no. 2, pp. 243–248, Apr. 2007, doi: 10.3758/BF03194059.
[38] B. J. Zimmerman, "Becoming a self-regulated learner: an overview," *Theory into Practice*, vol. 41, no. 2, pp. 64–70, May 2002, doi: 10.1207/s15430421tip4102_2.
[39] OECD, *PISA 2018 results (Volume I): what students know and can do*. Paris: OECD Publishing, 2019, doi: 10.1787/5f07c754-en.
[40] A. Aristovnik, D. Keržič, D. Ravšelj, N. Tomaževič, and L. Umek, "Impacts of the COVID-19 pandemic on life of higher education students: a global perspective," *Sustainability*, vol. 12, no. 20, p. 8438, Oct. 2020, doi: 10.3390/su12208438.
[41] J. M. Namkung, P. Peng, and X. Lin, "The relation between mathematics anxiety and mathematics performance among school-aged students: a meta-analysis," *Review of Educational Research*, vol. 89, no. 3, pp. 459–496, Jun. 2019, doi: 10.3102/0034654319843494.
[42] M. Schneider and F. Preckel, "Variables associated with achievement in higher education: a systematic review of meta-analyses," *Psychological Bulletin*, vol. 143, no. 6, pp. 565–600, 2017, doi: 10.1037/bul0000098.
[43] B. Pepin, B. Xu, L. Trouche, and C. Wang, "Developing a deeper understanding of mathematics teaching expertise: an examination of three Chinese mathematics teachers' resource systems as windows into their work and expertise," *Educational Studies in Mathematics*, vol. 94, no. 3, pp. 257–274, Mar. 2017, doi: 10.1007/s10649-016-9727-2.
[44] N. R. Kuncel and S. A. Hezlett, "Standardized tests predict graduate students' success," *Science*, vol. 315, no. 5815, pp. 1080–1081, Feb. 2007, doi: 10.1126/science.1136618.
[45] M. Fullan, *The new meaning of educational change*, 5th ed. New York, NY: Teachers College Press, 2016.
[46] P. Drijvers and N. Sinclair, "The role of digital technologies in mathematics education: purposes and perspectives," *ZDM-Mathematics Education*, vol. 56, no. 2, pp. 239–248, May 2024, doi: 10.1007/s11858-023-01535-x.
[47] J. W. Creswell and C. N. Poth, *Qualitative inquiry and research design: choosing among five approaches*, 4th ed. Thousand Oaks, CA: SAGE Publications, Inc., 2016.
[48] M. Civil and R. Hunter, "Participation of non-dominant students in argumentation in the mathematics classroom," *Intercultural Education*, vol. 26, no. 4, pp. 296–312, Jul. 2015, doi: 10.1080/14675986.2015.1071755.
[49] G. J. J. Biesta, "Why 'what works' still won't work: from evidence-based education to value-based education," *Studies in Philosophy and Education*, vol. 29, no. 5, pp. 491–503, Sep. 2010, doi: 10.1007/s11217-010-9191-x.
[50] A. Lee, "How are doctoral students supervised? Concepts of doctoral research supervision," *Studies in Higher Education*, vol. 33, no. 3, pp. 267–281, Jun. 2008, doi: 10.1080/03075070802049202.

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