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Interlanguage Mediated Teaching Within the Multicultural Mathematics Classrooms: A Current Trend Overview Based on Bibliometrics

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Abstract: Interlanguage Mediated Teaching Within the Multicultural Mathematics Classrooms: A Current Trend Overview Based on Bibliometrics. Objectives: This study presents an analytical-based overview of the current trends in interlanguage mediated teaching (IMT) within multicultural mathematics classrooms, using a bibliometric analysis of 285 relevant research literature retrieved from the Web of Science database during 2014 – 2024. **Methods:** By examining the distribution of publications, citation patterns, and influential researchers via VOSviewer, this study identifies key themes and emergent trends in the field. **Findings:** Centered on the co-occurrence analysis of the 7,065 terms, the present study identifies seven distinctive clusters, i.e., (1) 'STEM integration and multiculturalism' (32.83%), (2) 'equity and access in diverse learning environments' (20.59%), (3) 'language acquisition and mathematical achievement' (17.16%), (4) 'culturally responsive pedagogy and teacher education' (11.76%), (5) 'cultural diversity and learner perceptions' (7.84%), (6) 'multicultural classroom dynamics and teacher perceptions' (7.35%), and (7) 'self-regulated learning and mathematical achievement' (2.45%). The analysis of leading researchers reveals a group of individuals who have made significant contributions to the field of IMT within multicultural mathematics classrooms. While the number of publications is relatively small, the researchers have demonstrated a notable impact through their research, as evidenced by the citation counts and total link strength. **Conclusion:** Qualitative research methods, such as case studies and interviews, could be complement this quantitative-based analysis and postulate a deeper considerate of the implementation and influence of IMT in diverse classrooms.

Keywords: applied linguistics, ethnomathematics, interlanguage, multicultural mathematics, multicultural students.

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INTRODUCTION

The intersection of language learning and mathematics education has become increasingly salient in contemporary educational discourse. As classrooms become increasingly diverse, there is an increasing acknowledgement of the importance of fostering both linguistic and mathematical proficiency among students from various cultural backgrounds (Fouze & Amit, 2018b; Ulovec & Novotná, 2021a). Interlanguage Mediated Teaching (hereafter: IMT) emerges as a promising pedagogical approach that can address the unique challenges and opportunities presented by Multicultural Mathematics Classrooms (hereafter: MMC). IMT, a learner-centered methodology, recognizes and leverages the developing language systems (or interlanguage) of second language learners as

valuable resources for language acquisition (de Bot, 2015; Frith, 1978; White, 2003). Admittedly, IMT cultivates a supportive and stimulating pedagogical environment conducive to both linguistic development and intercultural development (Frith, 1975; White, 2023). Within the context of multicultural mathematics classrooms, IMT present compelling methodology for integrating language acquisition with mathematical proficiency. Specifically, IMT achieves this by: (a) establishing a culturally responsive and inclusive educational milieu that acknowledges and valorizes the diverse linguistic repertoires of learners (Arikan et al., 2020; Fouze & Amit, 2018a), (b) promoting intercultural communication and comprehension through the facilitation of target language use in substantive mathematical discourse and collaborative activities (Moraova & Novotna, 2018; Novotná et al., 2020a), (c) concurrently nurturing the advancement of both linguistic and mathematical competencies (Moraová & Novotná, 2016; Novotná et al., 2020b), and (d) generating opportunities for learners to connect mathematical constructs with their individual epistemologies and cultural backgrounds (García-Holgado et al., 2020; Hošpesová et al., 2021).

Moreover, IMT is predicated on the recognition of learners' interlanguage as a dynamic and evolving linguistic system (Frith, 1978; Guo, 2022). This approach transcends the traditional view of learner language as a deficient approximation of the target language, instead conceptualizing it as a unique and internally consistent system governed by its own logic and rules, shaped by the learners's L1, target language exposure, and individual cognitive processes. Within this framework, errors are not merely deviations requiring correction, but rather invaluable indices of the learner's developing linguistic competency, offering critical insights into their underlying linguistic arrangement and learning path (Stathopoulou, 2015; Gibbons, 2003). IMT underscores the significance of comprehending the systematic nature of learner language, empowering educators to customize instruction to the specific needs and developmental stages of their students. By acknowledging and analyzing interlanguage, teachers can discern patterns of error, anticipate potential learning obstacles, and provide targeted support that facilitates meaningful acquisition.

The significant of IMT in multicultural mathematics classrooms is paramount. In such diverse educational settings, students come with a variety of linguistic backgrounds and differing degrees of proficiency in the instructional language (cf. Ortega, 2012; Oyama, 2013). Mathematics, characterized by its specialized terminology and intricate syntax, poses considerable linguistic challenges for language learners. IMT offers an essential framework to tackle these issues by recognizing the function of interlanguage in the educational journey. It motivates educators to cultivate a welcoming and inclusive classroom atmosphere where students feel at ease utilizing their interlanguage to articulate mathematical concepts (Selinker & Rutherford, 2013). by examining students' interlanguage, teachers can pinpoint possible linguistic obstacles to understanding mathematics and devise strategies to bridge the divide between students' current language skills and the requirements of the mathematics curriculum. This method not only promotes language development but also enhances comprehension of mathematical principles, ensuring equitable learning opportunities for all students in a multicultural mathematics setting.

Accordingly, ethnomathematics, a field dedicated to exploring the mathematical practices inherent within diverse cultural contexts, provides a framework for considering the multifaceted ways in which mathematics is conceptualized and applied across cultures (Ascher, 2017; D'ambrosio, 1989). Through scrutinizing the

mathematical concepts and exercises discovered in many traditional clusters, ethnomathematics encounters the conception of a definite, universal mathematics (Meaney et al., 2022; Pinxten & Vandendriessche, 2023). In its place, it emphasizes the different modes in which society around the world have developed mathematical knowledge and skills. Furthermore, ethnomathematics accentuates the eminence of attributing mathematics to students' individual attachments and cultural understandings, formulating the matter farther applicable and enchanting (D'Ambrosio, 2018; Deda et al., 2024). By integrating ethnomathematical standpoints into mathematics learning, educators can construct supplementary customarily appropriate and captivating studying experiences for learners from assorted circumstances.

Heterogenous mathematic classrooms are distinguished by their intrinsic linguistics and cultural pluralism, wherein students from a spectrum of backgrounds converge to interact with mathematical constructs (Jao, 2012; Zaslavsky, 1996). These classrooms surpass the simple existence of varied learners; they actively incorporate and appreciate the abundance of linguistic and cultural resources that students contribute to the educational setting. This viewpoint contests the conventional conception of a uniform classroom where one language and culture prevail, acknowledging instead the richness and intricacy that arise from the interplay of disparate viewpoints. Within these classrooms, language is not merely an instrument for conveying information, but rather a vibrant through which students construct meaning, negotiable comprehension, and cultivate their mathematical identities (Clarkson, 2014; Daher, 2020). Heterogenous mathematical classrooms nurture and inclusive and egalitarian learning atmosphere where all students perceive themselves as valued, respected, and empowered to contribute their individual perspective to the collective learning endeavor.

The imperative to comprehend the dynamics of multicultural mathematics classrooms is of utmost importance in contemporary education (cf. Maloney & Matthews, 2020; Bütüner & Baki, 2020). Globalization and escalating migration patterns have yielded increasingly heterogenous student populations, necessitating that educators adapt their pedagogical practices to effectively address the requisites of all learners. Within mathematics education, this mandates a transition way from conventional approaches that prioritize rote memorization and procedural proficiency towards a more inclusive and culturally responsive pedagogy. Acknowledging and appreciating students' diverse linguistic and cultural backgrounds is not simply a matter of social equity; it is fundamental for establishing a learning environment where all student can flourish. By leveraging students' varied experiences and perspectives, educators can enrich mathematical discourse, cultivate deeper conceptual comprehension, and promote meaningful interaction with mathematical concepts. Consistent with Stunell (2021) and Sharma & Sharma (2023), multicultural mathematics classrooms, consequently, constitute a potent opportunity to augment the learning experiences of all students while concurrently nurturing intercultural understanding and respect.

The convergence of IMT and ethnomathematics offers a distinctive prospect to address the challenges and opportunities inherent in multicultural mathematics classrooms. IMT can assist learners in cultivating the linguistic proficiencies requisite for efficacious mathematical communication, while ethnomathematics can furnish a culturally pertinent context for exploring mathematical constructs. By integrating these two methodologies, educators can generate comprehensive and equitable learning environments that promote both language acquisition and mathematical comprehension. As of the current juncture, research explicitly

analyzing the confluence of IMT and ethnomathematics remains limited in its dissemination. However, several previous works can be traced. By exploring the Northern Thailand students, Jun-on et al. (2023) suggested that pre-service tutors need exposure to diverse cultural mathematics and multicultural instruction. Gromlich et al.'s (2023) report also recommended the importance of preservice teachers' attitudes towards multiculturalism in Mathematics. In another study, Planas et al. (2023) concluded that the significance of mathematics teaching talk intertwined with the interplay of other linguistic and pedagogical resources. One notable finding from African education practice has been disseminated by Naidoo (2021) that concluded the incorporation of homegrown comprehension and customarily based accomplishments into the mathematics curriculum fostered a more conducive environment for learners to engage freely and interact within the educational context. Another interesting study about the essentials of communiqué and rehearses in a CLIL (Content and Language Integrated Learning) mathematics lecture in contrast to a mathematics class managed in a native language has been done by Moraová & Novotná (2017). Other scholars, such as Chahar-Mahali & Sevigny (2022) by analyzing Canadian preservice teachers' self-efficacy in the multicultural classrooms, (El Mouhayar (2021) by investigating English-language mediated teaching of mathematics classrooms in Lebanon, and Opheim et al. (2023) by studying multilingual pre-service teachers' perception of self-efficacy in Norwegian mathematics classrooms, are also contributing to the field immensely.

While existing research has explored aspects of IMT and multicultural mathematics classrooms separately, there remains a need for a bird view analysis of the current trends and emerging themes in this field. Previous studies have often focused on either the theoretical underpinnings of IMT or the pedagogical challenges of multicultural mathematics education, but a holistic analysis examining their convergence is lacking. Specifically, there is a gap in the literature regarding a systematic, data-driven overview of the current research landscape that identifies prominent trends, emerging themes, and influential contributors at this crucial intersection. This present study objectives to specify an overview of the current trends in IMT within multicultural mathematics classrooms. Through a bibliometric analysis of relevant research literature, this study identifies significant research patterns, emerging themes, and influential contributors amongst other bibliographical aspects in this field. Admittedly, the research questions of the present study are:

1. RQ1: Based on bibliometric analysis, what are the emerging trends and patterns in the research on IMT within multicultural mathematics classrooms?
2. RQ2: How the research focus on IMT within multicultural mathematics classrooms has evolved over time, as evidenced by bibliometric analysis of field of study and authorship patterns?
3. RQ3: What nascent themes and tendencies characterize the co-occurrence of terms pertaining to IMT and multicultural mathemtics, as elucidated through term distribution analysis?

METHOD

Research Design

Bibliometrics constitutes the quantitative analysis of scholarly publications, employing statistical methodologies to discern patterns and trends within a specific domain of inquiry (Donthu et al., 2021; Zitt et al., 2019). Within the purview of applied language studies, bibliometrics offers potent lens through which to examine the evolution of research foci, identify influential authors and

publications, and delineate the intellectual terrain of the discipline. Consistent with Lim et al. (2024) and Henneken & Kurtz (2019), this approach transcends subjective interpretations of research trends, furnishing an objective and data-driven comprehension of the field's development. Through the analysis of keyword frequencies (Mukherjee et al., 2022; van Raan, 2019), bibliometric studies can reveal latent connections between research strands, highlight emergent areas of inquiry, and trace the dissemination of knowledge within the language field.

This bibliometric analysis pursued to delineate a data-driven overview of current developments in IMT within the context of multicultural mathematics classrooms. Employing a systematic and quantitative methodology, this study identified salient research characteristics, including annual publication output, citation impact, disciplinary affiliations, prominent researchers, and institutional origins, as well as analyzing notable term distribution patterns. A comprehensive database search was conducted using WoS, encompassing a specific timeframe of 2014 – 2024. The search strategy included a combination of keywords related to IMT and multicultural mathematics. The retrieved publications were then screened based on their relevance to the study objective, resulting in a final dataset of eligible publications.

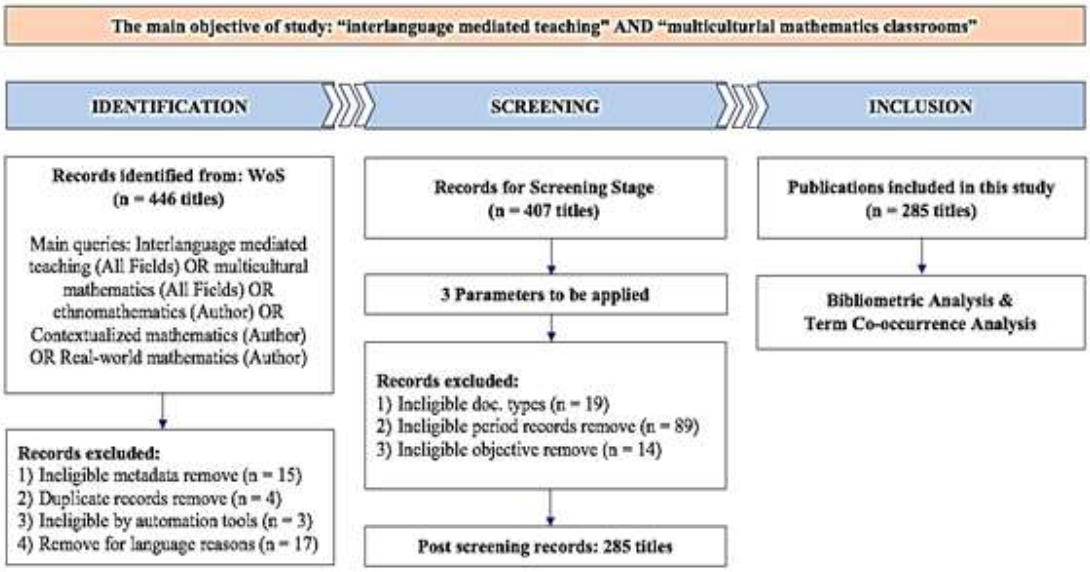

Figure 1. The present-study method, following Page et at.'s (2021) framework

Search Strategy

The main data basis for the present analysis was the Web of Science (hereafter: WoS) catalogue, a wide-ranging bibliographic catalogue that indexes scholarly articles (217 selected title), proceeding paper (81 selected title), and book chapters from a wide range of disciplines (38 selected title). Using WoS platform, a search was conducted to identify publications concerning "interlanguage mediated teaching within the multicultural mathematics classrooms" published between 2014 and 2024. A set of carefully selected keywords, i.e. "[Interlanguage mediated teaching (All Fields) OR multicultural mathematics (All Fields) OR ethnomathematics (Author) OR Contextualized mathematics (Author) OR Real-world mathematics (Author) and 2024 or 2023 or 2022 or 2021 or 2020 or 2019 or 2018 or 2017 or 2016 or 2015 or 2014 (Publication Years) and Article or Proceeding Paper or Book

Chapters (Document Types) and English (Languages) and Early Access or Editorial Material (Exclude – Document Types)]", were used to refine the search and retrieve pertinent publications. The initial-search yielded 285 relevant documents, which formed the corpus for this bibliometric analysis.

Inclusion and Exclusion Criteria

The selection processes for this bibliometric analysis employed specific inclusion and exclusion criteria to ensure the relevance and focus of the study. Inclusion criteria encompassed: (1) peer-reviewed literatures indexed in the WoS database; (2) publications explicitly addressing both "interlanguage mediated teaching" (or related terms like "interlanguage-focused instruction") and "multicultural mathematics classrooms" (or similar concepts, i.e., "heterogenous mathematics classrooms"); (3) literatures published within the timeframe spanning 2014 to 2024; (4) studies employing empirical research designs or presenting substantial theoretical contributions to the field; and (5) publications written in English, the dominant language of international academic discourse. Conversely, exclusion criteria comprised: (1) publications not indexed in WoS as a peer-reviewed type; (2) document types other than article or proceeding paper or book chapters; (3) publications focusing solely on either interlanguage teaching or multicultural mathematics education without explicitly linking the two; (4) publications lacking a clear connection to the intersection of language and mathematics learning in diverse classrooms; and (5) publications published outside the specified timeframe or in languages other than English. These criteria ensured a focused and systematic analysis of the relevant literature.

Data Analysis

The present study involved several key steps of procedure (*see* Figure 1) as follows. First, database selection. The specific database, i.e. WoS, was chosen to ensure a comprehensive search of publications. Three main reasons to choose WoS as the main data source are (a) comprehensive coverage – WoS boasts a vast collection of publications from a diverse range of disciplines that can ensures the representativeness of the main objective of this study, (b) quality and authority – WoS is renowned for its rigorous indexing and quality control procedures, and (c) citation analysis capabilities – one of the key advantages of WoS is its robust citation analysis tools.

Second, data extractions. Relevant data points, including publication year, authors, affiliations, journals/publisher's identification, citations, keywords, and abstract were extracted from each selected article. This extraction file (*.txt) was the main document of the inclusion for the analysis. Lastly, bibliometric analysis. To analyze the extracted data and identify prominent trends, patterns, and relationships within the dataset, a suite of quantitative techniques was employed. These techniques included an examination of annual research productivity to discern fluctuations and growth in scholarly output over time. Furthermore, a leading author analysis was conducted to identify influential researchers who have made significant contributions to the field, thereby shaping the intellectual landscape of inquiry. Finally, a term co-occurrence analysis was performed to explore relationships between key concepts and identify emergent themes and areas of emphasis within the research literature. These combined quantitative approaches allowed for a systematic and data-driven exploration of the research landscape. VOSviewer (1.6.20) (van Eck & Waltman, 2023) was selected to assist this analysis. Lastly, data interpretation. The results from the bibliometric investigation were interpreted and discussed in relation to the existing literature on IMT, multicultural mathematics, and language learning. Key trends, emerging themes, and influential contributors were highlighted.

■ RESULT AND DISCUSSION

This section presents and discusses the results derived from the bibliometric analysis conducted to addresses the research questions guiding this study. Specifically, the results illuminate emerging trends and patterns within research on IMT in multicultural mathematics classrooms (RQ1). Furthermore, the analysis elucidates the evolution of research focus in this area over time, as evidenced by field of study and authorship patterns (RQ2). Finally, the section explores nascent themes and tendencies characterizing the co-occurrence of terms related to IMT and multicultural mathematics, as revealed through term distribution analysis (RQ3). These results are followed by a brief discussion in the last part of section.

RQ1: Based on bibliometric analysis, what are the emerging trends and patterns in the research on IMT within multicultural mathematics classrooms?

Annual Research Productivity

Figure 2 provides a detailed analysis of annual research productivity pertaining to IMT within MMC. A close examination of the publication record counts and their corresponding percentages reveals a substantial surge in research activity on this topic in recent years. The year 2020 stands out prominently, registering the highest number of publications with a total of 76, representing a significant 26.67% of the entire research output. This peak strongly suggests a growing interest in and recognition of the importance of this area of inquiry within the academic community. While 2020 represents a clear zenith of productivity, the years preceding and following it also demonstrate notable research activity, indicating a sustained and ongoing engagement with the topic. Specifically, the years 2017, 2016, and 2021 witnessed a consistent flow of scholarly contributions, with 35, 36, and 25 publications, respectively. These figures underscore the sustained interest and momentum characterizing this field, highlighting a continuous stream of scholarly contributions and a growing body of knowledge dedicated to understanding and advancing the intersection of IMT and multicultural mathematics education. The consistent output across these years suggests a maturing field with an established base of researchers and a growing recognition of the importance of this area of study.

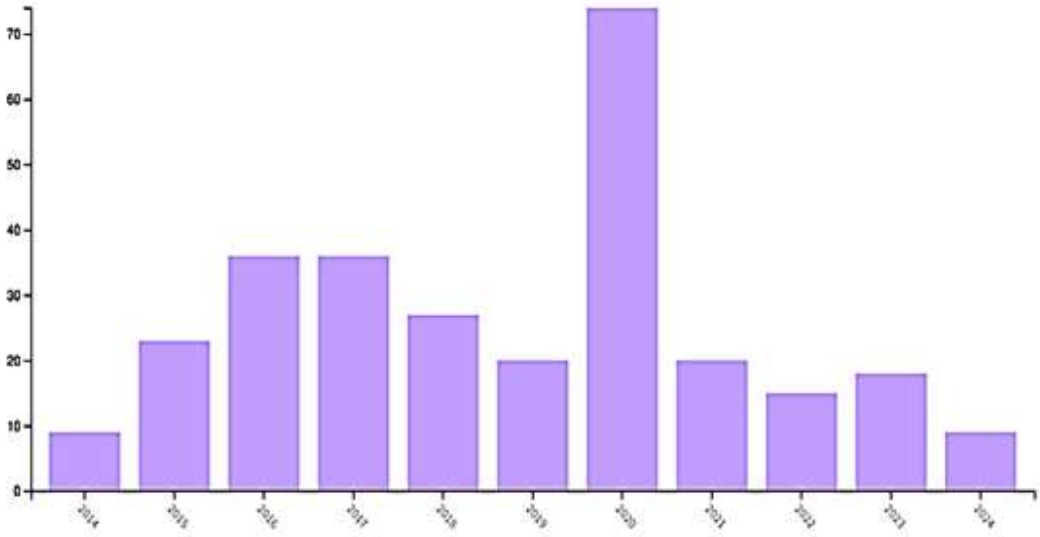

Figure 2. Publications record (2014 – 2024)

It is particularly noteworthy that the earlier years, specifically 2014 and 2015, demonstrate comparatively lower publication counts. In 2024, for instance, only nine publications were identified, constituting a mere 3.16% of the entire dataset. However, the subsequent gradual increase in publication numbers over time strongly suggests a growing awareness of and expanding scholarly exploration into this important topic. This upward trend effectively highlights the evolving nature of research within this area, as scholars progressively delve deeper into the inherent complexities and nuanced aspects of IMT as it intersects with the dynamics of MMC. It is also crucial to acknowledge that annual research productivity, as measured simply by the number of publications produced, represented only the facet of the broader and more intricate research landscape. Other equally important factors, such as the methodological rigor and overall quality of the research, the demonstrable impact and influence of the published work on the field, and the diversity of research perspectives represented, should also be carefully considered when comprehensively evaluating the overall progress and development of this important area of scholarly inquiry. A subsequent assessment necessitates moving beyond sheer publication counts to encompass these qualitative and impact-oriented dimensions.

In this respect, based on Figure 2, the marker surge in research productivity observed in 2020 can be plausibly attributed to several converging factors. While further investigation is warranted to definitely establish causality, it is reasonable to hypothesize that the COVID-19 pandemic, which disrupted educational systems globally, played a significant role. The abrupt shift to online and remote learning modalities likely catalyzed a surge of scholarly interest in technology integration within education, potentially including its application within IMT contexts. Researchers may have sought to explore how technology could be effectively leveraged to support language development and mathematical learning in virtual or blended learning environments, thus contributing to the increased publication output. Furthermore, the pandemic may have also highlighted existing inequities in education, prompting investigations into how IMT approaches could address the unique needs of diverse learners in these new educational landscapes.

Conversely, the relatively low research productivity observed in the early years (2014-2025) may attributed to a combination of factors. At that time, awareness of the importance of addressing linguistic diversity within mathematics classrooms, specifically through the lens of IMT, may have been less widespread within the broader educational research community. The field may have been in its nascent stages, with fewer scholars actively pursuing research in this specific area. Additionally, methodological challenges associated with studying IMT in situ within complex, multicultural classroom settings may have presented obstacles to researchers. Developing appropriate research designs, data collection instruments, and analytical frameworks for capturing the intricate interplay of language, culture, and mathematical learning in these contexts may have required time and methodological refinement. As the field matured, both theoretical understandings and methodological approaches likely evolved, paving the way for more robust research endeavors in subsequent years.

Additionally, Figure 3 provides a data-based overview of the indexation of the 285 research publications included in this study within the WoS database. This analysis illuminates the diverse nature of these research publications and their distribution across a range of subject areas, offering insights into the interdisciplinary character of the field. The Social Sciences Citation Index (SSCI) emerged as the most frequently utilized database for indexing these publications, accounting for a substantial 29.825% of the total.

This finding suggests that a significant proportion of research exploring IMT within MMC falls squarely within the social sciences domain, thereby further emphasizing the inherently interdisciplinary nature of this field. The Emerging Sources Citation Index (ESCI), which focuses on indexing emerging and often newer research, also played a considerable role in the dissemination of these publications, comprising 25.263% of the total. This indicates that a substantial number of studies on this topic are relatively recent or perhaps less established within existing body of literature, contributing to the field's dynamic and ongoing development. The presence of a significant portion of publications in ESCI suggests active and ongoing scholarship in this area, potentially signaling future growth and maturation of this research domain.

Figure 3. TreeMap chart of the publications' indexation based on WoS-identifier

The 'Conference Proceedings Citation Index – Science (CPCI-S) and – Social Science & Humanities (CPCI-SSH)' accounted for a collective 29.825% of the publications, representing the significance of conference presentations and proceedings in disseminating research findings within this area. While the 'Science Citation Index Expanded (SCI-EXPANDED)' and 'Book Citation Index' databases were represented, their proportions were relatively smaller, suggesting that the focus of research on IMT within multicultural mathematics classrooms is primarily within the social sciences and humanities. In short, the examination of publication indexation within WoS reveals dissimilar background of study on IMT within multicultural mathematics classrooms. The dominant presence of the SSCI and ESCI indicates the social science orientation and emerging nature of much of this research. Additionally, the significant representation of conference proceedings highlights the role of academic conferences in disseminting knowledge and fostering collaborations within this field.

Citation Count

Regarding citation count, Figure 4 presents a detailed analysis of the citations records for the 285 research publications indexed within the WoS database. The data spans the years 2014 to 2024, offering insights into the evolving citation patterns and impact of research on IMT within multicultural

mathematics classrooms. As the overall citation trends, the total number of citations has exhibited a significant upward trend over the past decade. Since a preliminary 2 citations in 2014, the cumulative total has reached 1,814 by 2024. This considerable progression designates a developing recognition and encouragement of research in this field.

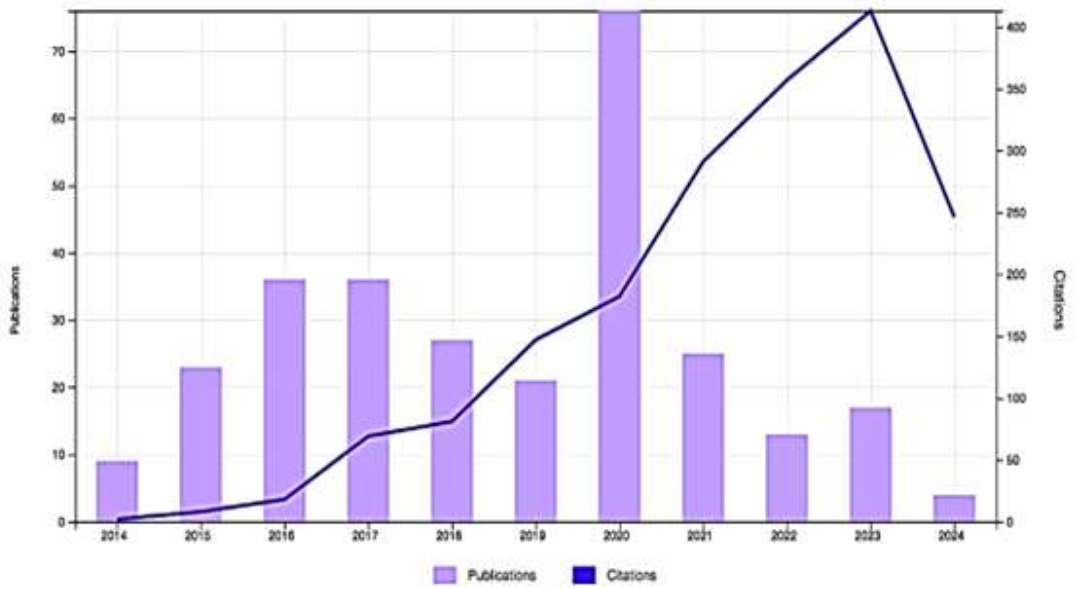

Figure 4. Citations record (2014 – 2024)

While the general tendency is progressive, the twelve-monthly citation frequencies have wavered. The year 2020 witnessed a greatest in citations, with 182 latest citations documented. This surge may be attributed to numerous influences, such as increased inquiry movement during the pandemic outbreak or the publication of highly influential studies. However, the annual citation rates have begun to decline in 2023 and 2024. This could be due to various reasons, including the time lag between publication and citation, changes in research priorities, or the emergence of new research areas. Specifically, the decline in 2023 and 2024 is likely attributable, at least in part, to the inherent time lag in citation practices. Newly published research often requires time to be disseminated, read, and subsequently cited by other scholars. Therefore, publications from these recent years may not yet have accumulated their full citation potential. Additionally, evolving research agendas and the natural ebb and flow of scholarly attention could contribute to fluctuations in citation rates. It is also possible that newer research, while potentially impactful in the future, has not yet had sufficient time to accrue citations. Finally, the emergence of related, but distinct, research areas could draw citations away from earlier work, even if that earlier work remains foundational. Correspondingly, the average number of citations per publication have also increased over time. In 2014, the average was 0.5 per publication, while in 2024, it reached 3.1 citations per publication. This indicates that the overall quality and impact of research in this field have improved. However, the distribution of citations including the 285 documents is imbalanced. A limited publications received disproportionately large citations, while others received moderately scarce. This suggests that certain studies have had a more noteworthy impact on the field, theoretically due to their novelty, methodological accuracy, or realistic

suggestions. In short, the analysis of citation records reveals a positive trend in the recognition and impact of research on IMT within multicultural mathematics classrooms. While the annual citation rates have fluctuated, the overall upward trajctory indicates a growing interest and influence in field.

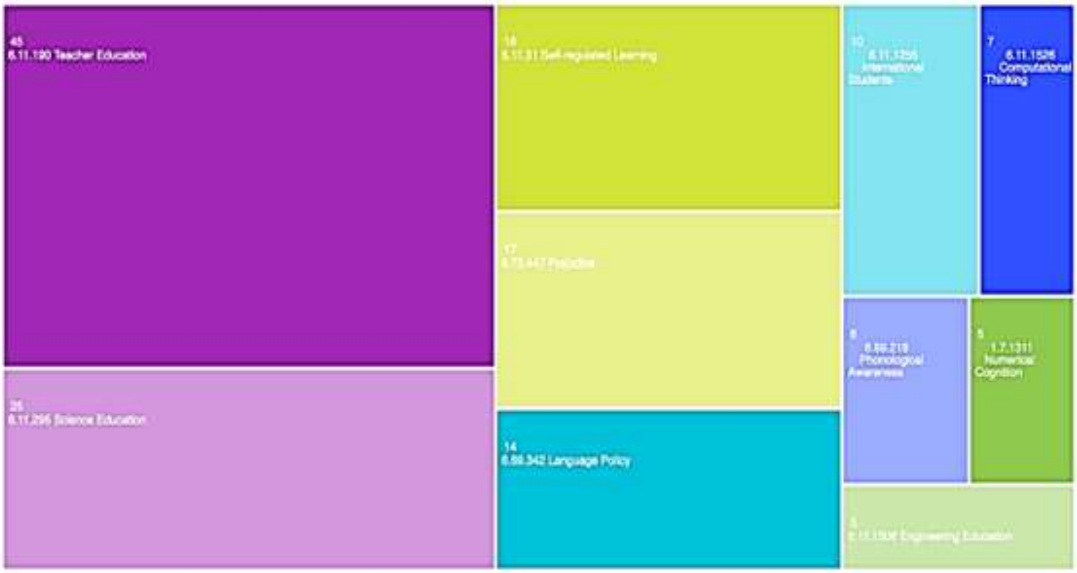

Figure 5. TreeMap chart of citation-topics micro for the WoS-based corpus of IMT-MMC

Furthermore, Figure 5 offers an analysis of the citation topics micro, which represent the primary themes or subjects addressed in the cited documents within the WoS-based corpus of publications related to IMT within multicultural mathematics classrooms. As the key citation topics, the most frequently cited topic was Teacher Education, accounting for 15.789% of the total citations. This suggests that a noteworthy ration of the study in this field focuses on the specialized improvement and training of instructors to effectively implement IMT in diverse classrooms. Other prominent topics included Science Education (8.772%), Self-regulated Learning (6.316%), Prejudice (5.965%), and Language Policy (4.912%). These findings highlight the interdisciplinary nature of the research and the need to consider factors such as scientific literacy, student autonomy, societal biases, and language policies when implementing IMT.

While teacher education and related topics dominate the citation landscape, several emerging themes are evident. International Students and Computational Thinking are represented, suggesting a growing interest in understanding the experiences and challenges faced by international students in multicultural mathematics classrooms and the integration of computational skills into language and mathematics instructions. As the less frequent topics, topics such as Phonological Awareness, Numerical Cognition, and Engineering Education appear less frequently in the citations. This may indicate that while these areas are relevant to the broader context of language and mathematics education, they are less directly connected to the specific focus of IMT within multicultural classrooms. Moreover, based on Table 1, the most cited document is (1) "*Using a web-based multilingual platform to support refugee students in mathematics*", garnering 72 citations with an average of 14.4 citation per year. This suggests a significant impact of this study on the field. Following this, (2) "*Toward a framework for multicultural STEM-focused*

career interventions" and (3) "*Acculturation and school adjustment of immigrant youth in six European Countries*" have received 63 and 53 citation respectively. Notably, the average citations per year for these top three articles range from 5.25 to 14.4, indicating a consistent and substantial influence over time. The remaining articles in the Table 1, while still significant, show a gradual decrease in both total citations and average citations per year. The lowest cited document, (8) "*Connections between secondary mathematics teachers' beliefs and their selection of tasks for English language learners*", has received 20 citations with an average of 2.22 citations per year. Overall, the citation data highlights a positive trend in the recognition and impact of research on IMT within MMC, with a few seminal papers significantly shaping the discourse.

In summary, the analysis of citation topics at the micro-level offers empirical insights into the key themes and research areas that have

Table 1. The most cited documents in the WoS-based corpus of IMT-MMC

No	Published Year	Title	Average Per Year	Total Citation
1	2024	"Using a web-based multilingual platform to support elementary refugee students in mathematics"	14.4	72
2	2014	"Toward a framework for multicultural STEM-focused career interventions"	5.25	63
3	2017	"Acculturation and school adjustment of immigrant youth in six European countries: findings from the programme for international student assessment (PISA)"	5.89	53
4	2019	"Towards a truer multicultural science education: how whiteness impacts science education"	6.71	47
5	2015	"Integrating professional development on mathematics and equity: countering deficit views of students of color"	3	33
6	2017	"PISA mathematics and reading performance differences of mainstream European and Turkish immigrant students"	2.78	25
7	2017	"Lessons learned using a values-engaged approach to attend to culture, diversity, and equity in a stem program evaluation"	2.33	21
8	2017	"Connections between secondary mathematics teachers' beliefs and their selection of tasks for English language learners"	2.22	20

significantly shaped the field of IMT within the context of multicultural mathematics classrooms. The conspicuous presence of teacher education and related topics underscores the importance of robust professional development initiatives and the effective integrations of diverse perspectives within this specialized area of pedagogical inquiry. This suggests a strong emphasis within the field on equipping educators with the necessary tools and knowledge to effectively implement IMT strategies and cultivate culturally responsive learning environments. Furthermore, the focus on diverse perspectives indicates a growing recognition of the crucial role that cultural

awareness and sensitivity play in fostering inclusive and equitable mathematics education for all learners. The convergence of these themes highlights the interconnectedness of teacher preparation, culturally relevant pedagogy, and the successful implementation of IMT within multicultural mathematics classrooms. Emerging themes such as international students and computational thinking suggest that the field is evolving to address contemporary challenges and opportunities.

RQ2: How the research focus on IMT within multicultural mathematics classrooms has evolved over time, as evidenced by bibliometric analysis of field of study and authorship patterns?

Fields of Study

As identified within the WoS-based corpus of publication concerning IMT within multicultural mathematics classrooms during period 2014 – 2024, Table 2 presents a detailed analysis of the eight most notable fields of study. In terms of dominant fields, the field of Education Educational Research emerged as the utmost prominent category, accounting for 53.684% of the overall scholarly periodicals. This dominance reflects the central role of educational research in understanding and improving language teaching practices within diverse classrooms. The second most notable field was Education Scientific Disciplines, contributing 27.018% to the total. This indicates a significant intersection between education and scientific disciplines, suggesting the prominence of integrating scientfic comprehension and approaches into language teaching research.

Furthermore, the presence of Engineering Multidisciplinary (14.035%) and Social Sciences Interdisciplinary (4.561%) highlights the interdisciplinary nature of the research on IMT within multicultural mathematics classrooms. These fields contribute diverse perspectives and methodologies to the study of language learning, cultural context, and educational practices. As for the specialized fields, the fields of Linguistics (22.281%), Language Linguistics (5.263%), Mathematics (3.509%), and Ethnic Studies (2.105%) represent more specialized areas of research within the broader context of IMT. These fields offer unique insights into the linguistic, mathematical, and cultural dimensions of language learning. In sum, the analysis of notable fields of study reveals a diverse research landscape surrounding IMT within multicultural mathematics classrooms. The dominance of educational research and the significant contributions from scientific disciplines, social sciences, and linguistics underscore the interdisciplinary nature of this field. The presence of more specialized fields such as linguistics, language linguistics, mathematics, and ethnic studies demonstrates the breadth and depth of research in this area.

Table 2. The most eight notable fields of study

Field	WoS Categories	Document Count	% of 285
1	Education Educational Research	153	53.684
2	Education Scientific Disciplines	77	27.018
3	Engineering Multidisciplinary	40	14.035
4	Linguistics	17	5.965
5	Language Linguistics	15	5.263
6	Social Sciences Interdisciplinary	13	4.561
7	Mathematics	10	3.509
8	Ethnic Studies	6	2.105

Leading Scholar

Table 3 presents analysis of the eight prominent scholars in the field of IMT within

multicultural mathematics classrooms, as identified within the WoS-based corpus of publications during the period 2014 – 2024. The researchers listed in Table 3 have all contributed significantly to the field, each having published at least two relevant titles within the specific timeframe. However, the number of publications does not vary significantly among these individuals, suggesting relatively even distribution of research output. While the number of publications is similar, the citation impact of these researchers differs. Ebony Omotola McGee stands out with 106 citations, indicating a substantial influence on the field. Alicia Garcia-Holgado, Jarmila Novotna, and Hana Morahova have also garnered a significant number of citations, suggesting their contributions have been widely recognized and cited by other researchers.

Table 3. Prominent scholars

No.	Name	Record Count	% of 285	Citations (n > 20)	Total Link Strength (n > 8)
1	Ebony Omotola McGee	3	1.053	106	13
2	Alicia Garcia-Holgado	2	0.702	34	11
3	Jarmila Novotna	7	2.105	85	10
4	Hana Morahova	4	0.702	85	10
5	Andreas Ulovec	3	1.053	29	10
6	Fons JR van de Vijver	3	1.053	29	10
7	Miriam Amit	2	0.702	29	10
8	Sooobin Choi	2	0.702	29	10

Furthermore, an examination of total link strength, a metric reflecting the interconnectedness of a researcher's publications within the citation network, offers additional insights into scholarly influence. Ebony Omotola McGee also demonstrates the highest total link strength, suggesting that her research has been frequently cited by other influential scholars in the field, thereby indicating a central role in the scholarly in discourse. While the table does not explicitly delineate collaboration patterns, it is reasonable to infer potential collaborations among these researchers, either with each other or with other scholars contributing to this area of inquiry. The presence of multiple publications authored by the same individuals strongly suggests potential collaborative endeavors or shared research interests. In summary, the analysis of leading researchers reveals a cohort of individuals who have made significant contributions to the field of IMT within multicultural mathematics classrooms. Although the absolute number of publications may appear relatively modest, these researchers have demonstrated a notable impact on the field, evidenced by both citations counts and total link strength, thereby highlighting the importance and influence of their scholarly work.

Organization Origin

Regarding the analysis of prominent institutions contributing to this field, Table **4** provides an overview of the notable organizations engaged in research on IMT within multicultural mathematics classrooms. Texas A&M University leads the ranking with six publications, followed by Ohio State University and Vanderbilt University with five and four publications, respectively. These institutions demonstrate a substantial commitment to research in this area. While Vanderbilt University exhibits the highest citation count, Texas A&M University and Ohio State University hold the second and the highest positions in terms of citations received.

Table 4. Top institutes in the field of study

No.	Organization	Record Count	Citations (n > 7)	Total Link Strength (n > 20)
1	Texas A&M University	6	99	227
2	Ohio State University	5	88	217
3	Vanderbilt University	4	166	207
4	University of Nevada	4	17	103
5	University of Missouri	5	69	50
6	University of Colorado	4	48	49
7	Western Carolina University	5	32	30
8	Charles University Prague	7	9	44

Moreover, the total link strength, a measure of interconnectedness of an organization's publications within the citation network, provides additional insights into their influence. Texas A&M University and Ohio State University again lead in terms of total link strength, indicating that their research has been frequently cited by other influential organizations and researchers in the field. Regarding the geographic distribution, many of the top organizations are in the United States, reflecting the significant contributions of American researchers to this field. However, the presence of institutions from different regions suggests a growing international interest in IMT within multicultural mathematics classrooms. In sum, Texas A&M University, Ohio State University, and Vanderbilt University have demonstrated strong research productivity, citation impact, and influence within the field. While most of the top organizations are located in the United States, collaborations and contributions from international institutions may be emerging as the field continues to evolve.

RQ3: What nascent themes and tendencies characterize the co-occurrence of terms pertaining to IMT and multicultural mathematics, as elucidated through term distribution analysis?

In terms of the term co-occurrence analysis based on the WoS-based corpus of publications concerning "interlanguage mediated teaching within the multicultural mathematics classrooms" during 2014 – 2024, smallest amount of manifestations of a term is 8. Of the 7,065 terminologies, 274 congregate the limit. For each of the 210 terminologies, a significance score has been estimated. Founded on this grade, the furthermost pertinent terminologies have been selected. The nonappearance high-quality is to select the 60% utmost pertinent terminologies. The amount of terminologies to be selected is 164. Based on these specific criteria, the WoS-based corpus has seven distinctive clusters. Table 5 presents a detailed result of the seven clusters identified through co-occurrence analysis. These clusters represent distinct thematic groupings of research within the field, offering insights into the key areas of focus and interconnections between different topics.

First, cluster 1, represented by red in Figure 6, is the largest cluster, comprising 67 terms. It highlights the central themes of foreign language learning, mathematics education, and multiculturalism. Notable terms within this cluster include "foreign language," "mathematics education," "mathematics teacher," "multicultural perspective," "multiculturalism," "STEM education," "STEM discipline," "STEM field," and "STEM program." This cluster suggests a strong focus on the integration of foreign language learning and mathematics education within multicultural contexts and the role of STEM education in promoting diversity and equity.

Table 5. Clusters of term occurrence in the examined corpus of publications concerning "interlanguage mediated teaching within the multicultural mathematics classrooms" during 2014 – 2024

Cluster	Items	%	Color in Figure 6	Notable Term Sample
1	67	32.84	Red	foreign language; mathematic education; mathematics teacher; multicultural perspective; multiculturalism; stem education; stem discipline; stem field; stem program
2	42	20.59	Green	diverse population; multicultural context; multicultural society; resilience; ethnicity; interaction; disparity
3	35	17.16	Blue	academic achievement; mathematical skill; computer science, English; engagement
4	24	11.76	Chartreuse	ethnomathematics; mathematical problem; preservice teacher; critical thinking; efficacy
5	16	7.84	Purple	cultural diversity; perception; teaching unit; instructor; flexicurity
6	15	7.35	Aqua	multicultural classroom; multicultural education; pdme; school climate; teachers' perception
7	5	2.45	Orange	math achievement; achievement; co regulation; self-regulation

According to first cluster, future research could be benefited by considering several research questions: (a) how can IMT teaching be effectively integrated into foreign language and mathematics curricula to promote cultural understanding and academic achievement in diverse classrooms; (b) what are the definite approaches and procedures that instructors can practice to foster intercultural communication and collaboration in mathematics classrooms; (c) how can STEM education programs be designed to address the needs of learners and promote both language and mathematical proficiency; (d) what are the encounters and prospects associated with instigating IMT in bilingual or multilingual mathematics classrooms; and (e) how can technology be leveraged to support IMT and promoted intercultural learning in mathematics classrooms?

The second largest cluster, represented by green in Figure 6, consists of 42 publications and focuses on the several themes, such as multicultural contexts, ethnicity, and interaction. Notable terms include "diverse population," "multicultural context," "multicultural society," "resilience," "ethnicity," and "interaction." This cluster accentuates the prominence of understanding and concentrating the encounters and opportunities presented by diverse student populations within multicultural classrooms. Based on the second cluster, the subsequent inquiry can be profited by examining some research questions: (a) how can IMT be adapted to assemble the specific prerequisites and learning styles of diverse student populations within multicultural classrooms; (b) what are the cultural and linguistic barriers that may hinder the effective implementation of interlanguage mediated teaching in certain multicultural contexts; (c) how can teachers foster resilience and a sense of belonging among diverse students in mathematics classrooms; (d) what are the implications of ethnic and verbal diversity for the assessment and evaluation of student learning in mathematics; and (e) how can IMT be used to promote social justice and equity in mathematics learning?

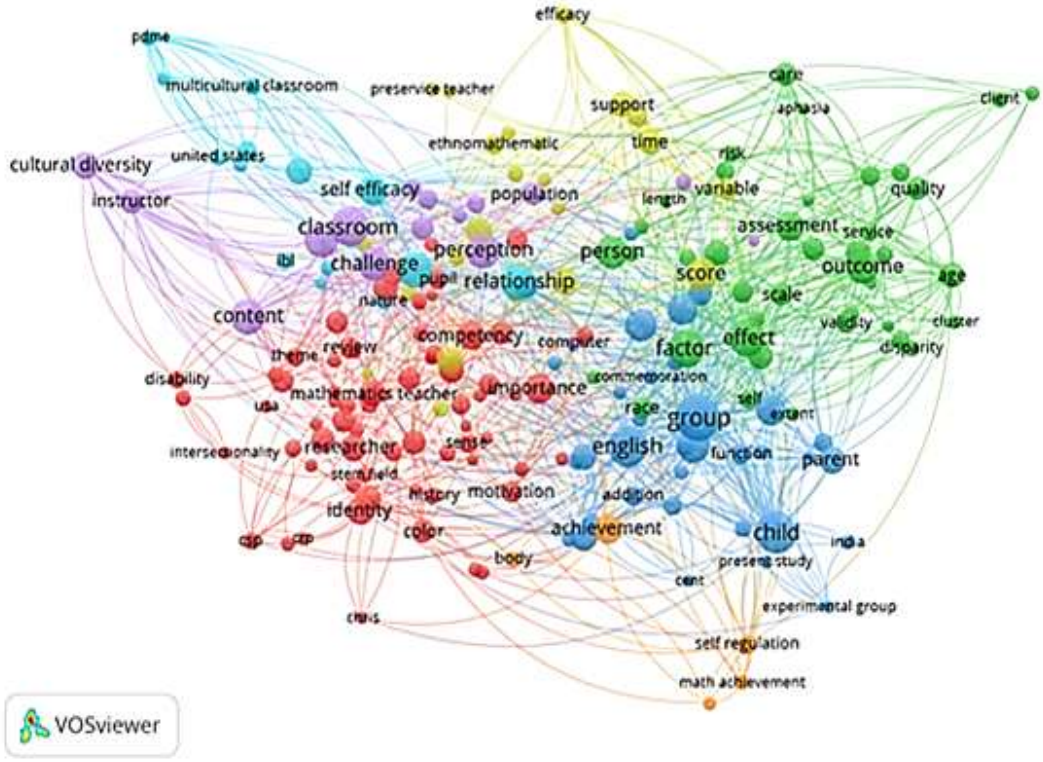

Figure 6. Terms network within the WoS-based corpus of publications concerning "interlanguage mediated teaching within the multicultural mathematics classrooms" during 2014 – 2024

The third cluster, represented by blue in Figure 6, comprises 35 terms and focuses on the themes of academic achievement, mathematical skill, computer science, English, and engagement. Notable terms include "academic achievement," "mathematical skill," "computer science," "English," and "engagement." This cluster highlights the importance of developing academic and mathematical skills and fostering student engagement in learning. Considering the third cluster, future work could analyze this following research questions: (a) how does IMT contribute to the improvement of educational and mathematical skills amongst diverse students; (b) what are the certain approaches and procedures that instructors can practice to encourage analytical discerning, problem-solving, and creativity in mathematics classrooms; (c) how can interlanguage mediated teaching be integrated with technology to enhance student engagement and motivation in mathematics learning; (d) what are the challenges and opportunities associated with assessing student progress in mathematics when using IMT approaches; and (e) how can IMT be used to address achievement gaps and promote equity in mathematics education?

Represented by chartreuse in Figure 6, fourth cluster consists of 24 terms and focuses on the themes of ethnomathematics, mathematical problems, preservice teacher education, and critical thinking. Notable terms include "ethnomathematics," "mathematical problem," "preservice teacher," "critical thinking," and "efficacy." This cluster emphasizes the significance of uniting ethnic and historical contexts into mathematics education and preparing preservice teachers to effectively teach in diverse classrooms. According to the fourth cluster, future research can be navigated by exploring several research questions: (a) how can ethnomathematics be

effectively incorporated into preservice teacher education programs to prepare instructors for training in multicultural classrooms; (b) what are the specific pedagogical strategies and techniques that preservice teachers can learn to use to connect mathematics to students' cultural experiences and identities; (c) how can ethnomathematics be used to promote cultural understanding and respect among preservice teachers and their students; (d) what are the encounters and prospects connected with incorporating ethnomathematics into traditional mathematics curricula; and (e) how can preservice teachers be supported in developing the cultural competence and intercultural communication skills necessary for effective teaching in diverse classrooms?

The fifth cluster, represented by purple in Figure 6, comprises 16 terms and focuses on the themes of cultural diversity, perception, and

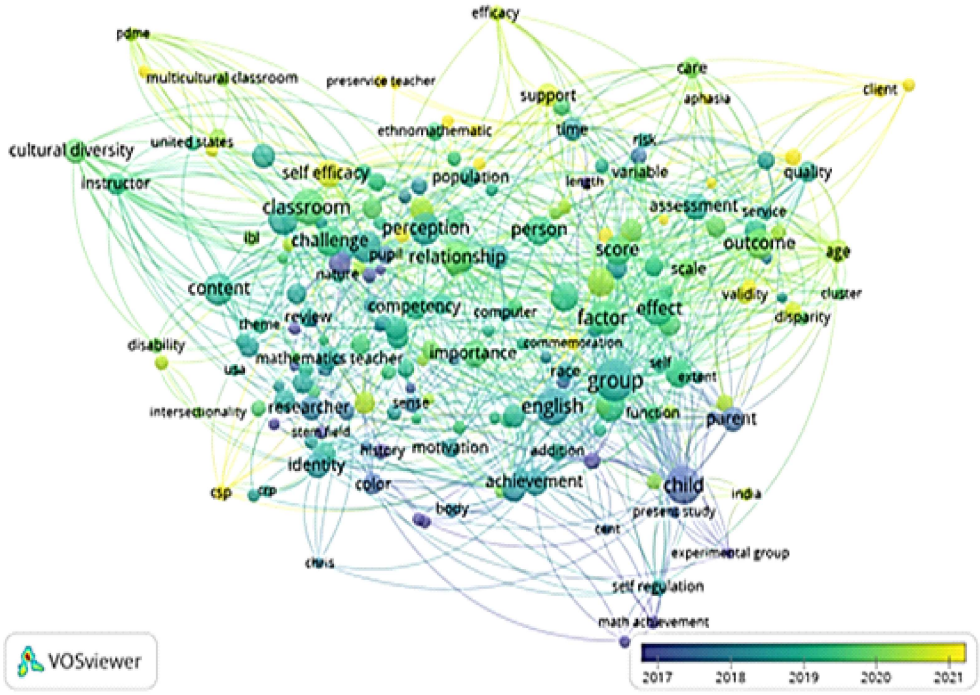

Figure 7. Overlay visualization of the terms co-occurrence within the WoS-based corpus of publications concerning "interlanguage mediated teaching within the multicultural mathematics classrooms" during 2014 – 2024

flexicurity. Notable terms include "cultural diversity," "perception," "teaching unit," "instructor," and "flexicurity." This cluster highlights the prominence of understanding and addressing cultural diversity in the classrooms and the responsibility of instructors in generating inclusive and supportive learning environments. By leveraging fifth cluster, future work can apply this research questions: (a) how can IMT be used to challenge and address cultural biases and stereotypes in mathematics classrooms; (b) what are the implications of cultural diversity for the design and implementation of mathematics curricula and assessments; (c) how can teachers create inclusive and supportive learning environments that respect and value the cultural diversity of their students; (d) what are the challenges and opportunities associated with fostering intercultural understanding and communication in mathematics classrooms; and

(e) how can IMT be used to promoted the development of cultural intelligence among both teachers and students?

Represented by aqua in Figure 6, sixth cluster comprises 15 terms and focuses on the themes of multicultural classrooms, multicultural

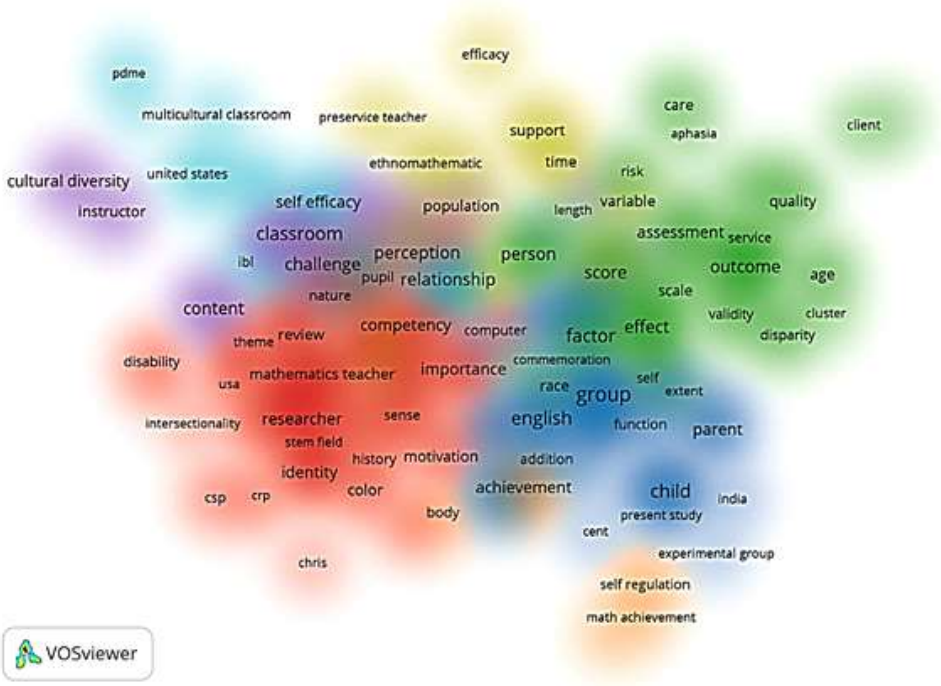

Figure 8. Density visualization of the terms co-occurrence within the WoS-based corpus of publications concerning "interlanguage mediated teaching within the multicultural mathematics classrooms" during 2014 – 2024

education, professional development for multicultural education (PDME), school climate, and teachers' perceptions. Notable terms include "multicultural classroom," "multilingual education," "PDME," "school climate," and "teachers' perception." This cluster emphasizes the status of proficient development for educators working in multicultural classrooms and the creation of positive and inclusive school climates. According to this cluster, future research can be benefited by investigating this following research questions: (a) how can IMT be integrated into broader multicultural education initiatives to promote cultural understanding and equity in schools; (b) what are the specific professional development needs of teachers working in multicultural classrooms, and how can these needs be met through targeted PDME programs; (c) how can school climate and culture be transformed to create more inclusive and supportive learning environments for diverse students; (d) what are the encounters and prospects associated with implementing IMT in schools with limited resources or support; and (e) how can IMT teaching be used to address issues of systemic racism and inequality in mathematics education.

The last cluster, represented by orange in Figure 6, comprises 5 terms and focuses on the themes of math achievement. Notable terms include "math achievement," "achievement," "co-regulation," and "self-regulation." This cluster highlights the standing of promoting student achievement and developing self-regulation skills. Based on the last cluster, subsequent analysis can deal with this following research questions: (a)

how does IMT contribute to the development of self-regulation skills and metacognition among mathematics learners; (b) what are the particular approaches and practices that educators can custom to encourage self-regulated learning and metacognition in mathematics classrooms; (c) how can IMT be used to address the challenges faced by students with learning disabilities or difficulties in mathematics; (d) what are the implications of self-regulation and metacognition for student achievement and motivation in mathematics; and (e) how can IMT be used to promoted the development of growth mindset and resilience among mathematics learners?

In conclusion, the analysis of clusters in this study reveals a diverse and interconnected term surrounding IMT within multicultural mathematics classrooms. These clusters represent distinct thematic groupings that highlight the key areas of focus and interconnections between different research topics. By examining the terms associated with each cluster, it becomes evident that the field encompasses a diverse range of perspectives and approaches, encompassing foreign language learning, mathematics education, cultural diversity, and pedagogical practices.

Discussion

Considering the results of the analysis, as also illustrated in Figures 7 and 8, IMT presents a compelling pedagogical approach for cultivating effective learning within multicultural mathematics classrooms. Consistent with Mesiti et al. (2019) and Artigue et al. (2023), by recognizing and catalyzing on learners' evolving interlanguages systems, IMT can established a supportive and engaging learning environment that facilitates both language acquisition and mathematical comprehension. Aligning with Novotná et al. (2023), it is posited that IMT can foster a more inclusive and equitable learning milieu by valuing and respecting learners' diverse linguistics backgrounds. Through the acknowledgement and utilization of learners' interlanguage systems, IMT can contribute to a sense of belonging and empowerment for all students. Furthermore, IMT can promote deeper acquisition and internalization of mathematical concepts. In accordance with Mesiti et al. (2022), by employing the target language to engage in meaningful mathematical dialogues and collaborative endeavors, learners can develop a more comprehensive understanding of the subject matter. Finally, IMT can enhance learners' intercultural communication skills. By providing opportunities for students to practice the target language in a variety of contexts, IMT can assist them in developing the skills necessary for effective communication across cultural boundaries within the mathematics classrooms.

Moreover, IMT can be a particularly efficacious approach for learning activities within mathematics classrooms. Mathematics constitutes a highly specialized discipline demanding precise and accurate language use. Concurring with Ulovec & Novotná (2021b), learners must be capable of comprehending and utilizing mathematical terminology, following logical argumentation, and articulating their ideas clearly and succinctly. In essence, IMT can assist learners in developing the linguistic competencies requisite for success in mathematics. Through concentrating on students' interlanguage and distributing probabilities to exercise the target language in consequential mathematical contexts, IMT can help learners to: (a) acquire the specialized vocabulary and terminology needed for mathematical communication (Parker Waller & Flood, 2016), (b) develop the ability to follow and understand complex mathematical arguments (Adamuz-Povedano et al., 2016), (c) express their mathematical ideas clearly and accurately in the target language (Tenorio, 2024) , and (d) engage in collaborative problem-solving and mathematical discussion with peers (Amit & Abu Qouder, 2017). In this respect, IMT can advantage to build a farther inclusive studying environment in mathematics schoolrooms. By concerning and appreciating learners'

miscellaneous linguistic upbringings, IMT can support to moderate apprehension and reassure an awareness of belonging between all scholars. In step with Schachner et al. (2017), Moraova & Novotna (2015), and McGee et al. (2016), IMT can stipulate projections for students to associate their subjective understandings and cultural circumstances to mathematical concepts, formulating the subject more applicable and enchanting.

Within multicultural mathematics classrooms, IMT can be applied in some conducts. First, instructors can obviously communicate characters of learners' interlanguage, facilitating them to comprehend the arrangements and assemblies they have developed. Parallel to Kashyap (2021), Subramanian (2015), Arikan et al. (2017), and García-Holgado et al. (2021), this may involve providing clear command on grammar, vocabulary, and discourse features pertinent to the mathematical matter under consideration. For illustration, a mathematics instructor is working with a group of intermediate-level English language learners from a non-native mother language who are studying geometry. The learners have been struggling with the use of prepositions in spatial relationships, such as "above," "below," "in front of," and "behind." As an implementation of IMT, the teacher might begin by conducting a needs assessment to pinpoint the specific challenges these learners face with prepositions. To address these challenges, the teacher can provide explicit instruction on the use of preposition in spatial descriptions. This could involve presenting a visual aid, such as a diagram of a room with object poisoned in different locations. The teacher could then explain the meaning of each preposition and provide illustrative examples of their usage in sentences. Learners might also be asked to construct their own sentences using prepositions to describe spatial relationships.

Secondly, instructors can compare learners' interlanguage with the target language, highlighting points of convergence and divergence. Consistent with Choi (2024), Novotná & Ulovec (2020) and Amit & Naaman (2014), this comparison can facilitate learners' awareness of their specific linguistic challenges and the development of strategies to address them. For instance, consider a group of intermediate-level English language learners from a non-native mother language studying geometry in a mathematics classroom. The teacher might introduce the concept of angles and provide examples of different types of angles (acute, obtuse, right, etc.). Students could then be asked to identify angles in various shapes or real-world objects. During this activity, the teacher could compare the learners' use of English terms for angles (e.g., "corner," "point') with the more accurate mathematical terminology (e.g., "acute angle", "obtuse angle"). Finally, teachers can encourage learners to use their interlanguage creatively, providing opportunities for them to experiment and explore mathematical concepts with the language. This can bolster learners' confidence and fluency in using the target language for mathematical communication. For example, students in a multicultural mathematics classroom could be asked to create their own original word problems that incorporate elements of their cultural backgrounds. Students from a Javanese-speaking background might create a word problem involving a traditional Javanese measurement for counting ingredients of food recipe, while students from a Balinese background might create a problem related to a Balinese festival. Once students have formulated their own word problems, they can share them with their classmates and engage in discussions about the underlying mathematical concepts.

■ CONCLUSION

The bibliometric analysis presented herein offers a synoptic view of prevailing trends in IMT

within the multicultural mathematics classrooms. The findings indicate a developing body scholarship on this topic, accompanied by a discernable emphasis on the significance of cultural relevance, language development, and pedagogical strategies. The analysis further underscores the interdisciplinary character of this field, drawing contributions from diverse disciplines such as education, linguistics, mathematics, and cultural studies. Nevertheless, certain limitations warrant acknowledgement. Firstly, the bibliometric analysis is predicated on a specific dataset of publications indexed in the WoS, which may not encompass the entirety of pertinent research within this domain. Secondly, the study primarily emphasizes quantitative data and may not fully capture the qualitative dimensions of research on IMT. Finally, the analysis is constrained by the temporal boundaries of the dataset, which may not reflect the totality of developments in the field.

Future research on IMT within multicultural mathematics classrooms could address these limitations by magnifying the capacity of the analysis to incorporate additional databases and methodologies. Quantitative inquiry approaches, such as case studies and interviews, could be used to complement the quantitative analysis and stipulate a profounder understanding of the implementation and influence of IMT in diverse classrooms. Additionally, future studies could focus on specific subtopics within the field, such as the role of technology in IMT, the challenges and opportunities faced by teachers implementing IMT, or the long-term outcomes of IMT for learners. One may also consider the examples of research questions extracted from the cluster of term co-occurrence. By concentrating these expanses, forthcoming investigation can supply to a more far-reaching and nuanced understanding of IMT within multicultural mathematics classrooms.

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