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Dichotomies of Mathematics Classroom Discourses in Higher Education: A Systematic Review

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Abstract: *Mathematics education in higher education institutions shapes students' understanding and problem-solving skills through classroom discourse which is pivotal for knowledge construction and sharing. This study explored and reviewed the various dichotomies of mathematics classroom discourses in higher education. This investigation utilized a systematic review method to synthesize existing literature concerning the aforementioned dichotomies on classroom discourses in Mathematics Education. Results showed five (5) emerging dichotomies in mathematics classroom discourses in higher education, namely; (1) Traditional vs. Non-Traditional Approaches; (2) Teacher-Centered vs. Student-Centered Instruction; (3) Disciplinary Identity vs. Interdisciplinary Perspectives; (4) Language and Discourse Practices; and (5) Enablers and Obstacles in Teaching and Learning Mathematics. In higher education mathematics classrooms, embracing non-traditional, student-centered approaches with interdisciplinary perspectives and inclusive discourse can enhance student engagement, critical thinking, and problem-solving skills. Educators may prioritize fostering peer collaboration, active participation, and effective communication to create inclusive learning environments that support diverse language practices and promote meaningful mathematical discussions, ultimately improving students' overall learning experiences in mathematics education.*

Keywords— Dichotomies; Mathematics Classroom Discourses; Higher Education; Systematic review

1. INTRODUCTION

Mathematics education in higher education institutions plays a pivotal role in shaping students' understanding of mathematical concepts and problem-solving skills (Căprioară, 2015). The discourse within mathematics classrooms is a critical aspect that influences how knowledge is constructed and shared among students and instructors (Walshaw & Anthony, 2008). This systematic review explores into the dichotomies of mathematics classroom discourses in higher education, aiming to explore the contrasting approaches, methodologies, and outcomes observed in these settings.

The dynamics of mathematics classroom discourses are multifaceted, and influenced by various factors such as teaching strategies, student engagement, assessment methods, and cultural backgrounds (Webb et al., 2017). Understanding the dichotomies within these discourses is essential for educators and policymakers to enhance teaching practices and promote inclusive learning environments (Jackson, Ryndak, & Wehmeyer, 2008). By systematically reviewing existing literature on this topic, this study seeks to provide a comprehensive analysis of the diverse discursive practices prevalent in mathematics classrooms at the higher education level.

One key aspect that this review addressed is the impact of traditional versus modern pedagogical approaches on mathematics classroom discourses. Traditional methods often emphasize rote memorization and procedural learning, while modern approaches focus on conceptual understanding, problem-solving skills, and collaborative learning (Voskoglou, 2019). By examining how these contrasting paradigms manifest in classroom interactions, this study shed light on the implications for student learning outcomes and overall academic performance.

Moreover, the review explored the role of technology in shaping mathematics classroom discourses. The integration of digital tools, online platforms, and interactive resources has revolutionized the way mathematics is taught and learned in higher education (Li & Ma, 2010). Analyzing how technology influences discourse patterns, student engagement, and knowledge dissemination will provide valuable insights into the evolving landscape of mathematics education in contemporary academic settings (Higgins et al., 2019).

This systematic review on the dichotomies of mathematics classroom discourses in higher education seeks to contribute to the existing body of knowledge by synthesizing research findings, identifying trends, gaps, and challenges, and offering recommendations for future research and educational practices. By critically examining the diverse discursive practices within mathematics classrooms, this study aims to inform educators, policymakers, and researchers on effective strategies to enhance teaching and learning experiences in higher education mathematics settings.

2. METHODS

A systematic review by Strech & Sofaer (2011) explored the dichotomies of mathematics classroom discourses in higher education from the existing literature. The study employed a designed search strategy utilizing electronic databases like Google Scholar and ResearchGate, along with relevant journals and books. Search terms included "Dichotomies of Mathematics Classroom Discourses in Higher Education" and "Mathematics Classroom Discourses

in Higher Education". Inclusion criteria focused on peer-reviewed English publications from the past decade, emphasizing the dichotomies of mathematics classroom discourses in higher education.

After an initial search yielding numerous articles, a screening process based on titles and abstracts identified thirty-nine articles for detailed review. This thorough examination revealed common themes and patterns, offering a comprehensive overview of the dichotomies of mathematics classroom discourses in higher education.

This systematic approach facilitated the integration of diverse literature, leading to a comprehensive grasp of the dichotomies of mathematics classroom discourses in higher education. Through the examination of specific articles, the research revealed valuable perspectives on the dichotomies of mathematics classroom discourses in higher education. The exploration of common themes aimed to provide significant insights for well-informed dialogues, upcoming studies, and strategic decisions concerning this aforementioned concern in mathematics education.

3. RESULTS AND DISCUSSION

Dichotomies of Mathematics Classroom Discourses in Higher Education

Traditional vs. Non-Traditional Approaches

The dichotomy between traditional and non-traditional approaches in mathematics education sparks discussions on the effectiveness of active student engagement and peer collaboration compared to passive learning methods (Baş & Kivilcim, 2021). Research suggests that non-traditional approaches, such as peer collaboration and mathematical discourse, can enhance student motivation, reduce anxiety toward learning mathematics, and promote a deeper understanding of mathematical concepts (Moliner & Alegre, 2020). By exploring the benefits of non-traditional methods, educators can adapt their teaching practices to create more engaging and effective learning environments for students in higher education (Luzano, 2020).

Teacher-Centered vs. Student-Centered Instruction

The debate between teacher-centered and student-centered instruction in mathematics classrooms raises questions about the impact of instructional approaches on students' mathematical thinking and sense-making abilities (Emanet & Kezer, 2021). While teacher-centered instruction may provide structure and guidance, student-centered approaches emphasize active participation and autonomy in learning. By analyzing the shift from teacher-centered to student-centered instruction, educators can evaluate how different teaching methods influence students' problem-solving skills, critical thinking abilities, and overall engagement with mathematics (Pakarinen & Kikas, 2019).

Disciplinary Identity vs. Interdisciplinary Perspectives

The dichotomy between disciplinary identity and interdisciplinary perspectives in mathematics education research highlights the balance between focusing on specific mathematical concepts and incorporating diverse interdisciplinary approaches (Williams et al., 2016). While maintaining a disciplinary identity is crucial for in-depth exploration of mathematical topics, integrating interdisciplinary perspectives can enrich teaching practices and foster connections between mathematics and other disciplines (Tytler et al., 2021). By exploring both aspects, educators can leverage disciplinary expertise while embracing interdisciplinary collaborations to enhance the relevance and applicability of mathematical concepts in higher education (Luzano & Ubalde, 2023).

Language and Discourse Practices

Discussions on language and discourse practices in mathematics classrooms emphasize the importance of creating inclusive learning environments that support diverse language practices, promote mathematical communication, and develop critical thinking skills (Erath et al., 2018). By fostering a culture of discourse where students feel comfortable expressing their mathematical ideas and reasoning processes, educators can enhance students' ability to communicate effectively, collaborate with peers, and engage in meaningful mathematical discussions (Xu & Clarke, 2019). Addressing language barriers and promoting inclusive discourse practices can contribute to a more supportive and enriching learning experience for students in higher education.

Enablers and Obstacles in Teaching and Learning Mathematics

Exploring enablers and obstacles in teaching and learning mathematics involves identifying factors such as student motivation, negative attitudes toward mathematics, teacher experience, class size, and family influences that impact students' learning outcomes (Caballero, Blanco, & Guerrero, 2011). By investigating strategies to address obstacles like negative attitudes towards mathematics through innovative instructional methods, peer collaboration, and personalized support, educators can enhance students' engagement with mathematics and improve their overall learning experiences in higher education (Townsend & Wilton, 2003). Understanding the interplay between enablers and obstacles can guide educators in creating effective interventions to support student success in mathematics education (Luzano, 2023).

4. CONCLUSION AND RECOMMENDATION

In conclusion, the dichotomies present in mathematics classroom discourses in higher education underscore the ongoing debate between traditional and non-traditional approaches, teacher-centered versus student-centered instruction, disciplinary identity versus interdisciplinary perspectives, as well as language and discourse practices. These discussions highlight the importance of adapting

teaching practices to foster student engagement, critical thinking, and interdisciplinary connections while addressing language barriers and promoting inclusive discourse. By exploring these dichotomies, educators can enhance the effectiveness of mathematics education in higher learning environments.

To enhance mathematics education in higher education, educators should adopt non-traditional methods promoting peer collaboration and mathematical discourse. Student-centered instruction fosters active learning, problem-solving, and critical thinking. Integrating interdisciplinary perspectives enriches teaching practices and the relevance of mathematical concepts. Inclusive environments supporting diverse language practices and effective communication enhance meaningful mathematical discussions. Overcoming obstacles like negative attitudes through innovative methods and personalized support improves students' overall learning experiences in mathematics education.

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