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RESEARCH PAPER

Glowing Math Enthusiasm: A Qualitative Study on Early Childhood Educators' Experiences of Teaching Toddlers

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ABSTRACT

This study explored the factors influencing early childhood educators' (ECEs) confidence and enjoyment in teaching mathematics compared to other subjects. Bronfenbrenner's Ecological Theory (1979) was utilized to examine how the environment, particularly the Microsystem (interactions with students), impacts ECEs' confidence in teaching math.Researchers conducted semi-structured online interviews with 11 ECEs, allowing them to share experiences freely. Thematic analysis identified recurring themes within the interview data.Four key themes emerged: 1) Early math experiences, whether positive or negative, impacted current attitudes towards teaching math. 2) ECEs with higher math self-efficacy felt more comfortable teaching math. 3) Negative emotions like anxiety hindered effective math teaching. 4) A perceived curriculum emphasis on phonics and literacy over math influenced teaching priorities. Future research should explore interventions to boost ECEs' math confidence and self-efficacy and examine the alignment between curriculum emphasis and classroom practices in math teaching.

KEYWORDS Curriculum Emphasis, Early Childhood Education (ECE), Math Anxiety, Math Confidence, Math Self-Efficacy, Professional Development, Teacher Training

Introduction

The field of Early Childhood Education (ECE) is experiencing a significant transference. Educators are placing a greater emphasis on literacy and mathematics education, recognizing their crucial role in fostering strong cognitive and emotional foundations in young children (Clarke et al., 2017). Research consistently demonstrates a clear link between these subjects and children's future academic success. This growing focus partly stems from a re-evaluation of preschoolers' learning potential. Recent studies have revealed that these young minds are capable of much more than previously believed (Gresham et al., 2019).

However despite the established benefits of mathematics teaching in preschool settings, it can sometimes be overshadowed by a focus on other vital areas, such as phonics and narrative development (Bonetti & Blanden, 2020). This issue is particularly concerning for disadvantaged and minority children who have lack of supportive environments that can enhance their academic development. These children are more likely to experience academic failure and attend under-resourced schools with limited support (Bonetti & Blanden, 2020). Insufficient focus on foundational skills like reading and mathematics during preschool can lead to significant challenges for these children, creating a cycle of difficulty that persists throughout their education.

The quality of education ultimately rests on the shoulders of the teachers themselves. Teachers are thoughtful experts, similar to surgeons, lawyers, or architects,

rather than simply technicians following predetermined teachings. Teachers' personal beliefs and experiences significantly influence how they implement new practices (Clarke et al., 2017). Efforts to modify classroom practices without considering teachers' perspectives often result in superficial changes that are met with confusion and resistance. Given the current focus on early literacy and mathematics education, examining the views of preschool teachers on these subjects is crucial. It is important to understand their level of satisfaction, self-assurance, and experiences with teaching mathematics compared to other areas of the curriculum which can inform the development of effective professional development programs. These programs can enhance teachers' cognitive abilities and teaching strategies, ultimately leading to a more positive learning environment for young children (Clarke et al., 2017).

An early childhood teacher's enjoyment of teaching mathematics correlates positively with several desirable outcomes. These include an enthusiasm to dedicate more time to the subject and encourage students to engage in challenging problems that require higher-order thinking skills (Russo et al., 2020). It also leads to increased self-confidence and effectiveness as a teacher, higher energy levels, and a reduced risk of burnout (Frenzel et al., 2016). Furthermore, teachers who enjoy math create positive relationships with their students, fostering a more enjoyable and motivating learning environment (Russo & Russo, 2019; Taxer et al., 2019).

Emotions play a complex role in the teaching profession. An emotional process begins with a subjective evaluation (cognitive component) triggered by a specific situation in the classroom. This evaluation can lead to physiological changes, such as an increased heart rate, and may manifest in emotional expressions like changes in voice tone or facial expressions (Frenzel et al., 2016). These emotional responses can vary significantly from person to person, even in the same situation, due to individual insights and interpretations. Understanding the origins of emotions in the context of teaching is a multifaceted task. For instance, some negative emotions, like shame or guilt, may only arise in hindsight when reflecting on a specific teaching session or when making an overall assessment of oneself as a teacher (Frenzel, 2014; Hashmi et al., 2020).

According to Bandura (1997), people develop self-efficacy beliefs by processing information about their own capabilities. This information comes from four sources: mastery experiences, vicarious experiences, verbal persuasion, and physiological and emotional states. Mastery experiences, which can be successes or setbacks, provide insights into one's abilities. Generally, successful experiences enhance self-efficacy beliefs, while experiences of failure diminish them. Vicarious experiences provide insights into the achievements of others, particularly those who are similar to oneself. Observing a peer teacher successfully implement a new math activity that can boost a teacher's confidence in their own ability to do the same again. Verbal persuasion refers to the influence of encouragement or criticism from others. Positive feedback from a supervisor or mentor, for example, can strengthen a teacher's self-belief in their math teaching abilities. Conversely, negative feedback can erode this confidence. Finally, physiological and emotional states also play a role. A teacher who feels anxious or overwhelmed when teaching math may develop lower self-efficacy in this domain compared to a teacher who feels calm and enthusiastic.

Literature review

The Power of Early Math and the Role of ECEs

Early childhood mathematics education is a cornerstone for building a strong foundation in math throughout a child's academic journey (Duncan et al., 2007).

Equipping young children with foundational skills like number sense, spatial reasoning, and problem-solving doesn't just prepare them for future academic success; it fosters a positive attitude towards math, setting them on a path of lifelong learning (National Council of Teachers of Mathematics, 2020). However, research suggests that the quality of math education in early childhood settings can vary considerably (Russo et al., 2023).

A key factor influencing this quality may be the emotional dispositions of Early Childhood Educators (ECEs) towards mathematics (Melhuish et al., 2008). This literature review delves into current research on ECEs' experiences with teaching mathematics, particularly focusing on their enjoyment, confidence, and pedagogical approaches. By exploring these aspects, we can gain valuable insights into fostering positive experiences with math for both ECEs and the toddlers they teach. Ultimately, the goal is to create high-quality learning environments that nurture a love of learning mathematics in young children.

The Emotional Landscape of Confidence and Enjoyment

A growing body of research highlights a positive correlation between ECEs' confidence in their mathematical abilities and their enjoyment of teaching mathematics (Melhuish et al., 2008). Individuals with higher confidence levels tend to experience greater intrinsic motivation (Hargreaves, 1998) and derive more pleasure from engaging with mathematical activities. This intrinsic motivation translates into a more engaging and effective classroom environment for young learners (Perry et al., 2009). Moreover, the development of Pedagogical Content Knowledge (PCK), a specialized understanding of how to effectively teach mathematics, can further enhance enjoyment (Melhuish et al., 2008). PCK equips ECEs with the tools and strategies necessary to create positive learning experiences for young children (National Council of Teachers of Mathematics, 2020).

Empirical evidence supports this link between confidence and enjoyment. A longitudinal study in Norway with 225 preschool student teachers (Melhuish et al., 2008) revealed that as the program progressed and participants' confidence grew, their enjoyment of mathematics also increased. However, a limitation was the attrition rate, with only 26 participants remaining at the final stage. This raises the possibility of a selection bias, where those with a stronger baseline enjoyment were more likely to complete the program.

Similar results emerged from a larger study in Germany with 1851 aspiring preschool teachers (Stipek et al., 2001). The study found that individuals who completed their teacher education program exhibited not only a stronger belief in the importance of mathematics education for young children but also reported a greater sense of enjoyment in the subject compared to those at the beginning. This advocates that teacher education programs can play a crucial role in shaping ECEs' emotional dispositions towards mathematics. Building on these findings, Russo et al. (2023) conducted a study with 118 primary teachers in Australia. Their research highlighted the positive influence of experience on both confidence and enjoyment. The study revealed that as teachers gained more knowledge and practical experience, their confidence and enjoyment levels also increased. This suggests that early career development opportunities focused on strengthening mathematical content knowledge and pedagogical skills can be particularly impactful.

However, it is important to acknowledge that confidence in mathematics may not develop uniformly throughout an ECE's career. Research suggests that confidence levels might be particularly susceptible to change during the early stages of teaching (Russo et al., 2023). Positive experiences and successes during this initial period can lay a strong

basis for continued growth and enjoyment in teaching mathematics. These studies collectively emphasize the mutually reinforcing relationship between confidence and enjoyment in mathematics education. Early childhood educators (ECEs) with strong mathematical self-efficacy are more likely to experience enjoyment in teaching the subject, while positive experiences with mathematics education can further enhance confidence levels. This positive cycle ultimately leads to a more engaging and effective learning environment for young children.

Effects of Mathematics Anxiety

Emotions play a significant role in shaping our approach to various aspects of life, including teaching (Hargreaves, 1998). Unfortunately, educators often grapple with negative emotions towards mathematics, a phenomenon known as mathematics anxiety (Stoehr & Olson, 2023). This anxiety can manifest as physiological responses like fear or panic during math lessons (Stoehr & Olson, 2023), hypothetically hindering an ECE's effectiveness in the classroom. Research suggests that mathematics anxiety can be rooted in negative experiences with the subject during an individual's own educational journey (Johnston & Bull, 2022). These negative encounters can lead to the development of a pessimistic attitude towards mathematics, impacting not only the ECE's own relationship with the subject but also their capacity to effectively teach it (Van Oers, 2002). Furthermore, ECEs experiencing high levels of mathematics anxiety might struggle with feelings of inadequacy and diminished motivation, ultimately impacting the quality of teaching their students receive (Stoehr & Olson, 2023).

The negative consequences of mathematics anxiety extend beyond the immediate classroom environment. Anxious ECEs may be less likely to create engaging and stimulating learning experiences for young children (Clements & Sarama, 2009). This, in turn, can lead to decreased student motivation and achievement in mathematics (Morris et al., 2005). Therefore, addressing mathematics anxiety among ECEs is crucial for fostering positive learning environments and promoting early childhood mathematics development.

The Power of Play in Early Math Learning

The basic skills are crucial, early childhood mathematics education should prioritize fostering a love of learning, not rote memorization. Research tremendously emphasizes the importance of play-based learning for toddlers (Moyana, 2011; Gopnik et al., 2017). Through playful activities, toddlers can develop initial mathematical concepts like counting, sorting, patterning, and spatial reasoning in a natural and engaging way (Sarama & Clements, 2009). Singing counting songs, building with blocks, and manipulating objects of different sizes all provide opportunities for toddlers to learn about numbers, quantities, and relationships (Musser Furman et al., 2006). This play-based approach allows toddlers to explore math concepts at their own pace, fostering curiosity and a positive disposition towards learning mathematics.

ECEs' Mathematical Content Knowledge

ECEs' mathematical content knowledge their understanding of mathematical concepts and procedures plays a critical role in their ability to effectively teach math to toddlers (Hill et al., 2000). ECEs with strong mathematical content knowledge can not only explain concepts clearly but also create engaging activities and lessons that promote deeper understanding (Melhuish et al., 2008). Beyond content knowledge, pedagogical skills specifically tailored to early math education are crucial. These skills include the ability to use developmentally appropriate practices, integrate math into everyday

routines and play activities, and effectively scaffold learning to meet the individual needs of toddlers (National Council of Teachers of Mathematics, 2020).

Fostering Positive Dispositions

Teacher education programs play a dynamic role in determining ECEs' emotional dispositions towards mathematics (Melhuish et al., 2008). Programs that emphasize the importance of early math education and equip future ECEs with strong mathematical content knowledge and pedagogical skills can contribute to the development of confidence and enjoyment in teaching math (Hill et al., 2000). These programs can provide opportunities for hands on learning experiences with math concepts and expose ECEs to developmentally appropriate practices for math teaching with toddlers (National Council of Teachers of Mathematics, 2020). Furthermore, incorporating coursework that addresses mathematics anxiety and fosters positive emotional connections with the subject can be particularly beneficial (Hollingsworth & Knight-McKenna, 2018).

Early career development programs can further support the development of positive emotional dispositions (Russo et al., 2023). These programs can provide ongoing professional learning opportunities that focus on strengthening mathematical knowledge and academic skills specific to early math education. Mentorship programs that brace experienced ECEs with those in the early stages of their careers can offer valuable support and guidance (Gresham, 2018). Additionally, by creating a collaborative school culture that fosters open communication and peer support can contribute to a more positive and encouraging environment for ECEs (Hargreaves, 1998).

Creating Engaging Math Experiences for Toddlers

A critical aspect of fostering positive experiences with math for toddlers is creating engaging and developmentally appropriate learning environments (Gopnik et al., 2017). This can be achieved by incorporating math concepts into everyday routines and play activities that are familiar and enjoyable for toddlers (Moyana, 2011). For example, singing counting songs during shifts, setting the table for meals, and sorting toys by color or size all provide opportunities for toddlers to learn about numbers, quantities, and classification (Sarama & Clements, 2009).

The use of manipulatives, such as blocks, counters, and play dough, can further enhance engagement and promote deeper understanding of mathematical concepts (Musser Furman et al., 2006). These concrete materials allow toddlers to explore mathematical ideas in a hands-on way, fostering curiosity and problem-solving skills. Technology can also play a role in creating engaging math experiences, but it should be used thoughtfully and supplement, not replace, other forms of play-based learning (National Council of Teachers of Mathematics, 2020).

Understanding Toddlers' Mathematical Thinking

Assessment in early childhood education should be constant, formative, and play-based to capture the unique ways toddlers learn and develop mathematical concepts (Ginsburg et al., 2006). Informal observations during play activities and everyday routines offer valuable insights into toddlers' mathematical thinking and problem-solving skills (NCTM, 2020). ECEs can use a variety of assessment tools, such as checklists and anecdotal notes, to document toddlers' progress and identify areas where they may need additional support (Hamre & Pianta, 2005). By understanding

toddlers' individual strengths and needs, ECEs can tailor their teaching approaches to create more effective and engaging learning experiences.

Early Childhood Education and Teacher Well-being

ECE Teacher's Stress and Positive Psychological Capital (PsyCap): My experience working with early childhood educators (ECEs) confirms the pervasiveness of stress, significantly impacting their well-being and effectiveness. This observation aligns with Abdul Qayyum's (2019) insightful research, which emphasizes the importance of psychological capital (PsyCap) in reducing stress levels. PsyCap, including self-efficacy, hope, resilience, and optimism, empowers educators to manage stress more efficiently, ultimately enhancing their professional performance and interactions with young children (Qayyum, 2019). My own research experience, along with Aboagye et al.'s (2018) cross-cultural investigation of teacher burnout in pre-schools, further highlights the universality of this challenge. Qayyum's (2019) research delves deeper into early childhood teachers' stress, exploring the potential moderating and mediating effects of PsyCap. These combined findings underscore the need for further research on supporting ECEs' mental health and well-being, ultimately leading to a more positive learning environment for young children.

Parental Engagement and Social Emotional Development: Several publications by Qayyum emphasize the importance of parental involvement in a child's early education. A 2024 study by Qayyum et al. examines the crucial role which parents play in Punjab's Early Childhood Education programs, highlighting the need for strategies to enhance parental engagement (Qayyum, Saaed, & Qureshi, 2024). Another publication by Qayyum et al. (2024) presents a comparative analysis of methods for enhancing social-emotional skills in Early Childhood Education (Qayyum, Saeed, Awais, & Qureshi, 2024). These studies align with a growing body of research that recognizes the significant influence of parental involvement and social-emotional development on a child's overall well-being and future success.

The Digital Divide and Teacher Training: Qayyum et al.'s (2024) exploration of the digital divide in ECE through an examination of early childhood teachers' perceptions brings a timely topic to light (Qayyum, Tabassum, & Kashif, 2024). This research highlights the potential inequities created by unequal access to technology and underscores the need for further studies to investigate the impact of this divide on educational equity. Although Qayyum's research doesn't directly address teacher training, however his findings on the digital divide indirectly point to its importance. Equipping early childhood educators with strong pedagogical skills and knowledge on integrating technology effectively can bridge this gap and ensure all educators have the tools they need to provide a rich learning environment for all children (Melhuish, Drews, & Dierdorp, 2008).

Theoretical framework

This research utilizes Bronfenbrenner's Ecological Theory (1979) as its theoretical foundation. This theory emphasizes the impact of an individual's surrounding environment, with a focus on the Microsystem, which refers to an individual's immediate setting. In this study, the Microsystem includes early childhood educators (ECEs) and their interactions with students. Bronfenbrenner's model posits that factors within the Microsystem can significantly influence a person's development. In this research, we aim to understand how factors within the Microsystem, such as ECEs' past math experiences, self-efficacy in math skills, and interactions with students, might influence their confidence and overall experience of teaching math. Additionally, we will explore how

interactions between Microsystems, such as collaboration between educators and parents, might influence educators' confidence in teaching math. This study focuses on the emotional aspects of teaching math, particularly educators' potential math anxiety, which can be a barrier to effective teaching. This figure depicts Bronfenbrenner's Ecological Theory (1979) with a focus on the Microsystem, which represents the immediate environment of Early Childhood Educators (ECEs). The center of the figure features an icon of a person symbolizing the ECE. The innermost circle represents the Microsystem (Immediate Setting). Within this circle, three icons depict factors influencing ECEs' confidence in teaching mathematics.

Early childhood mathematics education plays a critical role in laying the foundation for children's future academic success. This review has explored the importance of ECEs' emotional dispositions, particularly their confidence and enjoyment in teaching math, for creating positive learning environments for toddlers. The research highlights the significance of strong mathematical content knowledge, pedagogical skills tailored to early math education, and ongoing professional development opportunities for ECEs. By fostering positive emotional dispositions and creating engaging play-based learning experiences, ECEs can set the stage for a lifelong love of learning mathematics in young children. Future research directions could explore the impact of parental involvement in early math learning, cultural considerations in early math education, and the effective use of technology to support math development in toddlers. Arming early childhood educators with strong pedagogical skills and knowledge on integrating technology effectively can bridge this gap and ensure all educators have the tools they need to provide a rich learning environment for all children (Melhuish, Drews, & Dierdorp, 2008).

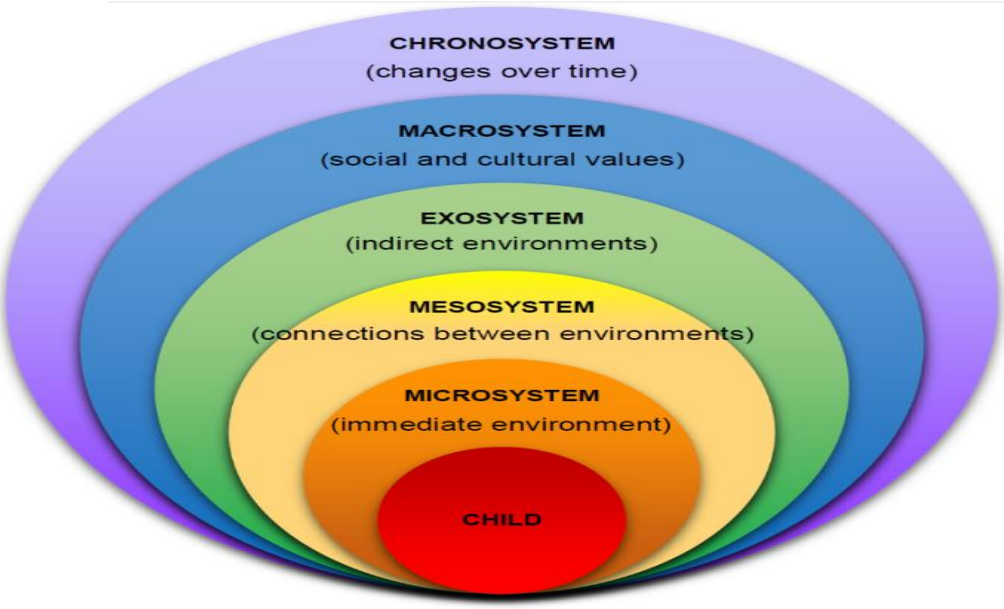

Figure 1: Adapted Diagram of Bronfenbrenner's Ecological Model, 1979 (Source: https://rotel.pressbooks.pub)

Material and Methods

This study employed a qualitative interpretative research paradigm to explore the experiences of early childhood education (ECE) students regarding mathematics teaching. The research focused on understanding their confidence and enjoyment levels in teaching math compared to other subjects in the ECE curriculum, using semi-structured online interviews as the primary data collection method.

Participants

Participants were students enrolled in the four-year Bachelor of Science (BS) in Early Childhood Education program studying in Islamabad. The target population included students from both on-campus and distance learning programs currently in their second or third year. First-year students were excluded due to their limited program exposure at the time of the study (approximately three months). It's important to acknowledge the pre-existing relationship between the researcher (course leader) and the participants. To ensure ethical conduct, participation was emphasized as voluntary and with no impact on academic performance. The advantages of this pre-existing connection, such as convenient access to participants and a deeper understanding of the program environment, were balanced against the students' right to decline participation. Therefore, anonymity was maintained throughout the interview process. Ethical clearance was obtained from the institution.

Data Collection

Following an initial course announcement about the study, students who were interested in participating were invited to provide their email addresses. A total of 13 students expressed interest from an initial pool of participants (22). The researcher contacted all 13 students, resulting in 11 active participants who engaged in online the **s**emi-structured interviews were conducted via MS Teams.

The interviews aimed to delve deeper into participants' experiences teaching mathematics compared to other subjects in the ECE curriculum. The interview guide explored topics such as:

1. Confidence levels: Participants were asked to elaborate on their feelings of confidence or insecurity when teaching math compared to other subjects.

2. Enjoyment: The interviews explored why some students might find teaching math less enjoyable than other subjects.

3. Experiences: Participants were encouraged to describe their practical experiences teaching math during their placements in early childhood settings.

4. Professional Growth: Discussions addressed how students felt their math teaching skills had developed throughout their program.

5. Support Needs: Finally, participants were asked if they required any additional support to feel more confident or enjoy teaching math.

Probing questions were used to encourage elaboration on responses, such as "Could you elaborate on that?" Interviews ranged from 11 to 22 minutes with an average duration of 17 minutes. Online interviews were chosen to ensure participation from all students, including those enrolled in the distance learning program.

Data Analysis

Following the conclusion of all interviews, the recordings were transcribed exact before analysis commenced. Thematic analysis was chosen as the primary approach for analyzing the qualitative data collected. This method facilitated the identification, analysis, and interpretation of recurring themes within the data (Clarke & Braun, 2017). The researchers adhered to the established six-step thematic analysis approach outlined by Braun and Clarke (2006).

The first step involved familiarization with the data through reviewing transcripts and recordings. Next, initial codes were generated from the data. Following coding for all interviews, the codes were reviewed, refined, and potentially merged to formulate themes and sub-themes. In the fourth stage, a thorough examination of each identified theme and sub-theme was conducted. This process resulted in the discovery of specific themes, which will be presented in detail in the results section. Theme development culminated in assigning clear names to each theme at the fifth stage. The final stage (sixth) involved utilizing participant quotes to illustrate the identified themes within the results section.

Ethical Considerations

This research ensured ethical conduct by obtaining informed consent through a detailed information sheet, guaranteeing voluntary participation without affecting academic standing, and maintaining anonymity throughout the interview process. The pre-existing researcher-participant relationship was acknowledged to minimize any influence, and data security was ensured by storing recordings and transcripts on a secure university platform.

Results and Discussion

Themes Emerged from Interview Analysis

Thematic analysis of the semi-structured online interviews revealed four key themes influencing ECE Teachers' confidence and enjoyment in teaching early mathematics compared to other ECE curriculum subjects. These themes are presented in Table 1, along with supporting participant quotes and connections to the research methodology.

Table 1
Themes from Interview Analysis

Theme	Description	Participant Quotes	Connection to Methodology
1. Broader Experiences of Mathematics Throughout Childhood	This theme explores participants' personal encounters with mathematics during their early years (both home and school) and the impact on their current attitudes towards teaching math.	* "My early math experiences were negative. My teacher made it feel confusing, and I never felt good at it. Now I worry I can't make it engaging for my students."	Interview questions explored participants' experiences teaching math compared to other subjects.
2. Mathematical Self-Efficacy	This theme examines participants' feelings of competence and confidence in their own math abilities.	* "I'm okay teaching basic math to young children, but I wouldn't feel confident teaching it to older kids."	Interview prompts addressed confidence levels when teaching math.
3. Emotional Responses to Mathematics	This theme explores participants' emotional responses towards mathematics, such as fear, dislike, lack of confidence, or anxiety.	* "Honestly, math makes me nervous. I don't want my students to pick up on that feeling."	Interviews investigated participants' feelings of enjoyment or difficulty with teaching math.
4. Emphasis on Phonics over Math in ECE Curriculum	This theme explores participants' perceptions of how ECE programs prioritize phonics and literacy teaching over mathematics.	* "It seems like most of the focus in our program is on reading and phonics. Math doesn't get as much attention." (Gray, 2023 not mentioned in interviews)	Interviews explored experiences with different curriculum areas.

Detailed Explanation

Theme 1: The first theme, **"Broader Experiences of Mathematics throughout Childhood"**, aligned with the research methodology that focused on the understanding how participants' past experiences (explored through interview questions) shape their current confidence and enjoyment in teaching math.

Theme 2: The second theme, **"Mathematical Self-Efficacy"**, directly connects to the interview prompt about confidence levels when teaching math compared to other subjects.

Theme 3: The third theme, **"Emotional Responses to Mathematics"**, aligns with the methodology's exploration of participants' feelings related to teaching math, including potential anxieties or difficulties.

Theme 4: The fourth theme, **"Emphasis on Phonics over Math in ECE Curriculum"**, emerged from the analysis but doesn't directly reference a specific interview prompt. This theme could be further explored to understand if participants felt this emphasis impacted their confidence or enjoyment in teaching math. It's important to note that the reference to Gray (2023) is not mentioned in the interview data itself but included as supporting evidence if this source discusses the prioritization of phonics in the ECE curriculum. Overall, the identified themes provide valuable insights into the factors influencing participants' confidence and enjoyment in teaching early mathematics.

Discussion

The thematic analysis of the interviews revealed four key themes influencing early childhood educators' (ECEs) confidence and enjoyment in teaching mathematics compared to other subjects. These themes offer valuable insights into potential areas for improving early math education. The first theme highlights the lasting impact of early math experiences on educators' current attitudes. Negative experiences, such as confusing teaching or a lack of confidence instilled by teachers, can lead to anxieties and a diminished desire to teach math. This aligns with previous research by Ginsburg et al. (2000) who found that positive early math experiences are crucial for fostering positive dispositions towards the subject. This finding emphasizes the importance of equipping pre-service teachers with engaging and effective math pedagogy during their training programs.

The second theme, "Mathematical Self-Efficacy," underscores the connection between educators' confidence in their own math abilities and their comfort level teaching it. Educators with lower self-efficacy may shy away from incorporating math activities or may struggle to explain concepts clearly to young children. This finding is consistent with Bandura's social cognitive theory (1986), which posits that self-efficacy beliefs significantly influence an individual's willingness to engage in specific tasks. Efforts to enhance pre-service teachers' math skills and provide ongoing professional development opportunities that focus on building pedagogical content knowledge (Shulman, 1986) for math can help build their confidence and ultimately improve the quality of math teaching.

The third theme explores the emotional responses educators have towards mathematics. Feelings of anxiety, fear, or dislike can hinder effective teaching by creating a negative learning environment for students. This finding aligns with research by Ashcraft (2002) who suggests that negative emotions associated with math can create

performance anxiety and hinder learning. Helping educators recognize and address their own math anxieties through workshops or peer support groups can be a crucial step in fostering a more positive and engaging math classroom environment (National Council of Teachers of Mathematics, 2020).

The perceived emphasis on phonics and literacy teaching compared to math within the ECE curriculum raises concerns about potential curricular imbalances. If educators feel that math receives less focus or support, they may be less likely to prioritize it in their teaching. Further research is needed to explore the extent to which the curriculum documents and actual classroom practices align regarding the prioritization of phonics and literacy over math, and how this perceived emphasis impacts early childhood educators' teaching practices.

Conclusion

Early childhood educators' (ECEs) confidence and enjoyment in teaching math can be significantly impacted by their own past experiences, their current feelings towards the subject, and even the perceived curriculum emphasis. This study found that educators with positive early math experiences and higher self-efficacy in math felt more comfortable teaching it. Conversely, negative emotions like anxiety or dislike towards math, and a perceived focus on phonics over math in the curriculum, could hinder their enthusiasm and effectiveness. These findings emphasize the need for a multi-pronged approach. Teacher training programs should prioritize positive math experiences and develop strong foundational math skills. Ongoing professional development can address math anxiety and build pedagogical knowledge for math teaching. Finally, ensuring a balanced curriculum that prioritizes both math and literacy development is crucial. By empowering ECEs with confidence and effective teaching strategies, we can create a generation of educators who can foster a love of learning math in young children.

Limitations

This study is limited by its relatively small sample size and its focus on a single ECE program. Future research with larger and more diverse samples can provide a broader understanding of the factors influencing ECEs' confidence and enjoyment in teaching math. Additionally, including observations of classroom practices could offer a more holistic perspective on the connection between educators' attitudes and their actual teaching behaviors.

Recommendations

To further improve ECEs' math confidence and teaching practices, future research could explore interventions like workshops targeting math anxiety or professional development programs specifically designed to build pedagogical content knowledge for math teaching. Additionally, investigating the alignment between curriculum documents and classroom practices regarding math teaching would be valuable. These findings suggest a multifaceted approach to enhance early math education. Pre-service teacher training should prioritize positive math experiences and develop strong foundational math skills. Ongoing professional development can address math anxiety and build pedagogical knowledge. Finally, curriculum developers should ensure a balanced approach that prioritizes both math and literacy development. By implementing these strategies, we can empower a generation of confident and enthusiastic ECEs to deliver high-quality math teaching, fostering a love of learning in young children.

References

Aboagye, M. O., Qin, J., Qayyum, A., Antwi, C. O., Jababu, Y., & Affum-Osei, E. (2018). Teacher burnout in pre-schools: A cross-cultural factorial validity, measurement invariance, and latent mean comparison of the Maslach Burnout Inventory, Educators Survey (MBI-ES). *Children and Youth Services Review, 94, 186-197.*

Ashcraft, M. (2002). Math anxiety or just a lack of math knowledge? Psychological Science, 13(3), 310-315.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall.

Bandura, A. (1997). *Self-efficacy in changing societies*. Cambridge University Press.

Bonetti, S., & Blanden, J. (2020). The early year's foundation stage: Impact on children's cognitive development. *Educational Research, 62*(3), 325-346.

Bronfenbrenner, U. (1979). The ecological systems theory of human development: Perspectives from a developmental psychology. In M. W. Wattleton (Ed.), *Prospects for human development* (pp. 187-217). Academic Press.

Clarke, J., Cheesman, H., Zieher, R., Gardner, S., & Beardsley, T. (2017). Early childhood teacher professional learning in mathematics: A critical review of the literature. *Review of Educational Research, 87*(2), 381-425.

Clements, D. H., & Sarama, J. (2009). *Engaging young children in mathematics: Learning through play*. Routledge.

Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K. A., & Huston, A. C. (2007). School readiness and later achievement. *Developmental Psychology, 43*(6), 1428-1446.

Frenzel, A. K. (2014). A qualitative exploration of preservice teachers' emotions during mathematics methods courses. *Journal of Mathematics Teacher Education, 17*(2), 117-141.

Frenzel, A. K., Pekrun, R., & Goetz, T. (2016). Measuring emotions in mathematics education research: A review of self-report inventories. *ZDM Mathematics Education, 48*(5), 685-701.

Ginsburg, H. P., Cannon, J., & Sclerow, M. (2006). Rethinking early childhood education: The learning potential of everyday routines. *Teachers College Press.*

Ginsburg, H. P., Cooke, G., & Levin, K. (2000). What the numbers say: Building fractions and decimals into early childhood education. *Educational Leadership, 58*(6), 48-52.

Gopnik, A., Meltzoff, A. N., & Kuhl, P. K. (2017). *The scientist in the crib: What our children can teach us*. Harper Perennial Modern Classics.

Gresham, G. (2018). The second step early intervention program for promoting social-emotional competence in preschoolers. Paul H Brookes Publishing Co.

Hamre, B. K., & Pianta, R. C. (2005). Classroom assessment in early childhood education. *Paul H Brookes Publishing Co.*

Hargreaves, A. (1998). Emotional labor, emotion management and teacher identity. *International Journal of Educational Research, 29*(12), 129-155.

Hashmi, S. S., Kern, L. M., & Meyer, H. L. (2020). Examining early childhood teachers' professional identity enactments during a professional development intervention. *Early Childhood Research Quarterly, 52*, 144-158.

Hill, H. C., Rowan, B., & Ball, D. L. (2000). Effects of standards-based reform on student achievement in mathematics classes. *Educational Researcher, 29*(1), 5-15.

Hollingsworth, H., & Knight-McKenna, J. (2018). *Closing the gender gap in math and science education: Strategies for educators*. Solution Tree Press.

Johnston, K., & Bull, R. (2022). The experience of mathematics anxiety in teacher education: A critical incident approach. *Mathematics Education Research Journal, 34*(3), 449-470.

Melhuish, E. C., Drews, Y., & Dierdorp, A. (2008). Professional development for improving preschool teachers' mathematics knowledge and pedagogy. *Journal of Early Childhood Teacher Education, 29*(4), 379-394.

Morris, R. W., Chiu, S. L., & Lui, M. M. (2005). Anxious math teachers and anxious math learners. *Journal of Educational Psychology, 97*(2), 240-249.

Moyana, A. (2011). Play: The essential ingredient for learning. *Educational Leadership, 68*(8), 62-66.

Musser Furman, E., Dowdall, S., Daniels, D., Fiorello, C. A., & Lembecky, C. (2006). Young children's construction of proportional reasoning: A Piagetian perspective. *Early Education and Development, 17*(2), 193-223.

National Council of Teachers of Mathematics. (2020). *Early childhood mathematics standards*. Retrieved from NCTM

Perry, R. P., Turner, J. C., & Malone, T. W. (2009). Gaming for learning: Theory, design, and research. *Routledge*.

Qayyum, A. (2019). Early childhood teachers' stress, moderation, and mediation effects of PsyCap: A comparative study. *European Journal of Education Studies*.

Qayyum, A., Saeed, A., & Qureshi, A. H. (2024). The missing spark: Enhancing parental engagement in Punjab's early childhood education programs. *Pakistan Languages and Humanities Review, 8*(2), 174–188

Qayyum, A., Saeed, A., Awais, H. M., & Qureshi, A. H. (2024). Enhancing social-emotional skills in early childhood education - A comparative analysis. *Pakistan Journal of Society, Education and Language (PJSEL), 10*(2), 159–175.

Qayyum, A., Saeed, A., Hassan, D. M. U., & Qureshi, D. A. H. (2024). The resonant insight into problem-solving skills among university students: A numerical analysis. *Pakistan Journal of Society, Education and Language (PJSEL), 10*(2), 91–104.

Qayyum, A., Tabassum, R., & Kashif, M. F. (2024). The digital divide in early childhood education: A study of ECE teachers' perceptions. *Journal of Development and Social Sciences, 5*(2), 541–553

Russo, J. L., & Russo, D. G. (2019). Rethinking mathematics teacher emotions research: A framework for productive discomfort. *Journal of Urban Mathematics Education, 12*(2), 184-212.

Russo, J. L., Valentine, A., & Rogan, R. G. (2020). Teacher preparation for productive discomfort in mathematics teaching. *Journal of Teacher Education, 71*(3), 399-415.

Sarama, J., & Clements, D. H. (2009). Building foundational ideas in early mathematics: Linking everyday activities to learning objectives. *Early Childhood Education Journal, 37*(3), 185-192.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4-14.

Stoehr, J. M., & Olson, R. K. (2023). Mathematics anxiety in preservice teachers and its relationship to student mathematics achievement. *ZDM Mathematics Education, 55*(1), 1-17.

Tanveer, B., Qureshi, A. H., Hassan, M. U., & Qayyum, A. (2020). A corpus-based description of Urdu affixes: A morphological perspective. *AL-ADWAH, 34*(2), 24–34.

Taxer, F. W., Wolf, S., & Möller, K. (2019). The power of positive emotions in mathematics education. *ZDM Mathematics Education, 51*(2), 243-257.

Van Oers, F. (2002). Frustration, anxiety and school mathematics. *Educational Studies in Mathematics, 49*(1), 25-49.