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Mathematics teaching efficacy belief of preschool teachers of Hawassa city in Ethiopia

Tewodros Bekele* , Addis Ababa University and Hawassa College of Teachers Education, Ethiopia

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Abstract

The ability of a teacher to plan and carry out the required actions to achieve desired results is known as teacher effectiveness. Although views and subject matter expertise, particularly when teaching mathematics, are key determinants in teachers' ability to teach pupils effectively. This study uses the Mathematics Teaching Efficacy Belief Instrument (MTEBI), adapted and translated into Ethiopian Amharic, to ascertain preschool teachers' efficacy views towards early math teaching in Hawassa City. Participants in the research were teachers who work in both public and private preschools in Hawassa City. Forty-four preschool teachers participated in the data collection. The results showed that there is a low belief in the efficacy of teaching early math, and the majority of participants were unsure or uncertain about teaching early math effectively. There was no significant difference among KG teachers' efficacy beliefs on teaching beforehand early math in their time of experience. Also, there was a significant difference between private and public preschool teachers' efficacy beliefs in teaching early math.

Keywords: belief; efficacy; kindergarten teacher; math; teaching

* ADDRESS FOR CORRESPONDENCE: Tewodros Bekele , Addis Ababa University and Hawassa College of Teachers Education, Ethiopia
E-mail address: teddybekeletessema@gmail.com

1. INTRODUCTION

Numerous studies on early childhood education have shown that preschool curricula heavily emphasize supporting young children's mathematical development (Ginsburg et al., 2006). According to recent studies, teacher views influence how curricula are implemented. Teachers' beliefs have a bearing on how curricula are implemented (Copley and Padron, 1998).

Early childhood programs must employ mathematical teaching techniques that are taught in classrooms. The emphasis placed on early mathematics education by the policy is largely the result of the realization that mathematical ability is essential for participation in the modern world and that young children's mathematical aptitude lays the foundation for later learning (Baroody et al., 2014; Ducan et al., 2007; Tuanaya, 2024). Lowered math acquiring new skills as well as worse overall educational attainment may result from the absence of formative experiences to assist mathematical development abilities (Geary, 2000; Jordan et al., 2009). According to research, the way early childhood teachers are trained in the subject of mathematics has been changed; curricula that enhance young children's mathematical development are advised in publications from the National Council of Teachers of Mathematics (NCTM), the National Association for the Education of Young Children (NAEYC), and the National Research Council.

The lack of effective teacher preparation in early mathematics (Baroody, 2004; Sarama and Clements, 2009) and the influence of beliefs on the implementation of mathematics instruction in the early childhood classroom (Copley and Padron, 1998), both of which are major issues facing the early childhood education field regarding the support of math development in the instruction of early childhood, are highlighted by research. The Mathematical Development Belief Survey (MDBS), a tool for measuring attitudes that are recognized to impact how mathematics is taught in early childhood classrooms, was created. The MDBS assesses attitudes on the relevance and age appropriateness of supporting mathematical development in the preschool classroom. Additionally, it gauges teachers' confidence in delivering pertinent instruction as well as their views on where math knowledge is generated (with the student, the teacher, or both). These particular attitudes, according to different researchers, affect how teachers conduct lessons in classrooms (Copley, 2004; Haser et al., 2024).

Although previous studies on teacher beliefs have given us useful information, the main goal of these studies was not to validate multiple dimensions of beliefs known to influence classroom teaching practices (LeFevre et al., 2009; Kowalski et al., 2001). This study's contribution to the field is a survey instrument that evaluates early childhood educators' opinions about math instruction in preschool classes.

Beliefs operate as a filter for teachers' teaching experiences and behaviors and since they are invisible and might not be explicitly understood by the person who holds them, they are difficult to quantify (Hofer, 2001). Giving someone statements from which ideas may be deduced and giving them the chance to indicate their level of agreement or disagreement is one technique to understand that person's beliefs (Pajares, 1992). For instance, if a teacher firmly believes that children learn mathematics best through didactic instruction at the chalkboard, it can be assumed that they strongly believe that teachers are largely responsible for the development of students' mathematical knowledge in the classroom.

Beliefs have a direct impact on teachers' classroom activities, including the use of the curriculum and pedagogical adjustments (Fang, 1996; Kagan, 1992). An effective professional development program, intervention, or pre-service course may need teachers to "buy into" the program. It takes more than merely introducing a new curriculum to teachers to increase teacher support for kids' mathematical growth (Klein et al., 2011).

1.1. Literature review

According to Bandura's (1977) social cognition theory, self-efficacy refers to a person's perceptions of their ability to cope, adapt, and achieve goals. This belief system determines attitudes, and it is dynamic in that it may progressively change as a result of learning from experiences in various contexts or circumstances, leading to a cooperative relationship Philippou and Christou, (2002). According to Tschannen-Moran et al., (1998), teacher efficacy refers to a teacher's perceptions and beliefs about his or her capacity to instruct and produce anticipated results in students' academic progress. According to Gordon (2001), a teacher's effectiveness affects the learning environment in the classroom, how pupils are taught (Henson, 2001; Liu et al., 2023), and the learning strategies and interests used in mathematics instruction (Philippou and Christou, 2002). Additionally, studies have recognized the significance of the performance and motivation of students (Norton, 2017).

The effectiveness of a teacher has an impact on how well students do (Bandura, 1986). Teacher noticing and monitoring of students' assimilation and progress level shows the effectiveness of a teacher (Wei et al., 2023; Weyers et al., 2023). Effective mathematics teachers will carefully plan their lessons and activities, be open to new ideas, give clear instructions, be eager to encourage students to pursue mathematics, and exhibit a high level of commitment (Cevikbas et al., 2024; Deniz & Koç, 2020 Hoy and Spero, 2005). As opposed to that a math teacher with low self-efficacy would not possess the necessary skills for the teaching profession. A math teacher who thinks of themselves as "I can't, or I am not good at teaching" may grow to despise math instruction and steer clear of challenging subjects. However, by using the microteaching paradigm and gaining practical experience, a teacher's self-efficacy can be raised (Bandura, 1981).

The teacher efficacy model, created by Enochs et al., (2000) as a result of Bandura's social learning theory, is conceptualized in the current study. The 24 questions from the Mathematics Teaching Efficacy Belief Instrument (MTEBI) that were modified for this sample measure the sample's teachers' self-efficacy and result expectations about teaching mathematics. The Science Teaching Efficacy Belief Tool (STEBI-B) (Enochs and Riggs, 1990) is where MTEBI got its start. The Mathematics Teaching Outcome Expectation Scale measures outcome expectation whereas the Personal Mathematics Teaching Efficacy Belief Scale measures self-efficacy. The following table 1 displays the number of items and item descriptions for the two constructs used in the MTEBI questionnaire. It is investigated that gender, length of service, level of education achieved, and site of employment were among the often-studied variables affecting pre-service teachers' self-efficacy.

The current study, which attempted to investigate preschool teachers' efficacy beliefs in early math teaching who are teaching in Hawassa city, was motivated by the paucity of literature on teachers' efficacy beliefs in early math teaching from preschools as of the present time. The article intends to look at preschool teachers' perceptions of how effective they are at teaching early math. The results of this study will also show how crucial experience levels and place of work are when teaching math to young children.

1.2. Purpose of the study

This paper tries to present some research on teachers' effectiveness perceptions in math instruction. In particular, the following research questions serve as the direction for this paper:

1. How do teachers measure their level of efficacy in math, their outcome expectancy, and their overall math teaching efficacy?
2. Are there any significant differences in the mean score for teachers' efficacy based on the type of institution they are teaching?

3. Are there any significant differences in the mean score for teachers' efficacy based on years of teaching experience?

2. METHODS AND MATERIALS

2.1. Research design

The survey research technique was chosen for this study because it appeared to be the most organized and thorough approach to gathering participants' subjective opinions and perceptions. In both public and private preschools in Hawassa City Sidama region Ethiopia, this study will examine teachers' perceptions of their efficacy in teaching mathematics. To elicit replies to the study's research questions, quantitative data were gathered.

2.2. Data collection instrument

Two sections make up the questionnaire. The respondents' demographic profiles were necessary for Section A. The demographic profiles indicated the respondents' gender, the number of years spent teaching math, and the kind of preschool where math is now taught. The respondents' opinions on teachers' effectiveness views in teaching math were adapted in section B, Enochs et al., (2000) Mathematics Teaching Efficacy Belief Instrument (MTEBI) was used to produce the questionnaire for this part. It included two constructs personal Mathematics teaching efficacy and outcome expectancy and included a total of 24 items, as shown in Table 1.

It has a 5-point Likert scale, 1 for "Strongly disagree", 2 for "Disagree", 3 for "Uncertain", 4 for "Agree" and 5 for "Strongly agree" with 24 items. The researcher adopted to Ethiopian Amharic language and made a pilot test to check the reliability of the MTBEI. The 21-item MTEBI adopted in Amharic consists of 8 items on the mathematics teaching outcome expectancy (MTOE) subscale and 13 items on the personal mathematics teaching efficacy (PMTE) subscale. The PMTE scale has a possible range of 13 to 65, whereas the MTOE scale has a possible range of 8 to 40. Five of the final PMTE's items had a positive orientation, whereas eight had a negative word. All eight of the items with positive wording were included in the final MTOE. Items with negative wording were pushed back for analysis. Reliability analysis produced an alpha coefficient of internal consistency (Cronbach alpha) of .781 for the MTBEI scale.

2.3. Participants

Participants in the research are teachers who work in both public and private preschools in Hawassa City. The samples for the study were chosen by random sampling techniques from both public and private preschools in Hawassa City, Sidama Regional State, Ethiopia. Forty-four (44) preschool teachers participated in the data collection but only 37 teachers properly completed the survey questionnaire. The remaining 7 questionnaires were rejected due to incompleteness and wrongly filled by the participants. The preschool teachers received the questionnaire while they were teaching, and it took around 10-15 minutes to complete. The completed questionnaires were given back to the researchers at the finish of class. However, due to the incomplete questionnaires received from the respondents, the study only analyzed 33 samples from 12 preschools, 6 public and 6 private.

2.4. Data analysis

Data produced by the Teaching Mathematics Efficacy Belief Instrument/Scale (TMEBS) were analyzed using quantitative methods. Descriptive statistics are presented as the mean scores and standard deviations together with inferential statistics to ascertain the preschool teachers' perceptions about the efficacy of teaching mathematics. The SPSS 20 statistics program was used to analyze the data before it was displayed in tables.

3. RESULTS

This part presents the findings from descriptive and inferential statistics regarding responding to the study questions. First, descriptive findings are provided, which contain the mean and standard deviation needed to organize the remaining data and the next section includes statistical results.

3.1. The respondents' demographic profiles

The demographic features of the preschool teachers who participated in this study are shown in Table 2. The surveys were fully completed by the 37 preschool teachers, of which 37 (100%) were females and male 0 (0%), at Hawassa city, Sidama regional state in Ethiopia. They were employed in 16 (43.2%) private preschools and 21 (56.8%) public preschools. Their teaching experience was 1 to 7 experiences in years in math lessons represented by 28 (75.7%), 8 to 12 years by 2 (5.4%), and 13 years or more by 7 (18.9%).

3.2. Teachers' efficacy beliefs in math teaching

The itemized preschool teacher results from the Math Teaching Efficacy Beliefs Scale (MTEBS) are shown in Table 3. Five items scored the mean values equal to 4 and greater than 3. The item "When teaching Math, I will typically be able to answer students' questions" had the highest mean value of 4.14 (SD = 0.855), followed by the statement "I understand math concepts well enough to be effective in teaching preschool math" and "I will continually find better ways to teach Math" with the mean values of 4.08 (SD = 1.01) and 3.86 (SD = 0.948), respectively. When I teach math, "I will usually welcome student questions" had a mean value of 3.84 (SD=1.118), and the item "I know how to teach math concepts effectively" had a mean value of 3.49 (SD=1.096).

The next seven items were a mean value greater than two and less than equal to three, item "I will not be very effective in monitoring math activities" with a mean value of 2.97 (SD=1.213), item "Even if I try very hard, I will not teach math as well as I will most subjects" with mean value 2.68 (SD=1.132), item "If parents comment that their child is showing more interest in math at preschool, it is probably due to the performance of the child's teacher" with mean value 2.57 (SD=1.237), item "Given a choice, I will not invite the principal to evaluate my math teaching" with mean value 2.57 (SD=1.191), item "When a student does better than usual in math, it is often because the teacher expected a little extra effort" with mean value 2.54 (SD=1.14) , item "I do not know to do to turn students on math" with mean value 2.54 (SD=1.346) and item "When a low-achieving child progresses in math, it is usually due to extra attention given by the teacher" with mean value 2.46 (SD=1.016).

The mean value of the remaining nine items was more than 1 and equal to 2, the lowest mean value item "When the math grades of students improve, it is often due to their teacher having found a more effective teaching approach" with mean value 1.78 (SD=0.821), item "The teacher is generally responsible for the achievement of students in math" with mean value 1.97 (SD=1.118), item "If students are underachieving in math, it is most likely due to ineffective math teaching" with mean value 2.19 (SD=1.221), item "I wonder if I will have the necessary skills to teach math" with mean value 2.19 (SD=0.938), item "I will find it difficult to use manipulative to explain to students why math works" with mean value 2.22 (SD=1.084), item "Students' achievement in math is directly related to their teacher's effectiveness in mathematics teaching" with mean value 2.24 (SD=1.164), item "I will generally teach math ineffectively" with mean value 2.32 (SD=1.313), item "The inadequacy of a student's math background can be overcome by good teaching" with mean value 2.35 (SD=1.23) and item "When a student has difficulty understanding a math concept, I will usually be at a loss as to how to help the student understand it better" with mean value 2.35 (SD=1.338).

Table 4 shows the mean scores of respondents' teaching efficacy in math. Overall, the mean value score of the 21 items was 2.731 (SD=0.334), which indicated that preschool teachers are nearly uncertain about their efficacy in early math teaching.

The mean score for one's own belief in the efficacy of early math teaching (13 questions) and result expectancy (8 items) about math teaching is shown in Table 5. The average score for personal math teaching efficacy (PMTE) was 2.68 (SD = 0.388), indicating that teachers were almost uncertain of their efficacy in teaching math. Instead, the mean score for math teaching outcome expectancy (MTOE) was 2.8 (SD = 0.5396), indicating that preschool teachers were almost uncertain about their outcome expectancy for teaching early math.

The Kruskal-Wallis Test (Table 6) revealed no significant variations in the three categories of KG teachers' teaching experiences' Asymptotic significance value for performance efficiency and outcome expectancy respectively =0.785; df=2 and 0.824; df=2 p >.05).

The Kruskal Wallis Test Table 7 showed no significant differences in the mean score of teachers' efficacy beliefs in math teaching among the three categories of preschool teachers' teaching experiences (Asymp. Sig=1.114; DF=2; p>0.05). In conclusion, there was no significant difference in the mean score of teachers' efficacy beliefs in math teaching based on their teaching experience categories.

Table 8 shows that the results of the independent samples t-test on MTEB between the public and private kindergarten teachers appeared to be significantly different (t (35) = -0.3074; p=0.004). Therefore, there is a significant difference in MTEB between private and public preschools.

4. DISCUSSION

This study attempted to assess the understanding by preschool math teachers of the views provided in research question one. This study found that teachers' efficacy and beliefs in teaching math were poor. This indicates that the preschool teachers lacked confidence in their ability to teach young children math. The results of Takunyaci & Takunyaci's (2014) study, showed that preschool teachers have poor efficacy attitudes about teaching early math and most of the subjects strongly, agreed that they would normally teach early math ineffectively; their finding is compatible with this study's findings. Tschannen-Moran and Hoy, (2001) reported that a teacher's effectiveness as a math teacher is determined by their teaching efficacy. So, teachers of math must have excellent teaching efficacy.

Additionally, the result of math teaching outcome expectancy and personal efficacy of preschool teachers were both low, with the outcome expectancy somewhat greater than the personal efficacy. This study found that preschool teachers believed they might not be qualified to instruct young math. Teachers who have enough math knowledge may help kids learn math by using various math strategies. They are also open to trying out novel teaching techniques to get better teaching strategies.

This study found that there was significant variation in efficacy beliefs regarding math teaching across public and private preschools, answering research questions 2 and 3. Additionally, there was no statistically significant difference in the mean score on a scale measuring teachers' math teaching efficacy belief depending on their years of experience; this result contradicts findings by Takunyaci & Takunyaci (2014). Takunyaci & Takunyaci (2014) found a significant difference between teachers' perceptions about their efficacy in teaching math and their teaching years of experience, in favor of more than 13 years of preschool math teaching experience.

5. CONCLUSION

This study has contributed to the body of knowledge that increases our understanding of preschool teachers' views on the efficacy of teaching math in both private and public preschools in the city of

Hawassa. The findings showed that preschool teachers' efficacy views in teaching early math were low. There was a significant difference between public and private preschools in terms of the overall math teaching efficacy beliefs scale (MTEBS), and there was also no significant difference between the three categories of preschool teacher teaching experiences with their math teaching efficacy beliefs scale (MTEBS). In particular, teaching math outcome expectancy was slightly greater than that of teachers' math teaching personal efficacy.

Additionally, it was found that among the components of math teaching efficacy, teachers' beliefs in their ability to teach math effectively (teachers' math teaching personal efficacy), were slightly lower than their expectations for the results of their math instruction (teaching math outcome expectancy). This indicates that teachers are less confident in their abilities and efficacy as math educators, even though they may be a little more confident in the favorable outcomes their teaching could produce.

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Appendix A

Preschool Mathematics Teaching Efficacy Belief (MTEB) Questionnaire Teachers in Hawassa City

Dear Preschool Teacher: The purpose of this questionnaire is to gather the information that will be useful to determine the preschool mathematics teacher's efficacy belief instruction in Hawassa city-selected pre-primary schools. Your genuine response to the questionnaire is of great value for this study. I would, therefore, be grateful if you could take a little time to fill out the questionnaire carefully and honestly. Be sure that the responses you may give will be used only for educational and academic purposes and information is kept confidential. So, you are kindly requested to read all questions and fill the questionnaire with genuine responses by putting a tick **(√)** mark in the appropriate box next to your response. Thank you so much in advance for your cooperation.

SECTION I: Demographic Information

Instruction: Please give your answers to each of the following questions below by putting a tick (√) mark in the appropriate box next to your response.

1. **Age** 1. ☐ Below 20 2. ☐ 21-25 3. ☐ 26-30
   4. ☐ 31-35 5. ☐ 36-40 6. ☐ 41 and above
2. **Sex**
   1. Male ☐
   2. Female ☐
3. **In which type of institution are you teaching?**
   1. Private ☐
   2. Public ☐
4. **How long have you been teaching at the kindergarten school?**
   1. 1 – 7 years ☐
   2. 8 – 12 years ☐
   3. 13 years and more ☐
5. **What is your educational background?**
   1. 12 Complete ☐ 3. Diploma ☐
   2. Certificate ☐ 4. Degree ☐

SECTION II: TEACHER'S EFFICACY SCALE

Instruction: The following questions ask about your efficacy-belief of mathematics teaching in your school. Remember there are no right or wrong answers; just answer as accurately as possible. Please, put a **tick (√) mark** in the appropriate box to indicate the extent to which you agree or disagree with the following statements using the following scale:

SA= Strongly Agree, A = Agree, UN= Uncertain, DA= Disagree, SD= Strongly Disagree

No.	Items	SA	A	UN	DA	SD
1	When a student does better than usual in math, it is often because the teacher expects a little extra effort.					

2	I will continually find better ways to teach math.					
3	Even if I try very hard, I will not teach math as well as I will most subjects.					
4	When the math marks of students improve, it is often due to their teacher having found a more effective teaching approach.					
5	I know how to teach math concepts effectively.					
6	I will not be very effective in monitoring math activities.					
7	If students are underachieving in math, it is most likely due to ineffective math teaching.					
8	I will generally teach math ineffectively.					
9	The inadequacy of a student's math background can be overcome by good teaching.					
10	When a low-achieving child progresses in math, it is usually due to extra attention given by the teacher.					
11	I understand math concepts well enough to be effective in teaching preschool mathematics.					
12	The teacher is generally responsible for the achievement of students in math.					
13	Students' achievement in math is directly related to their teacher's effectiveness in mathematics teaching.					
14	If parents comment that their child is showing more interest in math at preschool, it is probably due to the performance of the child's teacher.					
15	I will find it difficult to use manipulatives to explain to students why math works.					
16	I will typically be able to answer students' questions.					
17	I wonder if I will have the necessary skills to teach math.					
18	Given a choice, I will not invite the principal to evaluate my math teaching.					
19	When a student has difficulty understanding a math concept, I will usually be at a loss as to how to help the student understand it better.					
20	When teaching math, I will usually welcome student questions.					
21	I do not know what to do to turn students on to math.					

I thank you for spending the time to complete the survey.