# Perspectives and Practices of Early Childhood Educators on Identifying Mathematically Talented Children

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This study examines early childhood educators' perceptions and experiences in identifying mathematically gifted children, addressing a critical gap in early education research. Using a quantitative research design, data were collected through an online questionnaire completed by 47 educators. Findings reveal that educators generally believe mathematical talent can be identified in preschool and agree on the importance of differentiated teaching approaches. However, many reported limited confidence in their ability to identify such children. Educators with positive attitudes toward mathematics showed a stronger recognition of differentiated instruction and early numerical concept development as key indicators of giftedness. Additionally, more experienced educators rated early counting skills as a more significant indicator than their less experienced counterparts. Despite frequent observations of children's mathematical abilities, only 40.4% reported encountering mathematically gifted children. No significant differences were found in observation frequency or encounters based on teaching experience or attitudes toward mathematics.

**DOI**
https://doi.org/10.18690/um.pef.4.2025.7

**ISBN**
978-961-286-999-1

**Keywords:**
mathematical giftedness, early childhood education, early childhood educators, attitudes towards mathematics, work experiences

University of Maribor Press

## 1 Introduction

Early childhood is a critical period for identifying and nurturing individual talents, including mathematical ability. Research highlights that early identification of mathematical talent fosters cognitive development and contributes to long-term academic and professional success (Campbell, 1996). Kindergarten teachers play a crucial role in this process, as they engage with children daily in both structured and unstructured learning environments. Through their observations, they are uniquely positioned to identify early indicators of mathematical talent, such as advanced numerical and spatial reasoning (Bakker et al., 2024; Waxman, et al., 1996). However, despite their important role, many educators—including those teaching older children—face challenges in recognizing and supporting mathematically gifted students (Leikin & Stanger, 2011). Limited formal training in gifted education, time constraints, and personal biases often hinder their ability to accurately identify and nurture these abilities (Al-Hroub & Whitebread, 2008).

This chapter explores the perspectives and practices of Slovenian early childhood educators regarding mathematical talent, addressing a critical gap in early childhood education research. By investigating educators' experiences, challenges, and beliefs, the study aims to provide actionable insights to improve teacher training and classroom practices, ultimately to better support young children's potential.

### 1.1 Mathematical Talent in Children

The definition and measurement of mathematical giftedness have long been subjects of academic discussion (Dai, 2010; Ziegler & Heller, 2000). While traditionally associated with scoring above the 95th percentile on standardized tests (Sheffield, 2003), recent research emphasizes that mathematical giftedness encompasses more than test performance. Traits such as motivation, persistence, and mathematical creativity are now considered integral to mathematical giftedness (Kontoyianni, et al., 2013).

To gain deeper insights into mathematical giftedness, researchers have examined the cognitive processes underlying exceptional mathematical ability. Krutetskii's (1976) seminal 12-year study described mathematical giftedness as a unique combination of cognitive abilities that manifest during successful problem-solving. According to

Krutetskii, mathematically gifted students excel at analyzing and synthesizing mathematical material, quickly generalizing content and solution methods, and effortlessly shifting between cognitive processes. These findings, further supported by Lester and Schroeder (1983), emphasize that the defining characteristic of mathematically gifted children is their advanced cognitive strategies for approaching mathematical tasks. Neurological research aligns with these insights, indicating that mathematically gifted children exhibit enhanced right-hemisphere development and stronger interhemispheric connectivity, suggesting greater neural efficiency in mathematical processing (O'Boyle, 2008).

Leikin et al. (2017) offered a nuanced framework for understanding mathematical giftedness by categorizing students into three groups: those excelling in mathematics without general giftedness (NG-EM), generally gifted students excelling in mathematics (G-EM), and super mathematically gifted students (S-MG). Their study examined three dimensions of mental processing: domain-general cognitive traits, domain-specific mathematical creativity, and neuro-cognitive functioning during problem-solving. Notably, the study identified four distinct characteristics of S-MG students: accumulative (extensive knowledge and skills), G-related (linked to general intellectual abilities), unique (specific individual traits), and unraveling (emerging and developing over time).

Further insights into the cognitive traits of mathematically gifted individuals are provided by Sipahi and Bahar (2024), who conducted a systematic review of 22 studies. Their analysis identified two primary dimensions of mathematical giftedness: domain-specific abilities, such as problem-solving, reasoning, and mathematical creativity, and domain-general abilities, including visual-spatial skills, memory, and perceptual abilities. They also highlighted significant within-group variations, reflecting the complex interplay of cognitive traits that contribute to mathematical giftedness.

Mathematically gifted children exhibit distinct cognitive and neural characteristics, including superior logical reasoning, mental imagery, and creative thinking skills (Zhang et al., 2017). They excel in unique capacities, such as memorizing and manipulating complex mathematical structures, transitioning between representational modes, and understanding relational concepts (Assmus, 2018). However, these abilities are often underrepresented in conventional achievement tests, which fail to capture the depth and complexity of their thought processes (Lester & Schroeder, 1983).

To effectively support these learners, educators must employ instructional strategies that leverage their unique strengths. These include using multimodal teaching methods, emphasizing visual-spatial tasks, and fostering creative problem-solving opportunities (O'Boyle, 2008). Without tailored educational interventions, mathematically gifted children risk underachievement, highlighting the urgent need for policies and teaching practices that nurture their exceptional abilities.

### 1.2 Mathematically Talented Preschool Children

Much of the research on mathematical giftedness has traditionally concentrated on older children, including school-age students and adolescents (e.g., Krutetskii, 1976; Leikin et al., 2017; Sipahi & Bahar, 2024). However, there is growing recognition of the importance of identifying mathematically talented children during the preschool years, as early detection and support can play a critical role in fostering their potential and laying a foundation for lifelong mathematical achievement.

Cognitive abilities crucial for mathematical development often emerge well before formal schooling begins. Espy et al. (2010) highlighted the significance of executive functions, particularly working memory and inhibitory control, in early mathematical skills. Their study of 96 preschoolers found that inhibitory control uniquely predicted arithmetic proficiency even after controlling for age, maternal education, and vocabulary, underscoring its pivotal role in early math development. Similarly, Bakker et al. (2024) conducted a longitudinal study demonstrating that preschoolers who later achieved high mathematics scores in Grades 1 and 3 exhibited early cognitive advantages in numerical skills, proportional reasoning, and number order. These findings affirm that early mathematical competencies serve as strong predictors of future academic success.

From a developmental perspective, Okamoto et al. (2007) examined mathematically precocious children, observing that while their working memory growth was comparable to peers, their numerical conceptual understanding was approximately a year ahead. This aligns with neo-Piagetian theories, suggesting an interplay between conceptual growth and cognitive processing that drives early mathematical talent.

Beyond cognitive skills, creativity and environmental factors also play a significant role in nurturing mathematical talent. Steinberg (2013) explored the abilities of a mathematically advanced four-year-old, Danny, who demonstrated exceptional problem-solving skills, creativity, and an ability to conceptualize large numbers and arithmetic operations. Danny's case underscored the importance of parental support in fostering curiosity and exploration, with implications for early education strategies aimed at encouraging mathematical creativity.

To effectively support mathematically gifted preschoolers, researchers emphasize the need for advanced and stimulating curricula. Waxman et al. (1996) conducted a two-year intervention study demonstrating that these children consistently outperformed their peers in mathematical reasoning, with spatial reasoning emerging as a stronger predictor of mathematical performance than verbal reasoning. Their findings also revealed gender differences, with boys exhibiting higher mathematical reasoning scores than girls. The study highlighted the effectiveness of targeted interventions, such as the Saturday Club, a biweekly enrichment program designed to enhance young children's mathematical reasoning skills. Based on these results, Waxman et al. (1996) recommended strategies to sustain engagement and provide appropriate challenges, including curriculum compacting, enrichment activities, and advanced lessons tailored to students' abilities. They also advocated for flexible grouping practices, such as cross-grade and cluster grouping, early kindergarten entry, and specialized classrooms. To foster deep conceptual understanding and creative problem-solving, they emphasized introducing big ideas in mathematics—such as infinity, number systems, equivalence, and probability—at an early age.

Parents also play a pivotal role in identifying and supporting mathematically precocious children. Pletan et al. (1995) investigated parental observations of mathematically advanced kindergarteners and found that these children demonstrated exceptional skills in areas such as spatial reasoning, relational knowledge, and memory. Using standardized measures like the K-ABC and WPPSI-R, the study showed that parents can reliably describe their children's mathematical abilities, offering valuable insights that complement teacher observations.

## 1.3 Identification of Mathematical Talent in Children

The early identification of mathematical talent in children is crucial for providing tailored educational opportunities and fostering their potential. Parents play an essential role in recognizing young children's mathematical abilities (Pletan et al.), but teachers are pivotal in formal identification processes. However, teacher accuracy in identifying mathematically gifted children varies widely. Al-Hroub and Whitebread (2008) argue that teacher nomination is a critical first step, yet it is prone to misidentifications, which can lead to misplaced interventions. Similarly, traditional methods such as standardized tests often fail to reliably identify mathematical giftedness. For instance, Niederer et al. (2003) demonstrated that over-reliance on such tests risks both overlooking gifted children and misclassifying others as gifted.

To address these challenges, innovative tools and approaches have emerged. Pavlekovic et al. (2010) introduced the Math Gift expert system, a decision-support tool designed to help teachers identify mathematically gifted fourth-grade students. Unlike traditional methods that focus primarily on mathematical competencies, this system adopts a holistic framework, evaluating cognitive abilities, personal traits, and environmental influences. Their findings confirmed that this approach offered a more reliable and comprehensive framework for identifying mathematical giftedness compared to conventional methods.

Accurate identification also requires diverse and nuanced assessment strategies. Waxman et al. (1996) emphasize the value of out-of-level assessments and systematic teacher observations to evaluate students' conceptual mastery and identify appropriate support measures. Professional development for teachers is paramount to improving their ability to recognize and nurture mathematical talent effectively. Al-Hroub and Whitebread (2008) stress the need for targeted training programs that enable teachers to identify gifted students, including those with dual exceptionalities such as learning difficulties, ensuring equitable access to educational opportunities.

Teachers' perceptions of mathematical giftedness are influenced by several factors, including teaching experience, grade level taught, and cultural background. Ficici and Siegle (2008) found that experienced teachers placed greater emphasis on computational skills, practical applications, and creative problem-solving as indicators of giftedness, whereas teachers in higher grades were less likely to value these traits. Additionally, cultural perspectives shape how teachers conceptualize mathematical talent. For example, South Korean teachers, despite their students' strong performance in international assessments, were less inclined to view mathematical talent as innate, emphasizing the role of practice and effort instead. These findings underscore the importance of professional development to address biases and improve the accuracy of identification practices.

Furthermore, teachers' mathematical content knowledge and pedagogical expertise significantly impact their ability to engage and challenge gifted students. Smedsrud et al. (2022) highlighted that students' perceptions of their teachers' mathematical competence varied over time, influencing their engagement and, in some cases, leading to underachievement. This underscores the need for ongoing professional development to equip educators with the skills necessary to foster mathematical talent effectively.

Finally, Yazgan-Sağ (2022) examined prospective mathematics teachers' views on mathematical giftedness, revealing that their perceptions were shaped by personal experiences and cultural contexts, often due to a lack of formal training. These teachers identified traits such as quick thinking, creativity, and curiosity as hallmarks of giftedness and emphasized the importance of effort and supportive social environments. This research highlights the pressing need to provide teachers with formal training to enhance their capacity to identify and nurture mathematically gifted children effectively.

### 1.4 Focus of the Current Study: Early Childhood Educators' Perspectives

While much of the existing research on mathematical talent centers on school-age children and relies heavily on standardized tests for identification, this study highlights the often-overlooked role of early childhood educators in recognizing mathematical giftedness in preschoolers. Through daily interactions in diverse learning environments, early childhood educators are uniquely positioned to observe emerging mathematical abilities, identifying exceptional talent through children's problem-solving strategies, pattern recognition, and creative approaches during both structured activities and unstructured play.

Leikin and Stanger (2011) underscore a notable gap in the literature concerning teachers' perspectives on mathematically gifted students, particularly among elementary school educators. Addressing this gap at the preschool level, the present study examines how early childhood educators perceive, identify, and support young children with advanced mathematical abilities. By exploring their practices, challenges, and experiences, this research aims to enhance early recognition and support for mathematical talent. Given the limited studies in this area, the findings underscore the need for targeted training and resources to equip educators with the confidence and skills to effectively nurture mathematically gifted preschool children.

## 2 Methods

This study employed a quantitative research design, utilizing an online questionnaire to explore early childhood educators' beliefs, practices, and experiences in identifying mathematically talented children. By investigating their beliefs, practices, and experiences, this study seeks to enhance understanding of early talent recognition and inform strategies for supporting mathematically gifted children in early childhood education settings.

### 2.1 Research Questions

The study was guided by the following research questions:

- What are early childhood educators' beliefs regarding the existence and identification of mathematical talent in young children?
- What indicators do early childhood educators perceive as signs of mathematical talent in young children?
- Have early childhood educators encountered children they considered mathematically gifted in their professional experience?
- How often do early childhood educators actively observe children with respect to their mathematical abilities?

Additionally, the study explored whether differences in beliefs, practices, and identification practices exist based on early childhood educators' attitudes toward mathematics and their years of teaching experience.

## 2.2 Sample

The study sample consisted of 47 early childhood educators, all of whom were female. The majority (80.9%) reported having less than four years of teaching experience, while 19.1% had between five and fifteen years of experience. This distribution reflects a focus on early- to mid-career professionals, offering valuable insights into how early childhood educators with varying levels of experience perceive and address the identification of mathematically gifted children in kindergarten settings.

Participants' attitudes toward mathematics were also examined, as these attitudes could influence their ability to recognize and nurture mathematical talent in young children. To gather this information, participants responded to the question, How would you describe your attitude toward mathematics? The responses are summarized in Table 1.

**Table 1: Participants' Attitudes Toward Mathematics**

| Attitude Description | f | f% |
|---|---|---|
| I never liked mathematics. | 2 | 4.3% |
| I never particularly liked mathematics, but I accept it as part of my job. | 13 | 27.7% |
| I somewhat like mathematics and find it practical. | 18 | 38.3% |
| I like mathematics very much and enjoy it. | 14 | 29.8% |
| Total | 47 | 100.0% |

The results indicate that only a small proportion of participants (4.3%) expressed a strong dislike for mathematics, while 27.7% indicated that, although they do not particularly enjoy the subject, they accept it as part of their professional responsibilities. Most participants reported positive attitudes toward mathematics, with 38.3% describing it as somewhat enjoyable and practical, and 29.8% expressing a strong liking for and enjoyment of the subject.

For further analysis, participants were categorized into two groups based on their attitudes toward mathematics. The first group (70.2%) comprised individuals with less positive attitudes toward the subject. The second group (29.8%) included participants with positive attitudes, characterized by a strong appreciation for and enjoyment of mathematics. This categorization facilitated an exploration of potential differences in early childhood educators' perceptions and practices regarding the identification of mathematically gifted children.

### 2.3 Data Collection Procedure

The data for this study were collected using an online questionnaire distributed at the end of 2024. The questionnaire was disseminated via Facebook groups specifically targeting graduates of the Faculty of Education at the University of Maribor. This approach ensured access to a relevant population of qualified early childhood educators with appropriate educational and professional experience. The questionnaire included a combination of closed-ended and scaled questions, carefully designed to capture a comprehensive range of perspectives on the identification and support of mathematically talented children.

### 2.4 Statistical Analysis

To assess the normality of the data for various statements related to mathematical giftedness, the Kolmogorov-Smirnov and Shapiro-Wilk tests were employed. Both tests revealed significant deviations from normality ($p < 0.001$) for all variables, indicating that the data were not normally distributed. As a result, non-parametric statistical tests were utilized for further analysis to ensure the robustness and reliability of the findings.

## 3 Results

In the following section, the main findings are presented, focusing on early childhood educators' perceptions, confidence levels, and practices in identifying and supporting mathematically gifted children. The results also explore differences based on educators' work experience and attitudes toward mathematics.

The results reveal that early childhood educators generally agree that mathematically gifted children can be identified as early as in preschool ($M = 4.00$) and believe that such children often stand out in their peer groups ($M = 3.83$). Additionally, early childhood educators agree on the need for a differentiated teaching approach for mathematically talented children ($M = 3.83$). However, participants were less confident in their knowledge regarding the identification of mathematically gifted children, as indicated by a mean score of 3.06.

**Table 2: Descriptive Statistics for early childhood educators' Perceptions on Identifying and Supporting Mathematically Gifted Children**

| Statement | N | Mean | Std. Deviation | Min | Max |
|---|---|---|---|---|---|
| Mathematically gifted children can be identified as early as in preschool. | 47 | 4.00 | 1.063 | 1 | 5 |
| I have sufficient knowledge to identify mathematically gifted children. | 47 | 3.06 | 0.734 | 2 | 5 |
| Children with exceptional mathematical abilities often stand out in the group. | 47 | 3.83 | 0.842 | 2 | 5 |
| I believe that mathematically gifted children require a different teaching approach than their peers. | 47 | 3.83 | 1.028 | 1 | 5 |

**Table 3: Results of Mann-Whitney U Test for Differences in Responses Based on Work Experience**

| Statement | Group | N | Mean Rank | Sum of Ranks | Mann-Whitney U | Z | Asymp. Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|
| Mathematically gifted children can be identified as early as in preschool. | Less than 5 years | 38 | 25.17 | 956.50 | 126.500 | -1.287 | 0.198 |
| | 5 years or more | 9 | 19.06 | 171.50 | | | |
| I have sufficient knowledge to identify mathematically gifted children. | Less than 5 years | 38 | 23.76 | 903.00 | 162.000 | -0.268 | 0.789 |
| | 5 years or more | 9 | 25.00 | 225.00 | | | |
| Children with exceptional mathematical abilities often stand out in the group. | Less than 5 years | 38 | 24.76 | 941.00 | 142.000 | -0.858 | 0.391 |
| | 5 years or more | 9 | 20.78 | 187.00 | | | |
| I believe that mathematically gifted children require a different teaching approach than their peers. | Less than 5 years | 38 | 25.70 | 976.50 | 106.500 | -1.825 | 0.068 |
| | 5 years or more | 9 | 16.83 | 151.50 | | | |

The results in Table 3 reveal that for all statements except "I have sufficient knowledge to identify mathematically gifted children," early childhood educators with less than 5 years of experience reported slightly higher agreement compared to their peers with 5 or more years of experience. However, these differences were not statistically significant.

For the statement "I believe that mathematically gifted children require a different teaching approach than their peers," early childhood educators with less than 5 years of experience (Mean Rank = 25.70) reported higher agreement compared to early childhood educators with 5 or more years of experience (Mean Rank = 16.83). This finding showed a tendency toward significance ($p = 0.068$), suggesting that further investigation with a larger sample might reveal meaningful differences in perceptions between the groups.

**Table 4: Results of Mann-Whitney U Test for Differences in Responses Based on Attitudes Towards Mathematics**

| Statement | Group | N | Mean Rank | Sum of Ranks | Mann-Whitney U | Z | Asymp. Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|
| Mathematically gifted children can be identified as early as in preschool. | Negative attitude | 33 | 23.38 | 771.50 | 210.500 | -0.510 | 0.610 |
| | Positive attitude | 14 | 25.46 | 356.50 | | | |
| I have sufficient knowledge to identify mathematically gifted children. | Negative attitude | 33 | 23.65 | 780.50 | 219.500 | -0.294 | 0.769 |
| | Positive attitude | 14 | 24.82 | 347.50 | | | |
| Children with exceptional mathematical abilities often stand out in the group. | Negative attitude | 33 | 22.12 | 730.00 | 169.000 | -1.578 | 0.115 |
| | Positive attitude | 14 | 28.43 | 398.00 | | | |
| I believe mathematically gifted children require a different teaching approach than peers. | Negative attitude | 33 | 20.24 | 668.00 | 107.000 | -3.018 | 0.003* |
| | Positive attitude | 14 | 32.86 | 460.00 | | | |

Note: *$p < 0.05$ indicates statistical significance.

Early childhood educators with positive attitudes toward mathematics demonstrated slightly higher agreement regarding the ability to identify mathematically gifted children in preschool, expressed greater confidence in their knowledge to do so, and were more likely to agree that such children stand out compared to those with negative attitudes. However, these differences were not statistically significant. Notably, early childhood educators with positive attitudes (Mean Rank = 32.86) showed significantly higher agreement than those with negative attitudes (Mean Rank = 20.24) on the need for a different teaching approach for mathematically gifted children (p = 0.003). These findings highlight the critical role of early childhood educators' attitudes in shaping their perceptions and approaches to effectively support mathematically talented children.

**Table 5: Descriptive Statistics for Teachers' Perceptions of Indicators of Mathematical Giftedness**

| | N | Mean | Std. Deviation | Min | Max |
|---|---|---|---|---|---|
| Early counting skills indicate mathematical giftedness. | 47 | 3.70 | 0.907 | 2 | 5 |
| Early writing of numbers indicates mathematical giftedness. | 47 | 3.53 | 0.881 | 2 | 5 |
| Early development of numerical concepts indicates mathematical giftedness. | 47 | 4.34 | 0.915 | 1 | 5 |
| Continuing and creating complex patterns indicates mathematical giftedness. | 47 | 4.36 | .942 | 1 | 5 |
| Advanced problem-solving indicates mathematical giftedness. | 47 | 4.45 | .996 | 1 | 5 |
| Exceptional spatial awareness indicates mathematical giftedness. | 47 | 4.30 | .976 | 1 | 5 |

This table presents the descriptive statistics for early childhood educators' perceptions of various indicators of mathematical giftedness in young children. The highest mean scores were observed for "Advanced problem-solving" (M = 4.45) and "Continuing and creating complex patterns" (M = 4.36), highlighting these as key attributes perceived by educators. Similarly, "Early development of numerical concepts" (M = 4.34) and "Exceptional spatial awareness" (M = 4.30) were also considered strong indicators. In contrast, "Early writing of numbers" (M = 3.53) and "Early counting skills" (M = 3.70) received comparatively lower mean scores, indicating less consensus among early childhood educators regarding their significance as markers of mathematical giftedness.

**Table 6: Mann-Whitney U Test Results for Perceived Indicators of Mathematical Giftedness Based on Work Experience**

| Indicator | Group | N | Mean Rank | Sum of Ranks | Mann-Whitney U | Z | Asymp. Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|
| Early counting skills indicate mathematical giftedness. | Less than 5 years | 38 | 21.93 | 833.50 | 92.500 | -2.278 | 0.023* |
| | 5 years or more | 9 | 32.72 | 294.50 | | | |
| Early writing of numbers indicates mathematical giftedness. | Less than 5 years | 38 | 23.96 | 910.50 | 169.500 | -0.043 | 0.965 |
| | 5 years or more | 9 | 24.17 | 217.50 | | | |
| Early development of numerical concepts indicates mathematical giftedness. | Less than 5 years | 38 | 23.42 | 890.00 | 149.000 | -0.664 | 0.507 |
| | 5 years or more | 9 | 26.44 | 238.00 | | | |
| Continuing and creating complex patterns indicates mathematical giftedness. | Less than 5 years | 38 | 24.04 | 913.50 | 169.500 | -0.046 | 0.964 |
| | 5 years or more | 9 | 23.83 | 214.50 | | | |
| Advanced problem-solving indicates mathematical giftedness. | Less than 5 years | 38 | 24.24 | 921.00 | 162.000 | -0.295 | 0.768 |
| | 5 years or more | 9 | 23.00 | 207.00 | | | |
| Exceptional spatial awareness indicates mathematical giftedness. | Less than 5 years | 38 | 24.12 | 916.50 | 166.500 | -0.135 | 0.893 |
| | 5 years or more | 9 | 23.50 | 211.50 | | | |

Note: $*p < 0.05$ indicates statistical significance.

The results indicate that, apart from early counting skills, no significant differences were observed between early childhood educators with varying years of experience in their perceptions of mathematical giftedness indicators. Specifically, for early counting skills, educators with 5 or more years of experience (Mean Rank = 32.72) rated this indicator significantly higher than their counterparts with less than 5 years of experience (Mean Rank = 21.93), with the difference reaching statistical significance ($p = 0.023$).

**Table 7: Mann-Whitney U Test Results for Perceived Indicators of Mathematical Giftedness Based on Attitude**

| Indicator | Group | N | Mean Rank | Sum of Ranks | Mann-Whitney U | Z | Asymp. Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|
| Early counting skills indicate mathematical giftedness. | Negative attitude | 33 | 22.23 | 733.50 | 172.500 | -1.460 | 0.144 |
| | Positive attitude | 14 | 28.18 | 394.50 | | | |
| Early writing of numbers indicates mathematical giftedness. | Negative attitude | 33 | 22.94 | 757.00 | 196.000 | -0.872 | 0.383 |
| | Positive attitude | 14 | 26.50 | 371.00 | | | |
| Early development of numerical concepts indicates mathematical giftedness. | Negative attitude | 33 | 21.65 | 714.50 | 153.500 | -2.011 | 0.044* |
| | Positive attitude | 14 | 29.54 | 413.50 | | | |
| Continuing and creating complex patterns indicates mathematical giftedness. | Negative attitude | 33 | 23.65 | 780.50 | 219.500 | -0.301 | 0.764 |
| | Positive attitude | 14 | 24.82 | 347.50 | | | |
| Advanced problem-solving indicates mathematical giftedness. | Negative attitude | 33 | 24.24 | 800.00 | 223.000 | -0.226 | 0.821 |
| | Positive attitude | 14 | 23.43 | 328.00 | | | |
| Exceptional spatial awareness indicates mathematical giftedness. | Negative attitude | 33 | 23.58 | 778.00 | 217.000 | -0.361 | 0.718 |
| | Positive attitude | 14 | 25.00 | 350.00 | | | |

Note: *$p < 0.05$ indicates statistical significance.

The results reveal that early childhood educators with more positive attitudes toward mathematics consistently rated all indicators of mathematical giftedness higher than their counterparts with less positive attitudes. However, a statistically significant difference was observed only for the indicator of early development of numerical concepts, where educators with more positive attitudes (Mean Rank = 29.54) rated it significantly higher than those with less positive attitudes (Mean Rank = 21.65; $p$ = 0.044).

**Table 8: Frequency of Encountering Mathematically Gifted Children in Professional Experience**

| Response | Frequency | Percent |
|---|---|---|
| Yes | 19 | 40.4% |
| Not yet | 28 | 59.6% |
| Total | 47 | 100.0% |

The results indicate that 40.4% of early childhood educators reported having encountered children they considered mathematically gifted during their work, while the majority (59.6%) had not yet identified such children. This suggests that direct recognition of mathematical talent in young children may not be widespread among educators, highlighting the need for further awareness and training in identifying mathematical giftedness.

**Table 9: Mann-Whitney U Test Results for Encountering Mathematically Gifted Children Based on Work Experience**

| Did you encounter children during your studies or work whom you considered mathematically gifted? | Group | N | Mean Rank | Sum of Ranks | Mann-Whitney U | Z | Asymp. Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|
| | Less than 5 years | 38 | 24.84 | 944.00 | 139.000 | -1.018 | 0.309 |
| | 5 years or more | 9 | 20.44 | 184.00 | | | |

The results indicate no statistically significant difference between educators with less than 5 years of experience (Mean Rank = 24.84) and those with 5 or more years of experience (Mean Rank = 20.44) in encountering mathematically gifted children during their studies or work ($p = 0.309$). This suggests that the likelihood of encountering mathematically gifted children does not vary significantly with the length of work experience.

**Table 10: Mann-Whitney U Test Results for Encountering Mathematically Gifted Children Based on Attitude**

| Did you encounter children during your studies or work whom you considered mathematically gifted? | Group | N | Mean Rank | Sum of Ranks | Mann-Whitney U | Z | Asymp. Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|
| | Negative attitude | 33 | 24.95 | 823.50 | 199.500 | -0.862 | 0.389 |
| | Positive attitude | 14 | 21.75 | 304.50 | | | |

Educators with a negative attitude toward mathematics (Mean Rank = 24.95) reported slightly more instances of encountering mathematically gifted children compared to those with a positive attitude (Mean Rank = 21.75). However, the difference was not statistically significant ($p = 0.389$), indicating that educators' attitudes toward mathematics did not significantly impact their reported experiences of identifying mathematically gifted children.

**Table 11: Frequency of Actively Observing Children's Mathematical Abilities**

| Response | Frequency | Percent |
|---|---|---|
| Always | 4 | 8.5% |
| Often | 22 | 46.8% |
| Sometimes | 16 | 34.0% |
| Rarely | 5 | 10.6% |
| **Total** | 47 | 100.0% |

The results show that nearly half of the early childhood educators (46.8%) reported actively observing children's mathematical abilities "often," while 34% stated they do so "sometimes." Only a small percentage (8.5%) indicated that they "always" observe children's mathematical abilities, whereas 10.6% reported doing so "rarely."

**Table 12: Actively Observing Children's Mathematical Abilities Based on Work Experience**

| How often do you actively observe children regarding their mathematical abilities? | Group | N | Mean Rank | Sum of Ranks | Mann-Whitney U | Z | Asymp. Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|
| | Less than 5 years | 38 | 24.51 | 931.50 | 151.500 | -0.570 | 0.569 |
| | 5 years or more | 9 | 21.83 | 196.50 | | | |

Early childhood educators with less experience (Mean Rank = 24.51) observed children's mathematical abilities slightly more frequently than those with more experience (Mean Rank = 21.83), but the difference was not statistically significant ($p = 0.569$).

**Table 13: Actively Observing Children's Mathematical Abilities Based on Attitude**

| How often do you actively observe children regarding their mathematical abilities? | Group | N | Mean Rank | Sum of Ranks | Mann-Whitney U | Z | Asymp. Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|
| | Negative attitude | 33 | 26.09 | 861.00 | 162.000 | -1.734 | 0.083 |
| | Positive attitude | 14 | 19.07 | 267.00 | | | |

As with attitudes toward mathematics, early childhood educators with a negative attitude reported slightly more frequent observations of children's mathematical abilities than those with a positive attitude, but this difference was not statistically significant ($p = 0.083$).

## 4 Discussion

This study explored early childhood educators' perceptions and practices related to identifying mathematically gifted children. The findings provide insight into how early childhood educators recognize and support mathematical talent, highlighting key differences based on years of experience and attitudes toward mathematics.

The results indicate that early childhood educators generally believe that mathematically gifted children can be identified as early as in preschool and that these children often stand out in a group. These findings align with research emphasizing the early emergence of mathematical talent and the importance of identifying it during the preschool years (Espy et al., 2010; Bakker et al., 2024). However, the lower confidence expressed by educators in their ability to identify mathematically gifted children highlights a pressing need for enhanced professional development in this area. Waxman et al. (1996) underscore the necessity of specialized training and robust evaluation tools for accurate identification. Similarly, Al-Hroub and Whitebread (2008) emphasize the value of targeted training programs to equip educators with the skills to identify gifted students effectively, including those with dual exceptionalities such as learning difficulties, ensuring equitable access to appropriate educational opportunities.

When analyzing differences based on teaching experience, results showed that educators with less than five years of experience reported slightly higher agreement on most statements regarding mathematical giftedness. The only notable trend was for the belief that mathematically gifted children require a different teaching approach, where teachers with less experience showed a greater tendency to agree ($p = 0.068$). The tendency for less experienced educators to agree that mathematically gifted children require a different teaching approach may reflect their recent exposure to contemporary pedagogical frameworks emphasizing differentiated instruction. Teacher education programs likely highlight the importance of adapting methods to diverse learners, including mathematically gifted children (Waxman et al., 1996), whereas more experienced educators may rely on traditional practices, perceiving existing methods as sufficient.

Regarding attitudes toward mathematics, educators with more positive attitudes rated all indicators of mathematical giftedness higher than those with less positive attitudes. A statistically significant difference was found for the belief that early development of numerical concepts indicates mathematical giftedness, with teachers who enjoy mathematics rating it significantly higher than those with a negative attitude ($p = 0.044$). Additionally, those with more positive attitudes were significantly more likely to believe that mathematically gifted children require a different teaching approach ($p = 0.003$). These findings align with research suggesting that educators' attitudes significantly influence their ability to recognize and support mathematically gifted children (Ficici & Siegle, 2008).

Despite recognizing key indicators of mathematical giftedness, only 40.4% of early childhood educators reported having encountered mathematically talented children in their professional experience. This finding suggests that many mathematically gifted preschoolers may go unidentified, highlighting the need for improved assessment methods and targeted teacher training. Tools such as structured observation protocols or expert systems, as proposed by Pavlekovic et al. (2010), could help bridge this gap.

Most educators reported frequent observations of children's mathematical abilities; however, no significant differences were found in observation frequency based on experience or attitudes toward mathematics. This finding suggests that regular observation of children's mathematical abilities is a common practice among early childhood educators, regardless of personal teaching experience or confidence in mathematics.

The findings underscore the importance of professional development programs focused on mathematical giftedness. Given that educators with positive attitudes toward mathematics were more likely to recognize the need for differentiated instruction, training programs should emphasize mathematical confidence-building among early childhood educators (Leikin et al., 2017; Waxman et al., 1996). Additionally, structured observation tools and assessment strategies, as highlighted in studies by Sipahi and Bahar (2024) and Pavlekovic et al. (2010), may help educators systematically identify and support mathematically talented children more effectively.

## 5 Conclusion

This study highlights the critical role of early childhood educators in identifying and supporting mathematically gifted children in preschool settings. The findings indicate that while teachers generally believe in the early identification of mathematical talent, many feel uncertain about their ability to recognize such abilities, underscoring the need for targeted professional development. Educators with positive attitudes toward mathematics were more likely to advocate for differentiated instruction, emphasizing the influence of attitudes on instructional practices.

Despite frequent observations of children's mathematical abilities, a significant proportion of educators reported not encountering mathematically gifted children, suggesting that many may remain unidentified. These results reinforce the importance of equipping educators with structured tools, training programs, and strategies to systematically observe, assess, and nurture mathematical talent. By addressing these gaps, early childhood educators can play a pivotal role in fostering mathematical potential during the critical preschool years.

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