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Analysis of Learning Style and Learning Media on Early Childhood Counting Skills

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ABSTRACT

This study aims to identify the influence of learning styles (kinesthetic, visual, and auditory) and gender on early childhood counting skills at Inpres Mannurukki Kindergarten, TKIT At-Tibyan, and Bone Kindergarten. The research method used was quantitative with an experimental design. The sample consisted of 45 students, with 17 male students and 28 female students, who were divided based on the learning styles applied. Data were collected through measurement of children's counting skills and analysed using descriptive statistical test, normality test, Levene test, and Two-Way ANOVA test. The results of the descriptive analysis showed that the mean scores of the counting skills of male and female students varied depending on the learning style applied. Kinesthetic learning style gives good results for students who are actively moving, visual learning style is more effective with the use of digital media, and auditory learning style shows good results with the use of songs and rhythms. The Two-Way ANOVA test showed that there was no significant difference between learning styles on children's numeracy skills, but there was a significant difference between gender and the interaction between learning styles and gender. Boys excel in auditory and kinesthetic learning styles, while girls excel in visual learning styles. This study concludes that learning that is tailored to learning styles and gender characteristics can improve early childhood numeracy comprehension. The implication of this research is the need for a differentiated learning approach according to children's needs to maximise learning outcomes.

Keywords: *Early Childhood; Learning Media; Learning Styles*

INTRODUCTION

Education is a crucial aspect, especially in early childhood, which encompasses the developmental period from ages 0 to 6 years (Fajrie, 2024; Fuente & Gillanders, 2021; Inten et al., 2022; Masykuroh & Mursyidah, 2023; Sells, 2023). This stage is often referred to as the golden age, a time when children become highly sensitive and receptive to various stimuli. During this period, children undergo rapid growth and development (Hidayati, 2020; Rahman & Sudirman, 2024; Sakti, 2020). The cognitive aspect is one of the key domains that must be emphasized in early childhood education. Cognitive development can be stimulated through the introduction of basic concepts such as reading, writing, and counting. These foundational

skills aim to prepare children for the next levels of education. Basic literacies including numeracy, science, civic, financial, technological, and cultural literacy can be nurtured from an early age (Dwirianto, 2023; Jin, 2023; Nurhayati, Hidayat, et al., 2023; Nurhayati, Qudsi, et al., 2023; Nurjanah et al., 2022)

Literacy is introduced through play-based methods because children naturally learn through play. Literacy is integrated into the context of the child's real world. According to UNESCO, literacy is defined as the ability to read and write, as well as to think critically in solving problems. According to De Roock (2021) literacy includes reading, writing, and numeracy. Learners are expected to master basic literacies, including reading, writing, numeracy, science, financial, digital, and cultural and civic literacies (Audrin & Audrin, 2022; Farias-Gaytan et al., 2022; Rahawarin, 2023; Tinmaz et al., 2022; Yunan et al., 2022). Numeracy skills in children help them solve everyday mathematical problems, so that as they grow older, they become accustomed to recognizing and dealing with complex issues without needing much time to find solutions (Sabat et al., 2021). Therefore, numeracy literacy skills are essential in early childhood. In early childhood education, children should be introduced to simple counting activities during play, making the learning environment enjoyable.

These skills not only form the basis for understanding mathematics at the next level of education (Al Ayyubi et al., 2018; Al Ayyubi, Bukhori, et al., 2024; Al Ayyubi, Hayati, et al., 2024; Al Ayyubi, Rohaendi, et al., 2024; Al Ayyubi, Rohmatulloh, et al., 2024), but also contribute to training logical thinking and problem solving from an early age (Ahlawat & Billeh, 1987; Şaşmazören et al., 2022; Shafina et al., 2020; Tobin & Capie, 1981; Winstanley, 2021). Various studies have shown that children's learning styles are very diverse, including visual, auditory and kinesthetic, each of which affects how they understand counting concepts. In addition, the learning media used is also an important factor in creating an effective and enjoyable learning experience for young children. The benefits of numeracy literacy skills are to help solve problems in everyday life. However, not all humans can utilise numeracy literacy skills. In general, most people have mastered the basic concepts of mathematics, but the application is still far from expectations, to solve mathematical problems requires numeracy literacy skills. Maths learning will be of limited benefit if it is not used to solve problems (Bang et al., 2023; Cheung et al., 2025; Gashaj et al., 2023; Saputri et al., 2023; Widayanti, 2021). Basic knowledge, principles and mathematical processes for their application in real-life contexts require numeracy literacy skills (Bruin et al., 2023; Purnomo et al., 2023; Ratnaya et al., 2024; Sa'dijah et al., 2023; Sonowal, 2023)

However, in practice, most educators still do not consider the learning approach with the learning style of students. In fact, many educators do not fully understand the characteristics of children's learning styles, which becomes one of the factors contributing to suboptimal learning outcomes. Previous research has shown a lack of studies that link children's learning styles with the effectiveness of learning media in enhancing counting skills (Anggereni et al., 2022). Most existing studies focus on the effectiveness of a single type of learning media, without taking into account the diverse learning styles of early childhood (Magay, 2022). This presents a research gap that needs to be explored further in order to understand how the interaction between learning styles and learning media can influence children's achievement in numeracy. This study offers a comprehensive analysis that not only examines the influence of each factor individually but also investigates the interaction between learning styles and learning media in relation to early childhood numeracy skills. By understanding these interaction patterns, this research aims to provide new insights for educators in developing more adaptive learning strategies that are tailored to the individual needs of children.

Therefore, the researchers reviewed several articles to identify research novelty and gaps related to learning styles and learning media in the analysis of early childhood counting

abilities. Researchers analyze literature studies from several journal articles through the Vosviewer application, this aims to analyze existing publications regarding this research so that it can see the extent of the relationship connected to each other through the matrix network.

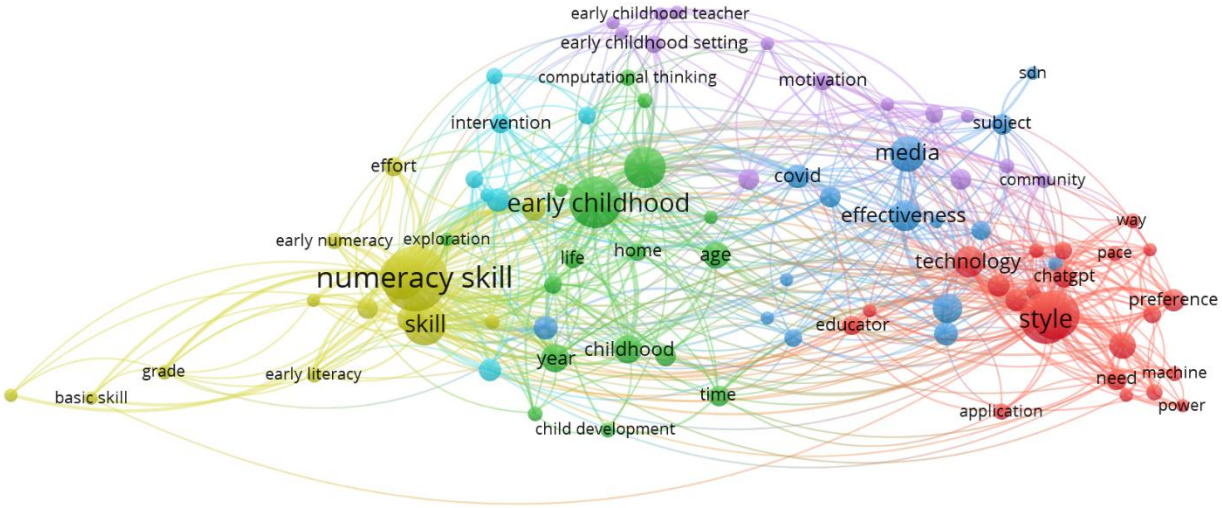

Figure 1. VosViewer Analysis Results on Learning Styles and Learning Media in Relation to Early Childhood Numeracy Skills

Based on the visualization results generated using VosViewer version 1.6.20, the researchers analyzed a total of 1000 articles published between 2023 and 2025. These articles were obtained through a systematic search on Google Scholar and indexed in the SINTA and SCOPUS database, utilizing the assistance of the Publish or Perish software version 8. The bibliometric network displayed in Figure 1 reflects the distribution and relationship of research topics related to learning styles, learning media, and early childhood counting skills. The visualization provides insight into how far the research trend has progressed in exploring the intersection of these variables. The analysis reveals that studies focusing on the intersection between learning styles and learning media in relation to early childhood numeracy remain scarce. The limited number of studies specifically addressing this topic indicates that it is an underexplored area in current academic literature. Furthermore, the terms related to "learning styles," "interactive learning media," and "counting ability" appear sparsely connected, highlighting a lack of integration between these themes in previous research. This fragmentation and minimal overlap suggest a significant gap in scholarly attention, which opens up opportunities for more in-depth exploration. The findings from this bibliometric analysis have further encouraged the researchers to delve deeper into understanding how learning styles interact with various types of educational media to influence the development of numeracy skills in young children. Moreover, this study aims to fill the gap by contributing new perspectives through a more holistic approach combining insights from both literature and field observations. As can be seen in the more focused visualization presented in Figure 2, the matrix network illustrates how the relevant research domains are still developing, with numerous potential connections yet to be explored. This reinforces the urgency and relevance of conducting a study that bridges the existing gaps in literature and practice.

Building upon the identification of existing research gaps, this study seeks to thoroughly analyze the relationship between learning styles and learning media in relation to early childhood numeracy skills. The primary objective is to understand how these two variables learning styles and educational media interact and influence the development of

children's ability to count during the early years of education. By exploring this relationship, the research aims to provide empirical evidence that can serve as a foundation for the design of more personalized and effective instructional models. These models are expected to be more adaptive to the diverse learning preferences of children, ensuring that every child has access to a supportive and engaging learning environment. Furthermore, the outcomes of this study are anticipated to make a meaningful contribution to the advancement of early childhood education, particularly in strengthening the aspect of numeracy. It is hoped that the findings will inform teachers, curriculum developers, and educational policymakers in implementing strategies that not only enhance mathematical skills from an early age but also foster positive attitudes toward learning. In a broader sense, this study underscores the importance of integrating pedagogical approaches with an understanding of individual learning characteristics, thereby promoting a more holistic and inclusive education system for young learners.

METHOD

This study used a mixed methods approach with an explanatory sequential design to obtain a comprehensive understanding of student learning outcomes in mathematics learning using manipulative, digital, and song through movement learning media (Creswell, 2010). This research was conducted at Inpress Mannurukki Kindergarten. TKIT At-Tibyan, and TK Bone with a population of all students in the school with a sample of 15 students in each school whose learning uses kinesthetic, visual, and auditory learning styles with sampling techniques using purposive sampling. This study employed a combination of quantitative and qualitative research instruments, specifically achievement tests and structured interviews, to gather comprehensive data related to early childhood numeracy skills. The quantitative component of the study was designed to compare more than two independent groups across two main variables: student learning outcomes and individual differences, including gender and learning styles utilized in the respective educational settings. This approach enables a more detailed understanding of how various factors intersect and influence learning effectiveness in different contexts.

On the other hand, the qualitative method was applied to provide deeper insights into the numerical learning outcomes observed (Susanty et al., 2023). This was achieved through in-depth interviews and systematic classroom observations, which helped capture contextual and experiential data that may not be visible through test scores alone. Through this mixed-method approach, the study aims to present a holistic picture of how learning styles and educational media relate to children's ability to count. In terms of data analysis, the quantitative data were processed using descriptive and inferential statistical techniques with the aid of SPSS version 26 (Arnani, 2024; Bryman & Cramer, 2012; Okello, 2022). Descriptive statistics were used to summarize the initial characteristics of the dataset, such as means, standard deviations, and frequency distributions. These statistics offer a clear depiction of the tendencies and variability within the sample, serving as a foundation for further hypothesis testing.

The inferential analysis began with a normality test using both the Kolmogorov-Smirnov and Shapiro-Wilk methods to determine whether the data met the assumptions for parametric testing. This was followed by a homogeneity of variance test using Levene's Test to assess whether variances across groups were equal. If the dataset was found to be normally distributed and homogeneous, a parametric two-way ANOVA was conducted to explore interaction effects between variables. However, in cases where these assumptions were not met, the analysis was redirected to non-parametric tests, such as the median test. When significant differences emerged from ANOVA, a Post Hoc Test was employed to pinpoint which specific groups differed significantly using the Bonferroni test for homogeneous data,

and the Games-Howell test when data were heterogeneous. For the qualitative data, a thematic analysis was used to systematically examine patterns and themes derived from the interviews, observations, and document analysis. This method enables the researcher to interpret rich narrative data and uncover underlying meanings within participant responses. The thematic analysis followed six key stages: 1) familiarizing with the data, 2) generating initial codes, 3) searching for themes, 4) reviewing themes 5) defining and naming themes, 6) producing the final analytical report. This rigorous process ensures the credibility and depth of the qualitative findings and complements the quantitative results by offering insights into students' lived experiences, perceptions, and the effectiveness of learning strategies from their own perspectives.

RESULTS AND DISCUSSION

RESULTS

Descriptive statistical analysis was initially conducted to summarize and visualize the characteristics of both independent and dependent variables. This analysis does not aim to generalize findings to the broader population but rather to provide a detailed snapshot of the dataset being examined. The summary of descriptive statistics is presented in the following table:

Table 1. Descriptive Statistics

Learning Styles	Gender	Mean	Std. Deviation
Kinesthetic	Male	84.33	5.007
	Female	84.11	4.106
	Total	84.20	4.313
Visual	Male	80.00	1.581
	Female	87.50	3.028
	Total	85.00	4.472
Auditory	Male	85.00	3.742
	Female	86.33	4.610
	Total	85.80	4.195
Total	Male	83.29	4.210
	Female	86.04	4.050
	Total	85.00	4.280

Referring to the data presented in the table above, it can be interpreted that the average scores of male and female students with a kinesthetic learning style are 84.33 and 84.11, respectively. The corresponding standard deviations are 5.007 for males and 4.106 for females. This results in a combined average score of 84.20 with a standard deviation of 4.313, indicating moderate consistency within this group. Meanwhile, students categorized under the visual learning style demonstrate a mean score of 80.00 for males and 87.50 for females. The standard deviation values are relatively lower for both genders, at 1.581 for males and 3.028 for females, yielding a total average of 85.00 with a standard deviation of 4.472. This suggests slightly higher variation within this group, especially between genders. As for students with an auditory learning style, male participants averaged 85.00, while their female counterparts scored slightly higher with an average of 86.33. The respective standard deviations are 3.742 and 4.610, with a combined mean of 85.80 and a standard deviation of 4.195 indicating relatively consistent performance across genders. Aggregating the data across all three learning styles, the overall average scores for male and female students are 83.29 and 86.04, respectively. The combined mean stands at 85.00, with a standard deviation of 4.280, suggesting a relatively moderate dispersion of scores from the central tendency.

The mean value serves as a measure of central tendency, representing a general or typical value within each group. This is particularly useful in comparative analysis across groups differentiated by gender and learning styles. Meanwhile, the standard deviation provides insight into the extent of variation or dispersion within each group. A higher standard deviation implies greater variability or inconsistency in the dataset, indicating that individual scores deviate more significantly from the average. Conversely, a lower standard deviation reflects tighter clustering of data around the mean, signaling higher consistency and uniformity in learning outcomes. Therefore, by examining both the mean and standard deviation, researchers can better assess not only the performance levels of students with different learning styles but also the degree of consistency within each group. This analysis is essential in determining the reliability and effectiveness of instructional strategies tailored to specific learning styles in enhancing early childhood numeracy skills.

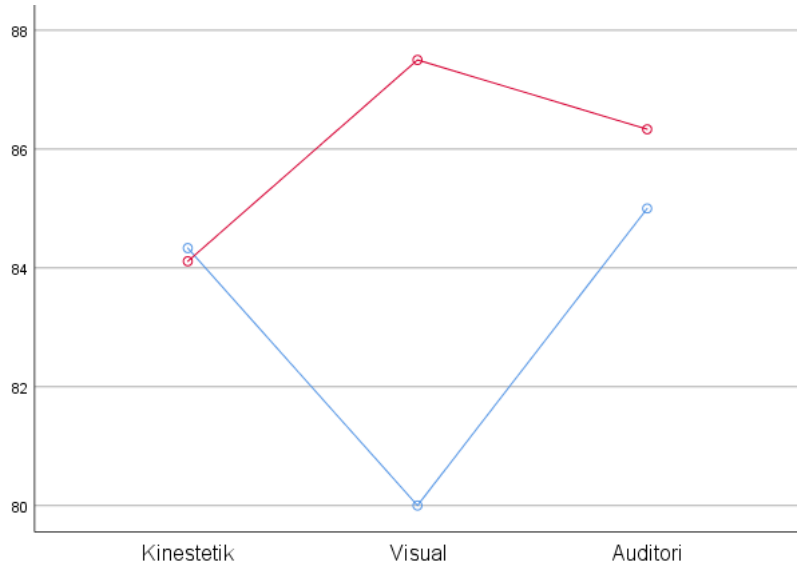

Figure 2. Estimated Marginal Means

Referring to the illustration above, male and female students are represented by blue and red colors, respectively, to distinguish their average scores across different learning styles kinesthetic, visual, and auditory. The visualization clearly shows the distribution of learning outcomes based on gender and preferred learning approach. For male students, the highest average performance is observed when using the auditory learning style, followed by the kinesthetic style, while the lowest scores appear in the visual learning category. This suggests that auditory-based instruction tends to be more effective for male students in developing their numeracy skills compared to other styles. Such graphical representation not only aids in comparing academic outcomes between genders but also highlights potential patterns or preferences in learning styles that could inform more personalized and adaptive teaching strategies for early childhood education. Meanwhile, female students showed that the superior average value was learning that used the application of visual learning styles, then auditory, and the lowest was kinesthetic. The learning style intersects with the learning media used in students' numeracy skills. Where the kinesthetic learning style uses manipulative learning media, then the visual learning style uses digital learning media, while the auditory learning style uses song and movement learning media.

Table 2. Between Subjetcs Factors

Learning Styles	Gender		Total
	Male	Female	
Kinesthetic	6	9	15
Visual	5	10	15
Auditory	6	9	15
Total	17	28	45

Based on the table above, it can be seen that the number of male and female students in learning using kinesthetic and auditory learning styles is 6 and 9 while in visual learning styles is 5 and 10 so that the total number of male and female students in this study is 17 and 28.

Table 3. Tests of Normality

	Kolmogorov-Smirnov[a]		Shapiro-Wilk	
	Statistic	Sig.	Statistic	Sig.
Standardized Residual	.081	.200*	.955	.079

Referring to the table above, the statistical results for the Kolmogorov-Smirnov and Shapiro-Wilk tests are 0.081 and 0.955, respectively, with significance values of the standardized residuals at 0.200 and 0.079, both exceeding the 0.05 threshold. According to the established decision criteria, these values indicate that the data follows a normal distribution. This conclusion is further supported by the data pattern shown in the Normal Q-Q plot as presented below.

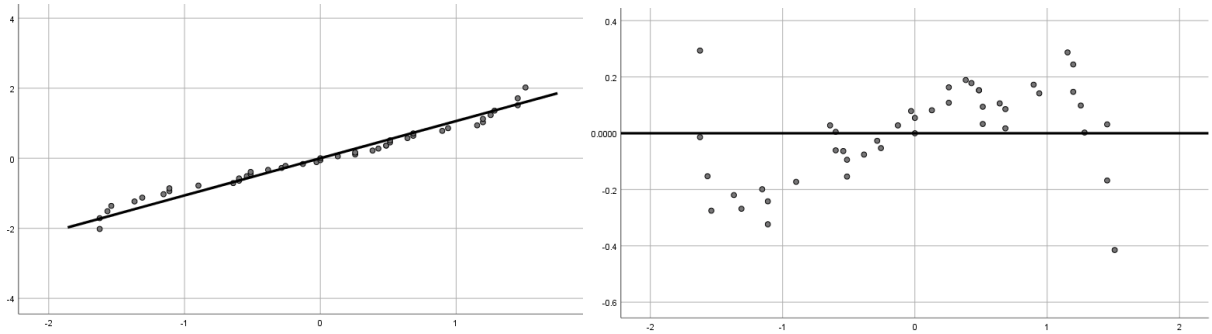

Figure 3. Normal Q-Q and Detrended Normal Q-Q Plots of the Standardized Residuals

From the diagram, it is apparent that the data points are dispersed around the line, with most of them closely aligned to it. This indicates that the standardized residuals follow a normal distribution. Therefore, the next step involves performing a parametric statistical test using the two-way ANOVA.

Table 4. Presents the Levene's Test for Equality of Error Variances.[a,b]

	Levene Statistic	Sig.
Based on Mean	2.551	.043
Based on Median	1.774	.141

	Levene Statistic	Sig.
Based on Median and with adjusted df	1.774	.148
Based on trimmed mean	2.541	.044

Based on the table above, it can be seen that the value of based on mean has a significance of 0.043 <0.05 so it can be said that the data does not have the same variance or can be said to be inhomogeneous.

Table 5. Tests of Between-Subjects Effects

Source	Mean Square	F	Sig.
Learning style	14.013	.922	.406
Gender	86.670	5.703	.022
Learning style*Gender	57.118	3.758	.032

Referring to the table above, the significance value for learning styles is 0.406, which is greater than 0.05. This indicates that there is no significant difference in early childhood counting skills when using kinesthetic, visual, and auditory learning styles. The absence of significant differences suggests that while children may have varying preferences for learning styles, these preferences do not appear to significantly impact their ability to perform counting tasks. This finding aligns with the notion that at an early age, the development of foundational skills, such as counting, may be more influenced by other factors, such as age, cognitive development, or the learning environment, rather than the specific learning style used. It may be that young children, particularly those in early childhood settings, benefit from a broad, multi-sensory approach to learning, which includes elements from all three styles kinesthetic, visual, and auditory without one style being distinctly superior to the others in fostering counting ability. However, the data shows a different outcome when examining the relationship between gender and learning style, as well as the interaction between learning styles and student gender. The significance value for gender and learning style * student gender interaction shows values of 0.022 and 0.032, respectively, both of which are less than 0.05. This suggests that there is a significant difference in early childhood counting ability between male and female students. Furthermore, it indicates that the effectiveness of learning styles in improving counting skills is influenced by the gender of the student. The gender-specific differences in learning outcomes may be attributed to a variety of biological, social, and cognitive factors that shape how male and female students engage with and respond to different learning stimuli.

In particular, the interaction between learning styles and gender highlights the importance of tailoring educational strategies to better suit the needs of both male and female students. The application of learning styles, when combined with gender-sensitive teaching methods, can result in a more effective learning experience for children. For example, male students may show a preference for kinesthetic or auditory learning, which aligns with more active, movement-based learning strategies, while female students may excel with visual learning styles that involve observation and attention to detail. By recognizing these gender-based differences, educators can more effectively apply learning media and tools that resonate with each student's individual learning preferences, ultimately enhancing their counting abilities. This finding underscores the importance of considering both gender and learning style when designing early childhood curricula. By incorporating a range of learning styles and accounting for gender-specific needs, educators can create a more inclusive and supportive learning environment that fosters the development of essential skills, such as counting, in all students. In essence, this study supports the notion that an individualized, gender-sensitive

approach to education, which takes into account both learning preferences and gender differences, can lead to improved academic outcomes for young learners.

Interviews with teachers and parents at Inpres Mannurukki Kindergarten show that children with kinesthetic learning styles are more active in understanding counting concepts when using real props such as number blocks or beads. One of the teachers stated,

> *"Children with kinesthetic learning styles grasp concepts faster if they can manipulate objects directly. In class, I often use number blocks and finger plays to make it easier for them to understand numbers and simple operations."*

Apart from that, some parents also realized that their children understood maths concepts more easily when learning through movement. One mum said,

> *"My son prefers to learn counting by using real objects. If he only listens or looks at pictures, he gets bored quickly."*

At TKIT At-Tibyan, children with visual learning styles respond better to digital media such as interactive learning videos. One teacher revealed,

> *"We often use projectors and interactive animated videos when teaching counting concepts. Children who have a visual learning style find it easier to understand the material if they see bright colours and interesting illustrations."*

One parent added,

> *"My son is more focused when learning to count with animation-based apps, compared to just hearing instructions. He can practice on his own at home with interesting digital number games."*

Teachers at TKIT At-Tibyan also noted that children with visual learning styles tend to be more interested in books with interesting illustrations and illustrated number cards.

Meanwhile, at Bone Kindergarten, children with auditory learning styles find it easier to understand counting concepts through songs and rhythms. One teacher stated,

> "Using counting songs really helps auditory children to remember number sequences better. We often sing maths songs before starting the lesson."

Parents also recognise the benefits of this method. One parent shared her experience,

> *"I often hear my son singing the counting songs he learnt at school, even while playing at home. It helps him remember numbers and addition concepts faster."*

In addition, teachers in all the schools studied observed that children with kinesthetic learning styles often find it more difficult to sit still for long periods of time, so learning methods that involve physical movement are essential to maintain their focus. One of the teachers at Inpres Mannurukki Kindergarten mentioned,

> *"I find kinesthetic children understand concepts more easily when they can move and use props, rather than just looking at pictures or listening to explanations."*

These interviews show that each learning style has an effective learning strategy if it is tailored to the child's needs. Teachers and parents at Inpres Mannurukki, TKIT At-Tibyan and TK Bone play an important role in providing appropriate learning media so that children can more easily understand counting concepts according to their learning preferences.

DISCUSSION

The results of descriptive statistical analysis indicate that each kinesthetic, visual and auditory learning style has different characteristics in influencing early childhood counting skills. Kinesthetic learning styles tend to provide more optimal stimulation through motor and manipulative activities, so that children more easily understand counting concepts through direct experience. Meanwhile, children with visual learning styles show improved counting skills when presented with media rich in images, colours and visual symbols that support the understanding of concepts concretely. On the other hand, auditory learning styles show a

significant influence on children who are more responsive to verbal explanations, songs, or rhythms related to numbers. This finding aligns with the learning style theory proposed by Fleming, which suggests that variations in learning styles can influence the effectiveness of the learning process, especially during early childhood a critical period for cognitive development. Therefore, it is essential for educators to identify the dominant learning styles of children early on, enabling them to tailor teaching strategies to optimize the development of numeracy skills in a more effective manner. The data reveals that male students with auditory learning styles have higher average learning outcomes compared to those with other learning styles, while female students excel with visual learning styles. This supports the research by Wenren et al. (2024) which highlights that individual learning styles are influenced by various factors such as gender, environment, and the teaching methods employed.

Kinesthetic learning style involves learning through physical activity and direct interaction, such as handling, moving, touching, and experiencing (Prayetno et al., 2024). Students who exhibit a kinesthetic learning style tend to prefer receiving information through movement or touch. For these students, hands-on activities and physical involvement can significantly enhance their learning achievements. Kinesthetic learners often express phrases like, "I can relate to that," "I'm struggling with this problem," "Please give me a real-life example," "I’m not quite sure," or "Let me try it myself before deciding". These expressions reflect their preference for active participation in the learning process, as they wish to experience and explore concepts directly (N. I. P. Nurhikmah, 2025). Children with kinesthetic learning styles typically grasp mathematical concepts more effectively when they engage in hands-on activities, such as using manipulatives. According to Piaget, early childhood is characterized by the preoperational stage, where abstract concepts are better understood when presented through concrete experiences (Buzzoni, 2021; Hazmi, 2023; Hinojoza, 2020; Marinda, 2020; Ratcliff, 2020; Suparno, 2001; Winstanley, 2023, 2024). Teachers at Inpres Mannurukki Kindergarten corroborate this by noting that tools like number blocks and finger plays help children better comprehend numbers and basic mathematical operations.

On the other hand, children with visual learning styles excel in understanding material presented through visual aids, such as pictures, diagrams, or digital media. Visual learners absorb information by looking, observing, and engaging with visual content. Essentially, this style of learning is focused on seeing whether it’s through images, charts, demonstrations, or videos. Behaviourist learning theory also supports visual learning styles. Learning is the result of stimulus and response. Providing information through pictures or diagrams is a stimulus in a visual learning style as a response to receiving this information is the student's learning achievement. Visual learning style plays a significant role in helping students retain the material they directly observe, leading to positive effects on their learning outcomes (Supit et al., 2023). The theories mentioned above align with the findings of this study, where visual learning style (X1) is identified as a crucial factor influencing student learning achievement (Y). Research by Waite-Stupiansky (2022) suggests that visual learners tend to be more effective at understanding information when it is presented through engaging colors and images. At TKIT At-Tibyan, the integration of digital media, such as interactive animated videos, has been shown to enhance the understanding of students with visual learning preferences. One teacher mentioned that children exhibit better focus when they are presented with visually appealing illustrations, compared to only hearing verbal explanations.

In contrast, children with auditory learning styles grasp counting concepts more effectively through listening, such as via songs or rhythmic activities. The auditory learning style plays a significant role in influencing student learning achievement, as students with this style are more adept at processing and retaining information through listening (Rosdiana et al., 2022). For these learners, auditory input is a primary avenue for acquiring knowledge, and they

typically learn best when engaging with verbal content. This is especially true for auditory learners, whose hearing ability is crucial in helping them absorb and comprehend information. The ear, with its intricate components, such as the auricle, ear canal, eardrum, and hearing bones, plays a vital role in transmitting sound stimuli to the brain. These stimuli are then processed by the brain, which interprets them as meaningful information. Consequently, students with auditory learning styles benefit greatly from listening activities, which facilitate the processing, retention, and application of information. This, in turn, leads to improved learning outcomes, as their ability to process sound is directly connected to their academic success. The theoretical frameworks that support this concept further emphasize the role of auditory learning styles as a crucial factor in determining student learning achievements (X2).

In line with this, Gardner's theory on multiple intelligences suggests that children with musical intelligence are particularly skilled in absorbing information through rhythm, melody, and sound (Tamphu et al., 2024). This aligns with the findings of this study, where children with auditory learning styles excel in processing and recalling information through auditory cues. For example, data from Bone Kindergarten demonstrates that counting songs significantly enhance the ability of auditory learners to memorize and recall number sequences. Teachers at this school have noted that children often sing counting songs even outside of learning sessions, which not only reinforces their understanding of numbers but also encourages a deeper connection to the material. This spontaneous use of song and rhythm highlights how effective auditory stimuli can be in enhancing students' learning experiences and in solidifying their knowledge of abstract concepts like numbers. The strong connection between musical intelligence, rhythm, and auditory learning further underscores the importance of incorporating auditory methods into teaching strategies to cater to these students' learning preferences.

The results of the statistical test revealed a significant difference in the ability to calculate between male and female students ($p = 0.022 < 0.05$). According to Almulla & Al-Rahmi (2023) this difference may stem from both biological and social factors. Boys tend to be more active and engaged in movement-based learning (kinesthetic), whereas girls often prefer more structured ways of processing information through visual and auditory methods. In this study, male students performed best with an auditory learning style, while female students excelled with a visual learning style (N. Nurhikmah, 2024). This suggests that personalized learning methods, tailored to both learning styles and gender, can enhance the effectiveness of education. This view is further supported by research conducted by Fauzi et al. (2025) which indicates that gender differences in learning styles often manifest as distinct preferences in learning approaches. Males are generally more inclined toward learning activities that involve physical or manipulative tasks, while females tend to respond better to methods involving visualization and verbal explanations. By acknowledging and addressing these differences, educators can design more adaptive learning experiences that cater to the unique needs of individual students.

Additionally, research by Arif et al. (2023), Mutaqin et al. (2024), and Pancawardana et al. (2023) on gender differences in cognitive domains highlights that, although learning styles differ, these distinctions are generally small and heavily influenced by social and cultural factors. This suggests that learning style preferences linked to gender may be shaped more by societal expectations and the educational environment than by inherent biological differences. Therefore, adopting an approach that recognizes both gender and learning style differences is essential in creating an inclusive learning environment that supports the optimal development of all students.

CONCLUSION

The results of the descriptive statistical analysis reveal differences in early childhood learning style preferences for understanding counting concepts. Children with kinesthetic learning styles prefer using manipulative teaching aids, those with visual learning styles engage better with digital media and illustrations, while children with auditory learning styles grasp concepts more easily through songs and rhythms. The normality test results indicate a normal distribution of data, allowing for the use of parametric statistical analysis with the Two-Way ANOVA test. The analysis found no significant difference in numeracy skills among the different learning styles (kinesthetic, visual, and auditory). However, significant differences were observed based on gender and the interaction between learning style and gender, suggesting that gender influences children's learning style preferences in numeracy. Boys generally excel in auditory and kinesthetic styles, while girls perform better with visual learning styles. This study highlights the need for a differentiated learning approach that considers both learning style and gender characteristics. Teachers and parents should be aware of children's learning style tendencies to provide suitable learning media. Additionally, the study supports the effectiveness of multi-sensory learning strategies in enhancing early childhood numeracy comprehension.

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