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Implementation of Natural Material Media for Understanding Number Concepts in Early Childhood 2-3 Years at SPS Al-Wildan Manyarsidomukti

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Abstract

Early numeracy learning for children aged 2–3 years requires concrete media that support sensory exploration and meaningful understanding of numbers. This study aims to describe the implementation of natural materials in improving number concept comprehension among young children at SPS Al-Wildan Manyarsidomukti. A qualitative case study approach was applied using participatory observation and documentation to capture children's responses during activities involving counting, comparing quantities, matching numbers, and reciting number sequences. The findings indicate that natural materials such as stones, leaves, shells, and sand enhance children's engagement, motivation, and ability to recognize numbers up to three, distinguish more and less, and correctly order numbers. Overall, natural materials are effective contextual learning media that support the early development of numeracy skills.

Kata kunci:
bahan alam, konsep bilangan, anak usia dini, numerasi, pembelajaran konkret

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Abstrak

Pembelajaran numerasi pada anak usia 2–3 tahun memerlukan media konkret yang dapat mendukung proses eksplorasi sensorik dan pemahaman bilangan secara nyata. Penelitian ini bertujuan mendeskripsikan implementasi media bahan alam dalam meningkatkan pemahaman konsep bilangan pada anak usia dini di SPS Al-Wildan Manyarsidomukti. Penelitian menggunakan pendekatan kualitatif studi kasus melalui observasi partisipatif dan dokumentasi untuk menggambarkan respons anak selama kegiatan menghitung, membandingkan jumlah, mencocokkan angka, dan menyebutkan urutan bilangan. Hasil penelitian menunjukkan bahwa media bahan alam seperti batu, daun, kerang, dan pasir mampu meningkatkan keterlibatan, motivasi, dan kemampuan anak dalam mengenali bilangan hingga tiga, membedakan banyak dan sedikit, serta mengurutkan angka secara benar. Kesimpulannya, media bahan alam efektif sebagai alternatif pembelajaran kontekstual yang mendukung perkembangan numerasi anak usia dini.

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PENDAHULUAN

Early childhood education (PAUD) represents a crucial stage in cognitive development, including strengthening understanding of fundamental number concepts. Between the ages of 2 and 3, children experience an intensive developmental phase, where concrete experiences and sensory interactions play a significant role in establishing the foundations of numeracy. However, data from the Indonesian Ministry of Education and Culture indicates that young children, particularly in rural areas, still experience difficulties in internalizing basic number concepts. This condition is generally caused by limited direct experience, a lack of engaging learning media, and a lack of innovation in classroom teaching methods (Kurnia, 2022). A similar situation is seen at the Al-Wildan Student Development School (SPS) in Manyarsidomukti Village, where limited educational infrastructure and human resources mean that learning activities still rely on conventional media such as picture books and plastic toys. As a result, the learning process fails to provide effective manipulative stimulation to foster children's curiosity and numeracy understanding.

In the context of early childhood education (PAUD) classrooms, number understanding in children aged 2–3 years includes the ability to count numbers 1–10, count concrete objects, recognize number symbols, and understand the concept of many and few through everyday activities. Children learn to count through direct experiences, such as counting stones, leaves, or objects in their environment, while beginning to understand the quantitative meaning of each number. For example, when children take three leaves and then add or subtract the number, they are building an intuitive understanding of simple addition and subtraction (Aziz et al., 2024; Aziz & Amir, 2025). These activities are ideally supported by concrete media so children can explore and form correlations between number symbols and the number of real objects. At the SPS Al-Wildan institution, such media has not been widely implemented due to limited facilities and reliance on manufactured media, such as beads and blocks. However, the use of media based on natural materials such as stones, leaves, grains, or sand can be a contextual and engaging solution for children in rural environments. (Widyastuti & Rahmawati, 2024). In addition, the understanding of concepts in SPS Al-Wildan tends to be still incomplete, among the 17 children who are able to count, there are 13 children and 4 children who are not yet able to.

Based on the Child Development Achievement Level Standards (STPPA) stipulated in the Regulation of the Minister of Education and Culture Number 137 of 2014, children aged 2–3 years are expected to be able to recognize the concept of many and few, count objects 1–10 concretely, and begin to recognize number symbols and match them with the number of objects. Research by Patiung et al. (2019) also confirms that at this age, cognitive achievement is often not optimal due to the lack of learning media support that is appropriate to the characteristics of child development. Thus, the implementation of natural material media available in the child's environment can help children achieve these development standards through fun and ecologically sustainable exploratory activities.

Several previous studies have also emphasized the importance of using appropriate media to improve early childhood number comprehension. Roostin (2021) in his research at Kober Mentari Preschool Sumedang used Montessori Number Rods and found an improvement

in the number concept skills of 3–4-year-old children. However, this media was ready-to-use and did not reflect the use of local resources. Chodijah (2021) research also showed that the use of natural materials was effective in improving early math skills in 4–5-year-old children through Bruner's theory approach, but this was in an urban setting with more adequate facilities. Meanwhile, Syarfina et al. (2023) at Nurul Aisyah Preschool, East Aceh, used digital games to improve numeracy in 4–5-year-old children with significant results. The main difference with this research lies in the context and approach of the study at SPS Al-Wildan, which focused on 2–3-year-old children in a rural area with limited facilities. The use of readily available natural materials as a learning alternative was economical, relevant, and sustainable.

Thus, this study is important to investigate in more depth the impact of the implementation of natural materials media on the understanding of number concepts in children aged 2–3 years at SPS Al-Wildan, Manyarsidomukti Village. This approach is expected to contribute to developing numeracy teaching strategies that are more contextual, interesting, and appropriate to the needs of early childhood, as well as being part of efforts to improve the quality of PAUD in rural areas of Indonesia (Rahim, 2025)Therefore, the researcher wants to know the implementation of the application of natural materials media on the understanding of number concepts in children aged 2–3 years at SPS Al - Wildan, Manyarsidomukti Village.

RESEARCH METHODS

This research applies a qualitative research method with a case study approach. Qualitative methods emphasize an in-depth understanding of social phenomena based on participant perspectives, rather than simply quantitative measurements or statistical data. According to Malahati et al. (2023), qualitative research aims to explore and understand the meanings individuals or groups deem significant regarding a social or humanitarian issue. This approach emphasizes the natural setting, where the researcher acts as the primary instrument in data collection and analysis (Kaharuddin, 2021). Qualitative research is used when researchers want to understand the behavior, perceptions, motivations, or actions of subjects holistically and descriptively through words, not numbers. Therefore, this method is highly relevant in early childhood learning research because it can provide an in-depth description of children's learning processes in natural contexts, such as when using natural materials in the classroom (Vyanti et al., 2025). In this research context, a qualitative approach was applied to understand how the use of natural materials can influence the understanding of number concepts in children aged 2–3 years. Through direct observation, researchers can comprehensively describe children's behavior, interaction processes, and learning outcomes. (Shafura & Adhani, 2022).

The type of research used is a case study, a method that focuses on an in-depth study of a particular object, event, or group to understand the phenomenon contextually and realistically. Yin (2018) defines a case study as a research approach used to understand contemporary phenomena in a real-life context, especially when the boundaries between phenomenon and context are not clearly apparent. In this study, the case studied is the process of implementing natural materials media at SPS Al-Wildan, Manyarsidomukti Village, as an effort to understand the concept of numbers for children aged 2–3 years. This case study was chosen because it is

able to describe in detail how environmental-based media can be integrated into early childhood numeracy learning in rural areas with limited facilities (Jayanti et al., 2022).

The data in this study were obtained through two main techniques: observation and documentation. Observations were conducted directly in the children's learning environment to observe activities during the learning process using natural materials such as stones, leaves, and seeds. The type of observation used was participatory observation, in which the researcher was present and involved in the activities to record the children's behavior, responses, and interactions while learning to count and recognize numbers (Jalil et al., 2025). This process enabled the researcher to obtain authentic empirical data regarding children's involvement and the effectiveness of the media used. Furthermore, documentation was conducted to complement the observation results and by collecting visual evidence in the form of photos of activities, notes on children's development, and learning outcomes that reflected an increase in understanding of number concepts before and after the use of natural materials. This approach serves to strengthen the validity of the data and ensure that the analysis conducted is objective and comprehensive regarding the dynamics of the learning process. ((Widyastuti & Rahmawati, 2024).

The data analysis in this study used an interactive model from Zulfirman (2022) which involves three main stages: data reduction, data presentation, and conclusion drawing. In the data reduction stage, the researcher selected, focused, and simplified the raw data obtained from observations to align with the research focus on the effect of using natural materials on children's understanding of number concepts in 2–3-year-olds. Furthermore, in the data presentation stage, the reduced information was organized into a descriptive narrative that clearly illustrates how natural materials were applied in the learning process and how children responded to these activities. The final stage was conclusion drawing, in which the researcher interpreted the findings to answer the research problem formulation. The analysis process was carried out continuously from the beginning to the end of the study to ensure the accuracy of data interpretation. To ensure the validity of the results, triangulation of sources and methods was carried out by comparing data from observations and documentation, so that the research results have high validity and credibility. (Qomaruddin & Sa'diyah, 2024).

The research was conducted at SPS Al-Wildan, Manyarsidomukti Village, with 17 children aged 2–3 years and one teacher assistant as subjects. This location was chosen because it represents the conditions of early childhood education in rural areas which are still limited in the use of innovative learning media. Children in this institution show variations in numeracy skills, making it an ideal context to observe the effectiveness of natural material media in learning (Patiung *et al*., 2019). The following assessment instruments were used in the research:

Table 1.
Assessment Instrument for the Implementation of Natural Material Media on Number Understanding in Early Childhood 2-3 Years at SPS Al-Wildan

No	Evaluation Aspects	CP	TP	Assessment Indicators	BB	MB	BSH	Information
1	Get to know the concept of	Children begin to recognize	Children can count and name the	Children can name objects up	☐	☐	☐	Children count while pointing to objects

	numbers 1-10 using natural materials (stones, leaves, seeds)	the sequence of numbers and the number of objects in everyday life.	number of simple objects made from natural materials.	to 3 using natural materials.				(example: "one, two, three").
2	Distinguishing between many and few through natural objects	Children are able to differentiate the number of objects in two small groups.	Children can match numbers (1–10) with the number of objects made from natural materials.	Children can show groups that are larger than two sets of objects.	☐	☐	☐	The child says "this is a lot, this is a little" when looking at two piles of leaves.
3	Connecting number symbols with the number of objects	Children begin to recognize the shape of number symbols visually.	Children can match numbers (1–10) with the number of objects made from natural materials.	Children are able to place numbers according to the number of objects available.	☐	☐	☐	The child sticks the number "2" under two small stones.
4	Saying the sequence of numbers with songs or games with natural materials	Children are able to follow the number sequence verbally.	Children can say the numbers 1–10 in sequence through songs or games.	The child correctly says the sequence "one, two, three" while playing.	☐	☐	☐	Children sing along while pointing to objects according to the number.

Score Description:

BB (Not Yet Developed) : The child has not shown the abilities according to the indicators.

MB (Starting to Develop) : The child tries to do it but still needs guidance

BSH (Developing According to Expectations) : The child is able and consistent in doing it independently

RESEARCH RESULTS AND DISCUSSION

Results

From this study, the results of the indicator stating the number of objects using natural materials media were obtained, NBL initially lacked response and the teacher motivated him by taking shells to form numbers according to the picture he saw, then the child began to follow what the teacher did until he formed the number 3 from the shells and when using sand media,

the child's face showed a smiling expression. EK in carrying out the activity was initially less interested and the teacher motivated and accompanied him in taking the material he chose, buttons, after that the child took the buttons to form the number 3 according to the picture he saw, when carrying out the activity the child initially pouted after finishing the child smiled and was cheerful. OM initially did not want to do what the teacher ordered, then the teacher helped him try to form the number 3 in the sand using his finger, then the child wanted to try again by himself and he showed a smiling expression. AKY in carrying out the activity was initially still pouting and less interested when using flour media but was willing to try with the teacher's help, when using shell media the child wanted to try alone even though still with a non-smiling expression.

Indicators of children's ability to show a larger group of objects, NBL and EK took stones and shells according to the teacher's instructions, then the child pointed to the shells that were more numerous after the teacher's guidance. AKY and OM when taking objects needed direction and assistance from the teacher, when pointing to more objects the child responded well but still needed assistance from the teacher.

The ability to place numbers according to the available objects from 4 children was able to place 1 appropriate number from 2 objects provided by the teacher. When doing the activity, EK and NBL showed a smiling expression, while OM and AKY did not have a smiling expression. The child's indicator was to mention the order of one, two, three correctly while playing. NBL and EK pointed to the numbers one and two correctly while singing with movements and songs with a cheerful smiling expression. AKY and OM, even with the teacher's help, were willing to order one and two numbers even without playing the song.

Based on the evaluation results of the application of natural materials media to the understanding of number concepts in children aged 2–3 years, all children showed progress in each indicator assessed. In the first aspect, namely the ability to name the number of objects up to three using natural materials media, children such as NBL, EK, OM, and AKY were all at the early stage of development, which indicates that they are beginning to be able to recognize and count the number of simple objects. In the second indicator, namely the ability to indicate groups of objects that are more than two sets, all four children also showed the early stage of development, which indicates a basic understanding of comparison of numbers.

The third indicator, which assesses children's ability to place various objects according to their quantity, again shows that all children are in the early stages of development, so it can be said that the ability to match quantities with real objects is beginning to emerge. In the final aspect, namely the ability to say the number sequence "one, two, three" while playing, all children also showed an early stage of development, indicating that they are beginning to understand simple number sequences. Overall, the use of natural materials media makes a positive contribution to supporting the early development of number concepts in children aged 2–3 years.

Table 2.
Assessment Results of the Implementation of Natural Materials Media on Number Understanding in Early Childhood 2–3 Years

No	Indicator	Child's Name											
		NBL			EK			OM			AKY		
		BB	MB	BSH	BB	MB	BSH	BB	MB	BSH	BB	MB	BSH
1	Children can name objects up to 3 using natural materials.		v			v			v			v	
2	Children can show groups that are larger than two sets of objects.		v			v			v			v	
3	Children are able to place numbers according to the number of objects available.		v			v			v			v	
4	The child correctly says the sequence "one, two, three" while playing.		v			v			v			v	

Discussion

Based on observations of learning activities at SPS Al-Wildan, Manyarsidomukti Village, all children showed positive development after implementing natural materials in the learning process regarding number concepts. Of the four students, Nbl, Ek, Om, and Aky, all began to develop the expected developmental milestones, namely being able to recognize and name numbers, letters, and geometric shapes through objects around them. This improvement indicates that natural materials-based learning activities have a positive influence on children's cognitive abilities, especially in recognizing number concepts in a concrete and meaningful way. Children who were previously only able to imitate or say numbers without understanding their meaning are now beginning to develop in associating number symbols with the number of real objects. After utilizing natural materials such as stones, leaves, seeds, twigs, and sand, children began to develop the ability to recognize, pronounce, and differentiate numbers more effectively. Each child appeared more active in counting objects in their environment, arranging stones or leaves according to the number mentioned, and began to demonstrate an understanding of the concepts of "more" and "less" (Kurnia, 2022).

The results of this study indicate that the use of natural materials in teaching basic mathematics (such as number recognition, quantity comparison, and sequencing) has a beneficial effect on participation, enthusiasm, and cognitive development in early childhood. Although there are differences in responses and levels of engagement among children, overall, these activities are effective in capturing children's attention and supporting their understanding of number concepts and comparing quantities of objects. The following is a comprehensive analysis based on the observed indicators.

The use of natural materials such as shells, buttons, sand, and flour introduced by the teacher enables children to arrange numbers based on objects they see. This is in line with research showing that the use of concrete media can increase children's attention and understanding in learning about numbers and quantities (Ramadhani et al., 2024). The change

in children's expressions from initially being less interested to smiling illustrates the positive influence of media on children's participation (Sugiarti et al., 2025). The concept of comparing various objects that begins to be understood with teacher support is in accordance with research that emphasizes the importance of scaffolding in teaching number concepts to preschoolers (Hidayah et al., 2025; Vygotsky, 1978). Children need guidance to clarify their understanding of quantities that are still dependent. (Zuhra et al., 2023).

Children's ability to match numbers to available objects is still in its infancy, with a success rate of approximately 50% (Yuliarti, 2018). Research conducted by (Supiati et al., 2022) shows that symbolic skills such as number placement require gradual practice and emotional support to build self-confidence. The use of songs and movements strengthens children's ability to recognize number sequences, which is supported by research in child cognitive development psychology that explains the effectiveness of multisensory integration in number learning. (Shalilihat et al., 2023).

Learning processes involving natural materials have been shown to provide direct experiences that are rich in sensory stimulation. Children not only memorize numbers verbally, but also associate numbers with concrete representations that they can touch and observe directly. For example, when children are asked to take three stones and add one more, they understand that the number increases to four. Simple activities like this reinforce basic addition concepts through empirical experience. This is in line with Jerome Bruner's learning theory, which emphasizes the significance of the enactive stage in the learning process, where children understand concepts through direct action before moving on to symbolic representations (Chodijah, 2021).

Furthermore, natural materials-based learning activities at SPS Al-Wildan also increase children's motivation to learn and curiosity. Children appear enthusiastic when exploring their environment to collect learning materials such as small stones, leaves, or twigs. This process not only fosters a spirit of collaborative learning but also trains children's social skills in working together and communicating with their peers. Educators play a crucial role in facilitating the activities by providing simple verbal guidance, such as "try counting how many leaves you picked up" or "which has more, stones or seeds?" This communicative approach helps children reinforce the meaning of numbers in an authentic and relevant context. (Widyastuti & Rahmawati, 2024).

Overall, the developmental outcomes showed that each child, including Nbl, Ek, Om, and Aky, could identify and pronounce numbers, letters, and geometric shapes through surrounding objects after implementing learning with natural materials. This is in line with the findings of Roostin (2021) who reported an increase in number concept abilities in children aged 2–3 years using Montessori Number Rods concrete media, although in the context of this study the media used came from the natural environment, making it more contextual and economical. These results also support the findings of Chodijah (2021) who showed that natural materials are effective in improving early childhood mathematics abilities through an exploratory approach based on Bruner's theory.

The improvements that occurred in the children of SPS Al-Wildan are also in accordance with the Child Development Achievement Level Standards (STPPA) as stated in Permendikbud No. 137 of 2014, which states that children aged 2–3 years are expected to be able to recognize

the concept of many and few, count objects 1–10, and identify number symbols. Research by Patiung et al. (2019) emphasized that at that age, the achievement of cognitive aspects is often not optimal due to the limited learning media that are appropriate to the characteristics of children. After the implementation of natural material media at SPS Al Wildan, children showed significant progress in achieving these development indicators (Patiung et al., 2019). In this section, the author discusses the results in the field with relevant theories or previous research results. in this section, explain in detail.

CONCLUSION

Based on observations and analysis, it can be concluded that the use of media made from natural materials is very effective in improving the cognitive abilities of children at an early age to recognize and understand the concept of numbers in a real and meaningful way. Children at SPS Al-Wildan showed significant progress after the application of natural materials such as pebbles, leaves, seeds, twigs, sand, shells, buttons, and flour in the basic mathematics learning process. This media supports children's ability to pronounce numbers, recognize number sequences, compare the number of objects, and match numbers with real objects.

The direct use of natural resources triggers sensory stimulation and provides concrete learning experiences, so that children do not just remember verbally but also connect numbers with real objects that they hold and see. Guidance from teachers and the implementation of effective play methods can increase children's motivation, interest, and curiosity, while helping them understand complex concepts with fun and appropriate methods. The most important research finding (something surprising, shocking): something that is only known after the research is conducted.

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