

Development of Numaze Media Based on Natural Materials to Improve The Concentration of Children With Autism

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ABSTRACT

This study aims to develop NuMaze media at PAUD institutions in Merauke District in improving the concentration skills of autistic children. The development method used is the ADDIE model (Analyze, Design, Develop, Implement, Evaluate). The research location was conducted at PAUD institutions in Merauke District involving four autistic children from four PAUD institutions as samples in the study. Data were obtained through interviews, observations, expert validity tests, and feasibility and effectiveness tests in the field. The results of the study showed that the assessment of validators by PAUD curriculum and learning experts, the development of children with special needs, and media development showed that NuMaze media was feasible to use, with an average score of 84% (Very Good Category). The results of the study provide implications that NuMaze media can be an effective reference in improving the concentration skills of autistic children.

Keywords: *NuMaze Media; Concentration; Autism*

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INTRODUCTION

Early childhood refers to children in the age range of 0–6 years. This stage is often referred to as the "golden age" due to the rapid development of the brain during this period. Children can grow and develop optimally when they receive early interventions provided by adults at home, in schools, and within the community. Appropriate stimulation during this critical period significantly influences a child's future growth and development. Stimulation through early childhood education can foster various aspects of development and assist children in achieving their developmental milestones more effectively.

Hurlock, as cited in Istiwidayanti & Soedjarwo, states that human development essentially involves two simultaneous processes: growth (evolution) and decline (involution). Development encompasses how individuals grow, adapt, and experience changes throughout their lives. This is supported by Santrock, who explains that development focuses more on mental processes, whereas growth refers to increases in size and structure. Development occurs throughout a person's lifespan, while growth has a

limited time frame. Monks further elaborates that development is a continuous and consistent process toward a higher level of integration, based on growth, maturation, and learning (Rahmah, 2024).

A fundamental principle of development is that its various domains are interconnected and follow certain patterns or directions. As Bredekamp affirms, children's developmental domains—intellectual, emotional, social, and physical—are closely related and influence one another (Rahmah, 2024).

Every citizen has the right to education—not only regular or typically developing children but also children with special needs (CWSN). This aligns with Law No. 20 of 2003, which guarantees equal access to quality education for all, including children with Autism. Dheasabel et al. explain that Autism, or Autism Spectrum Disorder (ASD), is a complex neurodevelopmental condition with highly variable characteristics. The term "autism" was first introduced by Leo Kanner in 1943, describing it as a condition marked by difficulties in social interaction, delayed language development, echolalia, mutism, sentence reversal, repetitive and stereotypical play behaviors, strong memory, and obsessive tendencies toward maintaining environmental order (Norlita et al., 2021).

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by challenges in social communication as well as restricted and repetitive behaviors and interests. In 2013, the DSM-5 introduced the concept of a spectrum to unify previously separate diagnoses (autism, Asperger's syndrome, childhood disintegrative disorder, and PDD-NOS) into one category. Rett syndrome was excluded due to its classification as a distinct neurological disorder. Social (Pragmatic) Communication Disorder (SPCD) was also introduced for individuals with communication issues absent of repetitive behaviors. DSM-5 added severity levels to indicate the level of support needed (Hodges et al., 2020).

Early childhood children diagnosed with autism exhibit developmental behaviors that differ from typically developing children, particularly in how they interact socially, communicate, and behave. Autism stems from neurological disruptions that affect brain function. Children with autism often show heightened sensory sensitivity, making them easily distracted and less able to focus. They tend to fixate on specific interests, which makes it difficult to transition to tasks requiring concentration, thus impeding their learning capabilities.

Rokhimah & Darmawanti suggest that autism may be linked to abnormalities in the brain, particularly in the cerebellum, which regulates balance, sensory processing, thinking, memory, learning, language, attention, and concentration (Khairiyah & Sanusi, 2022). Concentration is crucial for children with autism to stay engaged during the learning process. Imran et al. observe that children with attention difficulties often exhibit inattentive behavior, struggle to concentrate or listen, have communication limitations, fail to complete tasks, have difficulty organizing activities, and tend to avoid tasks requiring mental effort (Khairiyah & Sanusi, 2022).

Strategies to improve concentration in children with autism include sensory activities, physical movement, educational games, and play therapy. This aligns with the behaviorist perspective, which emphasizes the importance of observable and measurable

behaviors. Santrock defines behaviorism as an approach that focuses on explaining behavior through observable experiences rather than mental processes (Sutisna, 2020). Behavioral changes arising from the interaction between stimuli and responses are considered a learning experience influenced by the environment, making this perspective applicable for supporting children with autism.

Concentration plays a key role in the learning process for children with autism. Concentration difficulties can hinder the effectiveness of activities. One way to train attention is through play. According to Piaget, play is a means of enhancing children's cognitive abilities (Marinda, 2020). Through play, children can experience joy while developing cognitive skills. Moreover, play enhances children's attention span (Masrukah et al., 2020).

Choosing the right teaching methods and materials can significantly impact a child's development by improving the effectiveness of learning, increasing motivation, and helping children reach their full potential. Appropriate learning media are especially important for children with autism, who often struggle to understand abstract concepts. These tools can improve focus and reduce tantrums or withdrawal behaviors. Instructional media provide equal learning opportunities and can be an effective alternative strategy to enhance learning processes and outcomes. For children with autism spectrum disorder, instructional media can improve concentration, emotional connection, motor skills, and redirect attention to structured play (Khairiyah & Sanusi, 2022).

Play is essential in children's lives, including those with autism. One therapeutic play method for children with autism is the use of puzzles. Puzzles offer tangible, recognizable shapes that can stimulate fine motor development, enhance memory, reasoning, creativity, and focus. Srianis, Suarni, & Ujiati note that puzzles also help children recognize colors, shapes, and familiar objects (Darmayasa et al., 2020). Khomariyah describes maze games as a type of puzzle involving branching and winding paths, useful for training concentration, hand-eye coordination, and fine motor skills (Agustina & Hadis, 2023).

One effective approach for stimulating the development of children with autism is using natural materials from the surrounding environment. Oktari emphasizes that nature-based media utilize locally available resources that support the learning process (Andriani & Rakimahwati, 2023). Natural materials like stones, wood, branches, seeds, leaves, banana or papaya stems, bamboo, and sand are concrete and familiar to children, making them particularly suitable for early childhood education.

Teachers can create learning materials tailored to children's needs using available resources such as leaves, stones, sand, water, wood, and more. These materials are concrete, safe, engaging, and appropriate for children with autism. Early exposure to natural materials offers various sensory experiences—texture, temperature, scent—that support optimal sensory development. These natural materials can be used in indoor or outdoor settings, allowing children to learn, play, and connect with nature.

Based on the above rationale, the researcher is interested in conducting a study entitled: “Development of Nature-Based NuMaze Game to Improve Concentration in Children with Autism.”

METHOD

The research model used in this study is Research and Development (R&D) employing the ADDIE development model. Research and development involve the process of identifying learning needs and developing products to meet those needs (Mills, G. E., & Gay, 2016). Educational research and development is a development model that uses a research-based approach to design new products and procedures, which are then systematically tested in the field, evaluated, and revised to meet feasible, effective, and high-quality criteria (Gall et al., 2003). Research and development aim to produce specific products and test their feasibility and effectiveness (Sugiyono, 2014). Thus, research and development are models that examine learning needs and develop products that are subsequently tested for feasibility and effectiveness.

The data analysis in this study uses a mixed-method approach with a convergent parallel design, which combines qualitative and quantitative analysis processes. This research approach aims to improve existing products to be more relevant and to address problems at the research site or educational institutions through various innovative products (Sugiyono, 2014). The qualitative approach involves needs analysis through interviews and field notes, feasibility tests through expert assessments or product trials, as well as the analysis of interviews, field notes, and artifacts during the product testing phase. The quantitative approach involves effectiveness testing using a one-group pretest-posttest design to demonstrate the effectiveness of the media on a large-scale test group.

The development stage applied in this research follows the ADDIE model, a framework for instructional design procedures categorized under system design models (Richey et al., 2011). This model is designed to visually communicate the ongoing process to stakeholders by illustrating the steps that facilitate the creation of instruction. These steps emphasize five essential elements, including several processes: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation (Branch, 2009).

A. Population and Sampling Techniques

1. Research Population

The research population refers to the generalization area that includes the objects or subjects of the study, which possess specific characteristics and qualities to be examined, as defined by the researcher (Sugiyono, 2014). The population in this study consists of children with autism enrolled in early childhood education institutions (PAUD) in the Merauke District, Merauke Regency.

2. Sample

The research sample is a subset of the population that possesses the same characteristics and is selected to draw representative conclusions (Sugiyono, 2014).

The sample in this study consists of children with autism attending TKIT Permata Bunda and two nearby early childhood education institutions (PAUD).

B. Development Procedure

The design of this study refers to the objectives of research and development, which are to identify needs, develop, and validate a product. Therefore, this study employs the Research and Development (R&D) design using the ADDIE model by Robert Maribe Branch. The breakdown of the ADDIE model and its implementation by the researcher is illustrated in the following diagram:

Tabel Prosedur ADDIE

	<i>Analyze</i>	<i>Design</i>	<i>Develop</i>	<i>Implement</i>	<i>Evaluate</i>
Concept	Identify the probable causes for a performance gap	Verify the desired performances and appropriate testing methods	Generate and validate the learning resources	Prepare the learning environment and engage the students	Assess the quality of the instructional products and processes, both before and after implementation
Common Procedures	<ol style="list-style-type: none"> 1. Validate the performance gap 2. Determine instructional goals 3. Confirm the intended audience 4. Identify required resources 5. Determine potential delivery systems (including cost estimate) 6. Compose a project management plan 	<ol style="list-style-type: none"> 7. Conduct a task inventory 8. Compose performance objectives 9. Generate testing strategies 10. Calculate return on investment 	<ol style="list-style-type: none"> 11. Generate content 12. Select or develop supporting media 13. Develop guidance for the student 14. Develop guidance for the teacher 15. Conduct formative revisions 16. Conduct a Pilot Test 	<ol style="list-style-type: none"> 17. Prepare the teacher 18. Prepare the student 	<ol style="list-style-type: none"> 19. Determine evaluation criteria 20. Select evaluation tools 21. Conduct evaluations
	<i>Analysis Summary</i>	<i>Design Brief</i>	<i>Learning Resources</i>	<i>Implementation Strategy</i>	<i>Evaluation Plan</i>

C. Research Instruments

The research instruments used include observation sheets to assess children's concentration behavior while using the media, interview sheets to explore teachers' experiences, and expert validation sheets to evaluate the media's feasibility in terms of design, content, and its suitability for children with autism. The expert validation sheets involve assessments from specialists in early childhood education curriculum and instruction, special needs child development, and educational media development.

D. Data Analysis Techniques

1. Qualitative Data Analysis

The qualitative data analysis, derived from observations and interviews, follows several stages as outlined by Rijali (2018):

a) Data Reduction

Data reduction is the process of selecting, focusing, simplifying, abstracting, and transforming raw data collected from field notes. In this stage, the data will be summarized to support the development of the NuMaze game through five stages: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation.

b) Data Display

Data display involves organizing a collection of information in such a way that it allows for drawing conclusions and taking action. The development of each stage of the NuMaze game will be presented in narrative text.

c) Conclusion Drawing

Conclusions are drawn from the presented stages of the NuMaze game development.

2. Quantitative Data Analysis

a) Feasibility Test Data Analysis

The feasibility analysis of the product is conducted during the development and implementation phases, prior to large-group testing. Experts in early childhood curriculum and instruction, special needs education, and research methodology serve as references for determining the product's feasibility based on theoretical reviews. The researcher analyzes the final draft based on the total scores from the expert assessments using the feasibility instrument during media observation.

The product is considered feasible for small-scale trials if it meets the minimum feasibility standard, and will undergo another feasibility assessment before proceeding to large-scale testing. The scores are then converted into percentage values using the formula from Riduwan (2013) as follows:

$$NP = \frac{n \times 100}{N}$$

Explanation:

NP = Percentage value

n = Score obtained

N = Total score/data

The percentage result obtained will be classified to draw conclusions from the data as follows:

Feasibility Percentage Classification Table

Percentage	Criteria	Classification
0-20%	Very poor	Very unfeasible
20.1–40%	Poor	Unfeasible
40.1–60%	Fairly poor	Less feasible
60.1–80%	Good	Feasible
80.1–100%	Very good	Very feasible

Source: Fundamentals of Statistics, 2013

b) Effectiveness Test Data Analysis

The data analysis technique used in this research and development study is a combination of qualitative and quantitative analysis techniques. At this stage, the results of observations, interviews, and field notes are presented in descriptive qualitative form to clarify the existing problems. This is intended to reinforce the research problem background. During the product development process, data in the form of improvement suggestions from observers are reduced, presented, and then analyzed to draw conclusions that serve as the basis for revisions. Subsequently, the research data will be analyzed using descriptive quantitative statistical analysis with a pre-experimental one-group pretest-posttest design. The statistical analysis is carried out using the formula for the difference between two means for dependent samples, based on Kadir (2019), as follows:

$$t_o = \frac{[Y_1 - Y_2]}{\sqrt{s_y1^2 + s_y2^2 - 2r_y1y2s_y1s_y2}}$$

The result of t_o (t-obtained) will be compared with t-table as part of a one-tailed t-test, which aims to determine whether there is a significant improvement between the pretest and posttest after the implementation of the media..

FINDING AND DISCUSSION

A. Results of Needs Analysis

The needs analysis process began with data collection regarding the needs and problems encountered in the field related to the development of natural-material-based media to improve the concentration of children with autism. At this stage, identification and collection of information were conducted regarding the needs of children with autism, particularly in terms of their concentration abilities. This analysis was carried out through observations, interviews with teachers, and the distribution of questionnaires. The objective was to understand the challenges faced by children with autism in concentrating, as well as to identify the types of games and natural materials most suitable for enhancing this ability.

B. Model Feasibility Results

The feasibility test of the NuMaze game was conducted through expert evaluation as part of the formative evaluation of the NuMaze game from a theoretical perspective, alongside the analysis of interview data and field notes as empirical validation. The expert assessments were processed and analyzed using the following formula:

$$NP = \frac{n \times 100}{N}$$

Note:

NP = percentage score

n = obtained score

N = total number of scores/data

The resulting percentage will be classified to conclude the data as follows:

Feasibility Percentage Classification Table

Percentage	Criteria	Classification
0–20%	Very poor	Very unfeasible
20.1–40%	Poor	Unfeasible
40.1–60%	Fair	Less feasible
60.1–80%	Good	Feasible
80.1–100%	Very good	Very feasible

1.Theoretical Test

The following is a summary of the aspect validation results by experts.

Table of Expert Evaluation Results

Expert	Score
Early Childhood Curriculum and Learning	88%
Development of Children with Special Needs	88%
Media Development	77%
Average Score	84%

Based on the summary of assessments or validations conducted by the experts, the overall average score was 84%, which falls into the "Highly Feasible" category for use in stimulating the concentration ability of children with autism.

2.Empirical Test

The *NuMaze* game was tested on four children with autism from four different schools as part of the empirical testing process to prove the feasibility of the developed media. The research findings obtained through field notes were then processed and verified.

C. Discussion

In terms of the learning aspect, especially in enhancing the concentration skills of children with autism, the development of the *NuMaze* media began with an in-depth analysis of the needs and characteristics of children with autism at the *Anggrek Papua Learning Community*. Children with autism often struggle with concentration; therefore, the learning media designed must be able to capture their attention, provide appropriate sensory stimulation, and facilitate improved focus.

The use of natural materials such as seeds in the making of *NuMaze* was chosen for their texture, which can provide sensory stimulation to children with autism. Additionally, the use of natural materials aims to introduce children to their environment and foster a love for nature. *NuMaze* is designed to be visually engaging for children with autism. The game features clearly defined paths that are easy to follow, with numbers strategically placed. Children are encouraged to complete the maze while identifying the correct numbers. They are given the opportunity to explore this media independently or with teacher guidance. Observations were made to see how the children interacted with the media, their level of concentration, and their ability to understand numerical concepts.

The observation results showed an increase in concentration and focus in children with autism after using *NuMaze*. The children were able to engage in learning activities. The sensory stimulation from the natural materials and the engaging design of the maze helped maintain their attention for longer periods. In addition to improved concentration, *NuMaze* also helped children with autism understand numerical concepts. Through the maze activity, they learned to identify and comprehend numbers.

The effectiveness test results indicated that *NuMaze*, made from natural materials, successfully increased the concentration of children with autism at the *Anggrek Papua Learning Community*. The improvement in focus was evident in the children's ability to complete *NuMaze* with better focus and in less time compared to before using the media. This increased concentration can be explained by several factors:

1. The natural materials in *NuMaze* provided sensory stimulation that helped engage the children in the activity.
2. The attractive and challenging design sparked curiosity and motivation to complete the task.
3. The physical activity involved in completing *NuMaze* helped channel the energy of children with autism.

Formative evaluation conducted during the development of *NuMaze* involved observations and interviews with teachers. These evaluations were used to identify weaknesses and make improvements to the media. The use of natural materials such as seeds offered a rich sensory experience for children with autism. The textures helped stimulate the sense of touch and vision. The engaging and challenging design of *NuMaze* played a role in increasing the children's motivation to complete the tasks. The game was

designed with difficulty levels adjusted to the children's capabilities, and the use of bright colors helped attract their attention.

NuMaze media is evaluated periodically to assess its effectiveness and identify areas for improvement. Feedback from teachers is used to further develop the media. *NuMaze* has the potential for further development—for example, by incorporating different themes based on children's interests, or by adding interactive features like sound or lights. These developments could enhance the media's appeal and effectiveness in improving the concentration of children with autism.

CONCLUSION

This research successfully developed an innovative and effective learning media called *NuMaze* based on natural materials, which improves concentration in children with autism at the *Anggrek Papua Learning Community*. The use of natural materials provided sensory experiences, and the design of *NuMaze* helped enhance the concentration of autistic children.

Effectiveness test results showed that using *NuMaze* media can improve the concentration abilities of children with autism. This improvement indicates that the media is effective in helping children maintain their attention and stay focused on assigned tasks.

Formative evaluations conducted during the development and implementation process provided valuable insights into the strengths and weaknesses of the media. Feedback from teachers and children with autism helped the researchers refine the media's design and features to better suit the users' needs and preferences.

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