

Development of Magnetic Maze Media to Enhance Learning Concentration and Cognitive Abilities in Early Childhood

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Abstract

This study aimed to develop a valid, practical, and effective Maze Magnet learning media to improve learning concentration and cognitive abilities in early childhood. The study employed a Research and Development (R&D) approach using the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. The participants were 18 children in Group B of TK Pertiwi Bango, Demak Regency. Data were collected through validation sheets completed by material, media, and instructional design experts, practitioner assessments, concentration observations, and cognitive ability tests. Data were analyzed descriptively and inferentially using a paired sample t-test and N-Gain analysis. The results showed that the Maze Magnet media was highly valid, with scores of 90.4% from the material expert, 91.9% from the media expert, and 89.1% from the instructional design expert, and highly practical with a score of 90.8%. The media improved concentration with an N-Gain of 0.56 (56%) and cognitive ability with an N-Gain of 0.70 (70%). Thus, Maze Magnet is feasible as an innovative learning medium for early childhood education.

Keywords: Maze Magnet, learning concentration, cognitive ability, early childhood, learning media

INTRODUCTION

Early Childhood Education (ECE) represents a fundamental stage in establishing the basis for a child's comprehensive development. During this period, children undergo rapid development across various domains, including cognitive, language, socio-emotional, physical-motor, religious and moral values, and the arts. Consequently, the learning process for young children should not focus solely on achieving academic skills; rather, it must be designed to align with children's developmental characteristics through learning experiences that are enjoyable, active, and meaningful. This principle aligns with Law Number 20 of 2003 concerning the National Education System, which asserts that education is a conscious and planned effort to optimally develop the potential of learners. Education provided from an early age is expected to serve as a foundation for a child's development in subsequent stages of education (Law No. 20 of 2003).

The nature of early childhood learning is fundamentally inseparable from play. Children grasp learning experiences more easily when they are actively engaged in activities that are enjoyable, free from pressure, and suited to their developmental needs. A pleasant learning atmosphere helps children feel at ease and encourages active participation throughout the learning process (Perni, 2017; Maryati & Suryawati, 2023). In this context, games can serve as learning media that not only provide engaging experiences but also holistically stimulate various aspects of a child's development (Nasron et al., 2023). Thus, selecting learning media that align with children's characteristics is a crucial factor in creating effective ECE learning.

The use of learning media plays a vital role in helping children maintain attention and engagement during the learning process. Concrete, engaging media that allow for direct interaction can reduce boredom

and help children concentrate for longer periods compared to instruction relying solely on conventional methods (Rupnidah & Suryana, 2022). Furthermore, appropriate learning media can stimulate various developmental domains, including cognitive abilities (Zaini & Dewi, 2017). Cognitive ability is a crucial aspect, as it relates to a child's capacity to recognize, remember, categorize, sequence, and solve simple problems, as well as to understand the relationships between objects and events in their environment.

The development of these cognitive abilities is closely linked to a child's ability to maintain concentration during learning activities. Concentration enables a child to focus on a specific object or activity for a certain period, ensuring that the information and experiences provided during instruction are optimally absorbed. At the preschool age, concentration skills are still developing; consequently, children tend to have relatively short attention spans and are easily distracted by various environmental stimuli (Khasanah & Rocmah, 2024). Children who struggle to maintain attention may exhibit behaviors such as failing to heed the teacher's explanations, becoming easily distracted by peers' activities, playing while lessons are in progress, not responding effectively to instructions, and having difficulty completing assigned tasks (Husain et al., 2025; Khasanah & Rocmah, 2024). Ultimately, these conditions can hinder the optimization of the learning process and the development of the child's cognitive abilities.

Issues regarding concentration and cognitive ability have also been observed among young children at TK Pertiwi Bango. Preliminary observations and interviews with several teachers revealed that some children still struggle to concentrate during learning activities. These children are easily distracted by their surroundings, pay insufficient attention to the teacher's explanations, and face difficulties in completing tasks. Regarding cognitive aspects, initial observations indicated that 62% of the children had not developed optimally particularly in skills such as sequencing numbers, recognizing colors, and stating the quantity of objects when questioned by the teacher. This situation highlights a gap between expected competencies and the children's actual developmental status. These issues are further exacerbated when learning activities rely heavily on worksheets, offering limited opportunities for children to learn through play-based experiences and manipulative activities.

These circumstances underscore the need for innovative learning media capable of integrating play activities with the stimulation of concentration and cognitive skills. One potential medium for this purpose is the magnetic maze. A magnetic maze is a game. It consists of a winding path leading to a specific destination and may incorporate various obstacles or dead ends. Children are challenged to find the correct route to the finish by moving an object using a magnet. This activity offers children the opportunity to engage directly in problem-solving, sustain their attention, follow game rules, and coordinate observation with action. Given these characteristics, the magnetic maze serves as a potential learning tool that combines elements of play, motor activity, problem-solving, and cognitive stimulation.

Empirical evidence suggests that using mazes as learning tools holds promise for supporting early childhood development. Rosidah (2014) explains that maze games can stimulate various developmental domains, including motor skills, cognition, language, creativity, and emotional and social development. Research by Khasanah and Rocmah (2024) further demonstrates that magnetic mazes can significantly enhance children's concentration skills. Meanwhile, Sanusi and Sefriyanti (2025) found that magnetic maze games capture children's attention and boost motivation by stimulating their thoughts, feelings, and focus, thereby enabling them to maintain concentration during learning activities. These findings indicate that magnetic mazes have the potential to serve as learning tools that are not only visually engaging and tactile but also effective in supporting children's concentration.

Although previous studies have highlighted the benefits of magnetic mazes for concentration, there remains room to develop a tool that more intentionally integrates concentration and cognitive skill stimulation into a single learning aid. Furthermore, the development of such a tool must align with the realities of early childhood education settings, taking into account student characteristics, teacher needs, learning materials,

and practical challenges encountered in the field. Consequently, the development of the magnetic maze in this study aims not merely to create an engaging tool but also to ensure it meets the criteria of validity, practicality, and effectiveness for early childhood learning.

Based on these empirical issues and prior research, developing a magnetic maze serves as a valuable alternative learning tool, offering a learning experience through play activities that are concrete, interactive, and enjoyable. The developed media is expected to help children sustain their attention during learning activities while stimulating cognitive abilities through tasks such as recognizing colors, sequencing numbers, counting objects, following paths, and solving simple problems. Accordingly, this study aims to develop valid and practical magnetic maze media and to analyze its effectiveness in enhancing the concentration and cognitive abilities of young children at TK Pertiwi Bango, Demak.

METHODS

This research uses the Research and Development (R&D) method which aims to produce and test the feasibility of learning products (Sugiyono, 2019). The development model used is ADDIE which includes analysis, design, development, implementation and evaluation stages (Maulifia et al., 2024). The product developed is Maze Magnet media to improve learning concentration and cognitive abilities of young children. The development model used is ADDIE (Analysis, Design, Development, Implementation, and Evaluation). The analysis stage is carried out through observations and interviews to identify children's learning needs and characteristics. The design stage includes designing media, materials and research instruments. The development stage is carried out by creating media and carrying out validation and revision based on expert input. The implementation stage was carried out through media trials on group B children, while the evaluation stage was carried out to assess the feasibility, practicality and effectiveness of the product.

The research was carried out at Pertiwi Bango Kindergarten, Demak Regency, in the even semester of the 2025/2026 academic year. The research subjects were 18 group B children aged 5–6 years. Data collection uses expert validation sheets, practitioner validation sheets, concentration observation sheets, and oral cognitive ability tests. Observations are used to measure children's concentration during learning, while cognitive tests are given before (pretest) and after (posttest) the use of the Magnet Maze media on the theme of the Universe, especially celestial bodies and planets.

Data were analyzed descriptively, quantitatively and inferentially. Descriptive analysis is used to determine the level of validity and practicality of the media based on the percentage of expert and practitioner assessment scores. Media effectiveness was analyzed through comparison of pretest and posttest scores. The prerequisite test was carried out using Shapiro-Wilk to determine the normality of the data. Differences in abilities before and after media use were analyzed using paired sample t-test with the help of SPSS. Next, increases in concentration and cognitive abilities were analyzed using Normalized Gain (N-Gain) to determine the level of improvement after using Maze Magnet media.

RESULTS AND DISCUSSION

Results

Material expert and media expert validation score data for Maze Magnet Media in increasing learning concentration and cognitive abilities of young children in class B Kindergarten from the material aspect was obtained from expert observation. The checklist is intended to provide scores for experts' observations or observations of the Teaching Module using Maze Magnet Media to increase students' learning concentration and cognitive abilities on the theme of the universe

The results of the analysis showed that there was an increase in students' scores after learning was implemented using magnetic maze media. This increase can be seen in the research variables, namely concentration and cognitive ability.

Next, to find out whether the increase in each variable has a statistically significant difference, hypothesis testing is carried out using the Paired Sample t-Test. This test is used to determine the difference in average scores before and after treatment for the same student.

Apart from testing significance, this research also conducted a Normalized Gain (N-Gain) analysis to determine the level of effectiveness of implementing learning using magnetic maze media in increasing students' concentration and cognitive abilities. N-Gain analysis is carried out by comparing the increase in scores obtained by students between the pretest and posttest results so that the category of effectiveness of the treatment given can be identified.

Table 1. Material Expert Validation Results

Aspects Evaluated	Score
Content Suitability	93,3
Material	87,5
Average	89,4

Table 2. Media Expert Validation Results

Aspects Evaluated	Score
Interface appearance	97,9
Presentation	85,0
Language	87,5
Magnetic maze medium	97,2
Average	91,9

Table 3. Results of Instructional Design Expert Validation

Aspects Evaluated	Score
Alignment of Learning Objectives	97,9
Suitability of the Play-Based Learning Model	85,4
Appropriateness of Using the Magnetic Maze Aid	85,4
Quality of the Learning Activity Design	100,0
Coherence of the Teaching Module Components	95,8
Strategies to Enhance Learning Concentration	91,7
Strategies to Develop Cognitive Skills	81,3
Learning Assessment and Evaluation	75,0
Feasibility of Implementation	87,5
Average	89,1

Table 4. Results of Practicality Observations by Teachers

Aspects Evaluated	Score
Interface	100,0
Content	83,3
Language	86,7
Presentation	100,0
Magnetic Maze Media	91,0
Average	90,8

Improvement in Learning Concentration

t-Test Calculation Results

The t-test was used to determine the difference in children's learning concentration test scores before and after using the Magnetic Maze medium. In this study, the t-test was conducted using SPSS software, with the data processed via a Paired Sample t-Test comparing data from before and after the treatment. The results are as follows:

Table 5. Paired Sample t-Test Results for Children's Learning Concentration

	t	df	Sig. (2-tailed)
Post test score - Pre test score	9,588	17	,000

The Paired Sample t-test using SPSS yielded a calculated t-value of 9,588, whereas the t-table value at a 5% significance level with df = 17 was 1.740. Thus, the results indicate that:

$$t_{hitung} = 9,588 > t_{tabel} = 1,740$$

This indicates a significant difference in children's learning concentration scores before and after using the Magnet Maze medium. Consequently, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) is accepted, signifying that the use of the Magnet Maze medium has a significant effect on improving the learning concentration of early childhood students at TK Pertiwi, Bango District, Demak Regency.

These results demonstrate that the implementation of the Magnet Maze medium brings about positive changes in children's learning concentration abilities. Through play activities that require paying attention, following a path, remembering rules, and completing tasks, children show improved ability to focus their attention and maintain concentration during the learning process.

Based on these statistical test results, it can be concluded that the Magnet Maze is an effective learning medium for enhancing the learning concentration of early childhood students.

N-Gain Calculation Results

N-Gain is used to determine the improvement in student learning outcomes following an intervention (such as the use of a teaching module) by comparing pretest and posttest scores.

Table 6. N-Gain calculation results for children's learning concentration

No	Class	Pre-test Mean	Post-test Mean	Gain	%	Category
1	Kindergarten B	65.69	86.11	0.56	56	Moderate

Based on the N-Gain calculation results regarding the improvement in children's learning concentration following the use of the "Magnet Maze" (*Maze Magnet*) medium (Table 4.15), the average pre-test score for learning concentration was 65.69, while the average post-test score rose to 86.11. These results indicate an improvement in the children's learning concentration after instruction utilizing the Magnet Maze medium.

The calculations yielded an N-Gain value of 0.56, representing a 56% increase. According to N-Gain interpretation criteria, a value of 0.56 falls into the "medium" category (within the range of $0.30 \leq g < 0.70$). This demonstrates that the use of the Magnet Maze medium effectively enhances the learning concentration of early childhood learners.

Improvement in Children's Cognitive Abilities

t-Test Calculation Results

Table 7. Paired Sample t-Test Results for Children's Cognitive Abilities

	t	df	Sig. (2-tailed)
Post-test score – Pre-test score of students' cognitive ability	7,592	32,458	,000

Based on the Paired Sample t-Test results regarding children's cognitive abilities, a calculated t-value of 7.592 was obtained, with a significance value (Sig. 2-tailed) of 0.000. This test was conducted to determine whether there was a significant difference in children's cognitive abilities before and after using the Magnetic Maze medium in learning activities.

The decision-making criterion for the Paired Sample t-Test is that if the significance value (Sig. 2-tailed) is less than 0.05, a significant difference exists between the pre-test and post-test results. The analysis yielded a significance value of 0.000 (< 0.05); thus, it can be concluded that there is a significant difference between the children's cognitive ability scores before and after using the Magnetic Maze medium.

Furthermore, the calculated t-value of 7.592, with degrees of freedom (df) of 32.458, indicates an improvement in children's cognitive abilities following the intervention involving the Magnetic Maze medium. The positive t-value indicates that the post-test scores were higher than the pre-test scores.

Consequently, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) is accepted, meaning that the use of the Magnetic Maze medium significantly influences the improvement of cognitive abilities in early childhood students at TK Pertiwi, Bango District, Demak Regency. The Magnetic Maze medium provides cognitive stimulation through play activities that involve observing, remembering, matching, classifying, making choices, and solving simple problems.

Based on these statistical test results, it can be concluded that the Magnetic Maze medium is effective as a learning tool for enhancing early childhood cognitive abilities. This demonstrates that game-based learning using concrete media can help children grasp concepts and develop thinking skills appropriate for their developmental stage.

N-Gain Calculation Results

N-Gain is used to determine the improvement in children's cognitive abilities after the intervention (use of teaching modules and the Magnetic Maze medium) by comparing pre-test and post-test scores.

Table 8. N-Gain calculation results for children's cognitive abilities

No	Class	Pre-test Average	Post-test Average	Gain	%	Category
1	Kindergarten B	63,31	90,97	0,70	70	Moderate

Based on the N-Gain calculation results regarding children's cognitive abilities shown in Table 4.20, the average score prior to using the Magnet Maze medium (pre-test) was 63.31, whereas after instruction using the Magnet Maze medium (post-test), it rose to 90.97. This indicates an improvement in children's cognitive abilities following the implementation of the Magnet Maze medium in learning activities.

The calculation yielded an N-Gain score of 0.70, representing a 70% increase. According to N-Gain interpretation criteria, a score of 0.70 falls into the high category, as it sits at the upper limit of the medium category and enters the high-improvement category ($g \geq 0.70$). This demonstrates that the Magnet Maze medium is highly effective in enhancing the cognitive abilities of early childhood learners.

Discussion

Validity of the Magnet Maze Medium

Research results indicate that the developed Magnet Maze medium meets the criteria for high validity, with validation percentages of 90.4% from subject matter experts, 91.9% from media experts, and 89.1% from instructional design experts. These results show that the medium satisfies requirements regarding material suitability, alignment with the developmental characteristics of 5–6-year old children, design quality, safety, ease of use, and alignment with learning objectives. Thus, both theoretically and practically, the Magnet Maze medium meets the requirements for use as an instructional tool for early childhood education.

The material validity score of 90.4% indicates that the content integrated into the medium aligns with learning objectives and children's developmental characteristics. The medium does not merely convey information verbally; it provides opportunities for children to learn through activities such as observing, matching, recalling, classifying, and solving simple problems. These characteristics cater to the learning needs of young children, who require concrete and meaningful experiences. From the perspective of Piaget's cognitive development theory, children in the preoperational stage require direct experience with concrete objects to construct understanding. Therefore, the use of manipulative media like the Magnet Maze offers children the opportunity to build knowledge through activities involving experimentation, observation, and solution discovery. These findings are supported by the research of Santi, Dewi, and Suardika (2023), who developed the "Rare Hat" educational game tool using the ADDIE model. Validation results yielded Aiken's V scores of 0.99 from content experts and 0.86 from media experts, indicating that the medium is valid and suitable for use in early childhood education. The study demonstrates that developing media with due regard for children's needs, developmental characteristics, and engagement levels can result in learning products suitable for early childhood education settings.

These findings align with the work of Nugraha and Suryana (2021), which shows that the use of educational game media based on concrete activities can enhance the cognitive abilities of young children by providing more meaningful learning experiences. Media that align with children's developmental characteristics can boost engagement in the learning process and provide progressive stimulation for thinking skills.

A media expert validation score of 91.9% indicates that the visual aspects, safety, ease of use, and educational functionality of the "Maze Magnet" met excellent criteria. This high rating demonstrates that the media's design is not only appealing to children but also supports learning objectives. For young children, visual elements and concrete objects serve as crucial stimuli for capturing attention and maintaining engagement throughout activities. This is consistent with the findings of Sari, Hartati, and Yetti (2022), who stated that learning media addressing visual aspects, safety, and ease of use can enhance children's attention, motivation, and engagement in learning.

Meanwhile, the validation results from instructional design experts yielding a score of 89.1% indicate that the use of "Maze Magnet" is supported by an instructional design aligned with the characteristics of early childhood education (PAUD). The alignment among learning objectives, play activities, media usage, and assessment enables a systematic learning process without compromising the playful nature of the children's experience. These findings support the work of Fitria, Kristiawan, and Rahmat (2021), who explain that systematic instructional design can enhance the effectiveness of the learning process and provide a more meaningful learning experience.

The validity of the media also demonstrates its relevance to the play-based learning approach. Maze activities allow children to learn through play while simultaneously exploring, making choices, and overcoming challenges. Through this process, children not only develop cognitive abilities but also practice sustaining their attention on the task at hand. This aligns with findings by Hasanah and Ulfah (2023), who discovered that educational game media can positively influence cognitive development, as play activities

encourage children to learn actively and enjoyably. Furthermore, Wulandari and Kurniawati (2020) demonstrated that educational games involving problem-solving can enhance children's focus and engagement in learning.

Thus, the validation results indicate that "Maze Magnet" possesses a strong basis for suitability as an early childhood learning medium. The medium's strength lies in its integration of play elements, concrete experiences, exploration, and cognitive stimulation within a single learning activity. This makes "Maze Magnet" a relevant tool for supporting the learning concentration and cognitive abilities of Group B children at TK Pertiwi Bango, Demak Regency.

Practicality of the "Maze Magnet" Medium

Practicality test results show that the "Maze Magnet" medium and its accompanying teaching module achieved an average score of 90.8%, placing them in the "highly practical" category. These results indicate that the medium is easy to use in a learning setting and meets standards regarding visual design, content, language, presentation, and ease of use. The high practicality score demonstrates that the product is not only theoretically sound but also applicable in real-world learning situations.

Practicality is a crucial aspect of media development, as educational products must be easily usable by both teachers and children. In this study, the Maze Magnet is accompanied by a teaching module and usage guidelines, assisting teachers in integrating the medium into learning activities. Teachers do not require complex procedures to use the medium, while children can grasp the activities through instructions and hands-on experience. These findings align with Nugraha and Suryana (2021), who noted that game-based learning media easy for teachers to use and engaging for children can support the effectiveness of early childhood education.

These findings are consistent with research by Santi et al. (2023), which indicates that developed educational media are deemed suitable for use when aligned with children's characteristics and learning needs. The media development process involved needs analysis, design, development, implementation, and evaluation; consequently, the resulting product considers not only visual aspects but also practical applicability in learning activities.

The high level of practicality is also linked to the Maze Magnet's characteristics, which allow children to engage directly in play activities. Children can move the magnet, follow paths, make choices, and complete challenges. Such activities foster a more active learning environment compared to instruction focused solely on worksheets. Hasanah and Ulfah (2023) explain that educational game media provide meaningful learning experiences by giving children the opportunity to experiment, explore, and discover solutions firsthand.

Regarding its visual appearance, the medium received positive ratings for its use of shapes, colors, and concrete objects suited to the characteristics of young children. An engaging appearance helps reduce boredom and enhances children's attention to learning activities. This aligns with Sari, Hartati, and Yetti (2022), who stated that media featuring visual designs appropriate for child development can boost attention, motivation, and engagement during learning.

The practicality of the Maze Magnet is further demonstrated by its ability to help teachers create learning activities that simultaneously stimulate concentration and thinking skills. As children attempt to navigate the maze, they must heed rules, maintain focus, and determine the correct moves. This demonstrates that the medium's ease of use is inseparable from its pedagogical benefits.

These findings support Wulandari and Kurniawati (2020), indicating that educational games offering challenges appropriate for a child's developmental stage can enhance concentration and engagement in learning.

Thus, the practicality score of 90.8% demonstrates that the Magnetic Maze enjoys a high level of user acceptance. The learning aid can be implemented with relative ease and appeal, and it aligns well with the characteristics of early childhood learners. This serves as an indicator that the developed product not only meets feasibility standards but also holds potential for practical classroom application.

Effectiveness of the Magnet Maze Tool

Research results indicate that the use of the Magnet Maze tool positively influences children's learning concentration and cognitive abilities. This is evidenced by the Paired Sample t-Test results, which show a significant difference between outcomes before and after using the tool. These findings demonstrate that learning activities utilizing concrete, game-based tools can bring about changes in children's ability to engage in the learning process.

Regarding learning concentration, a significance value of 0.000 (< 0.05) indicates a significant difference between pretest and posttest scores. This improvement shows that after using the Magnet Maze, children were better able to focus their attention, follow instructions, maintain concentration, and complete activities. The nature of the maze game requiring children to observe the path, control movements, follow rules, and navigate to the goal provides repetitive attention training within an enjoyable atmosphere.

These results are supported by research conducted by Ulfah and Cica (2022) on the use of maze models to enhance the ability to recognize number concepts. Their study showed an increase in children's learning outcomes from 30.7% at the initial stage to 53.9% in Cycle I, 76.9% in Cycle II, and 84.6% in Cycle III. This progression demonstrates that maze activities can help children grasp learning concepts through activities that are more concrete and engaging.

These findings align with the work of Wulandari and Kurniawati (2020), which shows that educational game tools can boost concentration by providing activities that are engaging, challenging, and appropriate for children's developmental stages. Games provide clear objectives, thereby motivating children to sustain their attention until the task is completed. Thus, the improvement in concentration observed in this study can be understood as a result of the children's active engagement during the play-and-learn process.

The N-Gain result for concentration was 0.56 (or 56%), placing it in the moderate category. This indicates that the "Maze Magnet" effectively improved children's concentration, even though the improvement did not reach the high category. This suggests that concentration is a skill that develops gradually and is influenced by various factors, such as the child's individual characteristics, environmental conditions, the duration of the activity, and prior learning experiences. Therefore, using the Maze Magnet consistently and in combination with other instructional strategies has the potential to yield more optimal results.

Regarding cognitive abilities, the Paired Sample t-Test yielded a t-value of 7.592 with a significance level of 0.000 ($p < 0.05$). This indicates a significant difference in children's cognitive abilities before and after using the Maze Magnet. The improvement demonstrates that the game activity stimulates children's thinking processes, particularly in areas such as observing, matching, recalling, classifying, making choices, and solving simple problems.

These results align with findings by Hasanah and Ulfah (2023), which show that educational games can enhance cognitive abilities by providing children with opportunities to explore, experiment with various strategies, and discover solutions. Such activities enable children to construct knowledge through direct experience rather than merely receiving information passively.

The effectiveness regarding cognitive abilities is further reinforced by an N-Gain score of 0.70 (or 70%), placing it in the high category. This value indicates that the Maze Magnet brought about a substantial improvement in children's cognitive abilities. This significant gain can be attributed to the nature of the medium, which presents concrete challenges requiring active cognitive engagement. Children must observe the game state, select paths, remember rules, anticipate moves, and make corrections when errors occur.

These findings support the work of Nugraha and Suryana (2021), which demonstrates that game-based learning media can foster children's cognitive development through active and enjoyable learning experiences. Furthermore, Sari, Hartati, and Yetti (2022) emphasize that educational media designed to align with the characteristics of early childhood learners can enhance engagement and motivation, thereby supporting the comprehension of learning concepts.

Research by Silitonga et al. (2022) also demonstrates that maze-based educational games have the potential to foster cognitive development in children aged 5–6 years. A review of the literature indicates that the use of maze-based educational tools can assist children in developing problem-solving skills and recognizing numbers, numerical symbols, and various other symbols.

Additionally, a study by Kristiani, Suartini, Srinadi, and Nggera Ngaba (2023) found that maze activities can be utilized to improve the cognitive abilities of children aged 5–6 years, particularly regarding the resolution of simple problems. The study concluded that maze activities are effective in enhancing children's cognitive skills through tasks involving path-finding and problem completion.

These findings are further supported by Ramawati and Komalasari (2023), who specifically investigated the use of magnetic maze games with children aged 5–6 years. Their results showed an improvement in problem-solving skills, rising from 27% in Cycle I to 54% in Cycle II and 81% in Cycle III. This progression demonstrates that magnetic maze activities can stimulate children's abilities to analyze situations, make choices, and find solutions to simple problems.

Overall, the research findings demonstrate that the Magnet Maze serves not merely as a toy but as an educational tool that integrates play with cognitive stimulation and attention. Children learn through concrete experiences, exploration, decision-making, and problem-solving within an enjoyable environment. Validity scores ranging from 89.1% to 91.9%, a practicality score of 90.8%, and improvements in concentration and cognitive abilities (as indicated by N-Gain) suggest that the developed medium holds significant potential as an innovative learning resource for early childhood education.

Thus, these findings reinforce the view that early childhood learning becomes more meaningful when children have opportunities to play, explore, interact with concrete objects, and actively discover solutions. The Magnet Maze offers a viable alternative for implementing these principles while simultaneously fostering the development of concentration and cognitive skills in young children.

Implications Research

The development of Magnetic Maze Media has important implications for early childhood education, particularly in enhancing children's learning concentration and cognitive abilities. This learning medium provides an interactive and engaging learning experience that encourages children to focus their attention, solve problems, recognize patterns, and coordinate their visual and motor skills. From a practical perspective, Magnetic Maze Media can serve as an alternative instructional tool for early childhood educators to create meaningful, play-based learning activities that support children's cognitive development. The findings also highlight the importance of designing developmentally appropriate learning media that integrate exploration, manipulation, and problem-solving into the learning process. However, the effectiveness of this medium should be interpreted in accordance with the research design, participant characteristics, and implementation context. Further studies involving larger and more diverse samples, longer intervention periods, and comparative research designs are needed to examine its effectiveness and the sustainability of its effects on children's concentration and cognitive development.

Limitation Research

This study has several limitations that should be considered when interpreting its findings. First, the development and evaluation of Magnetic Maze Media were conducted within a specific educational

context, which may limit the generalizability of the findings to children with different developmental characteristics, learning needs, and educational backgrounds. Second, the evaluation may not fully capture the long-term effects of using Magnetic Maze Media on children's learning concentration and cognitive abilities, particularly if the implementation period was relatively short. Third, children's responses to the learning medium may have been influenced by contextual factors, including teacher facilitation, classroom environments, and individual differences in attention and cognitive development. Therefore, further research involving larger and more diverse samples, extended implementation periods, and more rigorous evaluation designs is needed to examine the effectiveness, applicability, and sustainability of Magnetic Maze Media in supporting early childhood learning.

Future And Suggestion Research

Future research should examine the effectiveness of Magnetic Maze Media in enhancing learning concentration and cognitive abilities among children in different early childhood education settings. Further studies could involve larger and more diverse participant groups to assess the applicability of this learning medium across different developmental stages and educational contexts. Longitudinal and experimental research designs are also recommended to investigate the sustainability of its effects and determine whether improvements in children's concentration and cognitive abilities can be maintained over time. In addition, future researchers could explore variations in the design, complexity, and instructional use of Magnetic Maze Media to accommodate children's individual learning needs and developmental characteristics. Collaboration between researchers, early childhood educators, and learning media developers is also encouraged to refine the medium's usability, safety, and pedagogical relevance. These research directions are expected to provide stronger empirical evidence regarding the potential contribution of Magnetic Maze Media to the development of engaging, developmentally appropriate, and effective learning experiences in early childhood education.

CONCLUSION

This study developed and evaluated Magnet Maze as a learning medium for improving the learning concentration and cognitive abilities of Group B children at TK Pertiwi Bango, Demak Regency. The results showed that the medium received validity ratings of 90.4% from the subject matter expert, 91.9% from the media expert, and 89.1% from the instructional design expert. Teachers also rated its practicality at 90.8%, indicating that the medium was suitable for classroom use. The effectiveness assessment revealed statistically significant differences between pre-test and post-test scores for learning concentration and cognitive abilities ($p < 0.001$ for both outcomes). The N-Gain scores were 0.56 for concentration and 0.70 for cognitive abilities, representing moderate and high improvement categories, respectively. These findings suggest that Magnet Maze can support play-based learning by engaging children's attention and providing opportunities to develop cognitive skills through hands-on activities. However, the study was conducted in a specific educational setting, and its findings do not establish whether the observed improvements can be sustained over time or generalized to children in other schools. Future research should therefore involve larger and more diverse samples, comparisons with alternative learning media or instructional approaches, and longer observation periods to assess the durability of the outcomes. Further studies could also examine which features of Magnet Maze contribute most to children's concentration and cognitive development. Such investigations would provide a stronger basis for determining the broader applicability of this medium in early childhood education.

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