

The Influence of Gamification Media Usage on the Enhancement of Cognitive Abilities in Children Aged 5-6 Years

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INDEXING	ABSTRACT
Keywords: Keyword 1; Gamification Media Keyword 2; Cognitive Ability Keyword 3; Children Aged 5-6 Years	This research was conducted to systematically describe the influence of gamification media in learning at TK Putra Harapan Surabaya on logical thinking and problem-solving in enhancing cognitive abilities, particularly in children aged 5-6 years. The research method used is quantitative descriptive, where this study employs a pre-test and post-test to compare the presence of variables in different samples. The data collection technique in this research utilizes observation, specifically direct observation at TK Putra Harapan of children engaged in learning in group B. After the data is collected, data analysis techniques will be performed by measuring indicators of objectivity level, validity level, and reliability level. Subsequently, these indicators will be tested using statistical testing tools such as the T-test or chi-square test.

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INTRODUCTION

Cognitive development is a thinking process possessed by each individual to connect, assess, and consider an event or problem. It can be said that cognitive processes are related to a person's level of intelligence that has learning ideas, it is similar with the explanation from Bjorklund (2022). According to piaget, cognitive development occurs through four stages, namely (1) the sensorimotor stage; (2) the pre-operational stage; (3) the concrete operational stage; and (4) the formal operational stage. Each individual will go through these four stages, although they may do so at different ages (Faqih *et al*, 2024). Furthermore, the speed of brain function possessed by each individual greatly influences that individual's intelligence in navigating these four stages of cognitive development. Thus, it is possible for a 6-year-old child to be at the concrete operational level, while an 8-year-old child may still be at the pre-operational level. Therefore, it is necessary to have appropriate stimulation so that the cognitive development of each individual experiencing delays can align with the actual stages of cognitive development, especially in early childhood. At this age, a child's development is very susceptible to change or formation.

The scope of cognitive development that requires stimulation according to the Government Regulation on Education and Culture of the Republic of Indonesia Number 137 of 2014 concerning the National Standards for Early Childhood Education includes (1) learning and problem-solving; (2) logical thinking; and (3) symbolic thinking. Each indicator encompasses (1) learning and problem-solving, which includes the ability to solve simple problems in daily life flexibly and socially accepted, as well as applying knowledge or experience in new contexts; (2) logical

thinking, which includes the ability to understand various differences, classifications, patterns, initiative, planning, and recognizing cause and effect; and (3) symbolic thinking, which includes the ability to recognize, name, and use numerical concepts, recognize letters, and present various objects and imagination in the form of images.

In general, the characteristic of early childhood children are active, energetic, and possess a high level of curiosity (Gopnik, 2020). These traits and characteristics lead to their concentration in learning being slow. They tend to be unfocused during learning. Therefore, play-based learning is a hallmark of education in early childhood. However, it is often found that in these learning environments, there are still deficiencies in the availability of educational play tools and other media. Therefore, there is a need for media solutions that are easy to use and engaging for children to learn. One appropriate solution to address this issue is gamification media.

Gamification can be defined as a game tool to make learning more engaging. This game is designed by involving players in various challenges and includes rules and feedback to measure outcomes (Dichev *et al*, 2014). Gamification is similar to the concept of play for early childhood. Play is an enjoyable way because children engage in it voluntarily, spontaneously, and without pressure. Through play, cognitive abilities in children can be developed, where children learn to understand knowledge through interaction with objects in their surrounding environment (Gauvain, 2022). This active and enjoyable approach to gamification is certainly very much related to the principles of learning in early childhood. Gamification is not a new concept in the realm of learning. The application of learning methods using gamification for early childhood has been in practice for a long time, as well as researched by Koval *et al*, (2024). A simple example is when a child successfully completes a task assigned by the teacher, they receive a reward in the form of a star.

However, in this research, we will update by integrating gamification with technology, specifically through game media. The teacher will design the learning process using this gamification concept tailored to the learning objectives, the characteristics of the children, the readiness of the teacher, and the resources available at the school. In this game, the teacher can select several elements provided in the game features. Therefore, the researchers are interested in conducting a study on "The Impact of Using Gamification Media on Enhancing Cognitive Abilities in Children Aged 5-6 Years."

LITERATURE REVIEW

Cognitive Ability

According to Galotti (2020), cognition is a thinking process, which refers to an individual's ability to connect, evaluate, and consider an event or occurrence. This indicates that cognitive processes are related to a person's level of intelligence, which encompasses learning ideas. According to Clarindo *et al* (2020), cognitive development involves the development of thinking and how thinking activities function. The life challenges that children will face require them to find solutions. This necessitates that children possess the ability to seek ways to resolve these challenges.

According to Piaget, cognitive development occurs through four stages, namely: (1) the sensorimotor stage; (2) the preoperational stage; (3) the concrete operational stage; and (4) the formal operational stage (Wahyuningsih, 2025). Piaget believed that we all go through these four stages, although each stage may be experienced at different ages. Each stage is entered when our brain is sufficiently mature to allow for new types of logic or operations (Simatwa, 2010). All humans go through each level, but at different speeds, so it is possible for a 6-year-old child to be at the concrete

operational level, while an 8-year-old child may still be at the preoperational level in terms of thinking. However, the sequence of intellectual development is the same for all children, with the structure of the previous levels being integrated and included as part of the subsequent levels. (Fuson, 2012). The scope of cognitive development according to the Government Regulation on Education and Culture of the Republic of Indonesia Number 137 of 2014 concerning the National Standards for Early Childhood Education is: (1) learning and problem-solving; (2) logical thinking; and (3) symbolic thinking, as well as described by Fadlillah (2016).

Learning and Problem Solving

According to the Regulation of the Minister of Education and Culture number 137 of 2014 concerning the national standards for early childhood education in chapter 4, which contains the content standards explained in article 10 paragraph 4 regarding cognitive development aspects as referred to in paragraph (1) concerning learning and problem-solving, it includes the ability to solve simple problems in daily life in a flexible and socially acceptable manner and to apply knowledge or experience in new contexts. The indicators of learning and problem-solving are (1) demonstrating exploratory and investigative activities, such as: what happens when water is sprayed on fire; (2) solving simple problems in daily life in a flexible and socially accepted manner; (3) applying knowledge or experience in a new context; (4) showing a creative attitude in problem-solving (ideas, concepts outside the norm). In this regard, Piaget argues that it is important for teachers to develop cognitive skills, especially in the aspects of learning and problem-solving in children, so that children are able to solve the life problems they face, ultimately becoming individuals who can help themselves.

According to Layali dan Masri problem-solving is a high-level mental process that requires more complex thinking processes (Layali & Masri, 2020). By learning problem-solving in the learning process, it will enable students to think more critically in investigating issues, thus making students better at responding to and resolving problems. Furthermore, students can apply this mathematical problem-solving ability in addressing issues in mathematics learning, other learning areas, as well as in solving problems in daily life, as well as described by Tumangger *et al* (2024). Learning and problem-solving involve an individual's ability to address simple issues in daily life flexibly, socially accepted, and to apply knowledge or experience in new situations. It is important for teachers to develop children's cognitive abilities in terms of learning and problem-solving so that they can face life's challenges independently. The problem-solving process requires high-level and complex thinking, which can enhance children's critical abilities in investigating and resolving various issues, including mathematical problems. This ability can be applied in various learning contexts and in children's daily lives (Hilton and Pellegrino, 2012).

Logical Thinking

In accordance with the Minister of Education and Culture Regulation number 137 of 2014 concerning the national standards for early childhood education in chapter 4, which contains the content standards explained in article 10 paragraph 4 regarding cognitive development aspects as referred to in paragraph (1) about logical thinking, which includes the ability to understand various differences, classifications, patterns, initiative, planning, and recognizing cause and effect. The indicators of Logical Thinking are: (1) Recognizing cause and effect in their environment; and (2) Arranging objects based on size from smallest to largest or vice versa.

According to Piaget, logical thinking in early childhood is the awareness of an individual with the concept of thinking to understand the difficulties faced by a child; however, the child will recognize the difficulties and solve their problems independently, which will stimulate them in facing future challenges (Robson, 2012). Meanwhile, according to Irwansyah and Lubis logical thinking is the process by which an individual expresses opinions logically and employs reasonable logic so that it can be learned in the future and is said to develop as expected (Irwansyah and Lubis, 2016).

Gamification in Learning

Gamification can be defined as a game tool to make learning more engaging, where the game is designed to involve players in various challenges, and within the game, there are rules and also provide feedback to measure outcomes (Moncada, 2014). Gamification is the process of game thinking and game mechanics to engage users and solve problems. Gamification utilizes design elements that form a game in a non-game context or the games needed in learning or education (Parapanos and Michopoulou, 2020). Game mechanics are a medium that consists of game mechanisms made up of key elements in designing a gamified system.

Gamification, as it relates to the concept of play for early childhood, is an enjoyable method because children engage in it voluntarily, spontaneously, and without pressure. Through play, cognitive abilities in children can be developed, where they learn to understand knowledge through interaction with objects in their surrounding environment, as well as described by Alam (2022). This active and enjoyable approach to gamification is certainly closely related to the principles of learning in early childhood. Furthermore, how teachers will design learning using this gamification concept should be aligned with the learning objectives, the characteristics of the children, the readiness of the teachers, and the resources available in the school.

Gamification consists of two forms, namely structural gamification and content gamification. The tools for creating gamification can be explained as follows:

1. **Structural Gamification**

Structural gamification is a learning concept in which there are game elements in the learning process without altering the delivery of the material (Landers *et al*, 2017). Structural gamification uses points, badges, and leaderboards as incentives to motivate and assist children in acquiring new skills, knowledge, or behaviors. However, structural gamification can also involve stories and even characters (Chou, 2019). The content remains unchanged by elements such as games or is not redesigned. Therefore, it still retains its original form, such as multiple-choice questions, readings, videos, and so on. This type of gamification can be designed using tools such as Quizziz and Kahoot.

2. **Content Gamification**

Content gamification is a learning concept that involves the application of dynamics, mechanics, and game elements to transform educational content into something more akin to a game (Sanchez *et al*, 2020). It can be regarded as the application of game thinking to educational content. This type of content gamification alters scenarios or narratives to resemble a game, where players must navigate through several levels. An example of content gamification could involve adding narrative elements to learning materials. Incorporating these elements makes the content more game-like, without actually turning it into a game. It merely provides context and incorporates activities typically found in games, enhancing the content being taught. This type of gamification can be designed

using tools such as Canva, Genially, Wordwall, and others, as well as researched by Karampa and Paraskeva (2023).

RESEARCH METHOD

The type of research used in this study is quantitative descriptive research. As Sugiyono (2012: 13) explains, descriptive research is to determine the value of independent variables without making comparisons or relationships with other variables. Meanwhile, according to Arikunto (2013: 12), the quantitative approach is an approach that uses numbers, starting from data collection, interpretation of the data, and presentation of the results. It can be said that quantitative descriptive research is a type of research used to analyze data by providing an overview of how the data is collected. The choice of quantitative descriptive method in this study is based on research that aims to test and observe the effect of using gamification media on improving the cognitive abilities of children aged 5-6 years at TK Putra Harapan. TK, is a word to describe the Kindergarten School.

This research was conducted at TK Putra Harapan located at Jl. Balas Klumprik No.2, Balas Klumprik, Wiyung District, Surabaya City, East Java. The implementation time of this research is divided into three occasions, the first being on November 30, 2023, followed by the second on December 1 and December 2, 2023. In quantitative descriptive research, there are terms for population and sample. The population refers to the entirety of subjects or objects that will be studied. The subjects of this research are all children of TK Putra Harapan aged 5 to 6 years. Meanwhile, the sample is a part of the number and characteristics possessed by a population that will be studied. This research is a total sampling study with a sample size of 18 children at TK Putra Harapan.

The data collection technique in this research employs observation, specifically direct observation at TK Putra Harapan of children engaged in learning in group B. Once the data is collected, data analysis techniques will be conducted by measuring indicators of objectivity, validity, and reliability. Subsequently, these indicators will be tested using statistical testing tools such as the T-test or chi-square test.

Tabel 1: The category of student success

Interval	Category	Score
1-40	Belum Berkembang (BB) or undeveloped	1
41-60	Mulai Berkembang (MB) or start developing	2
61-80	Berkembang Sesuai Harapan (BSH) or develop as expected	3
81-100	Berkembang Sangat Baik (BSB) or develop very well	4

(Source: Johni Dimyanti, Guidelines for Assessment in Kindergarten)

RESULT AND DISCUSSION

Result

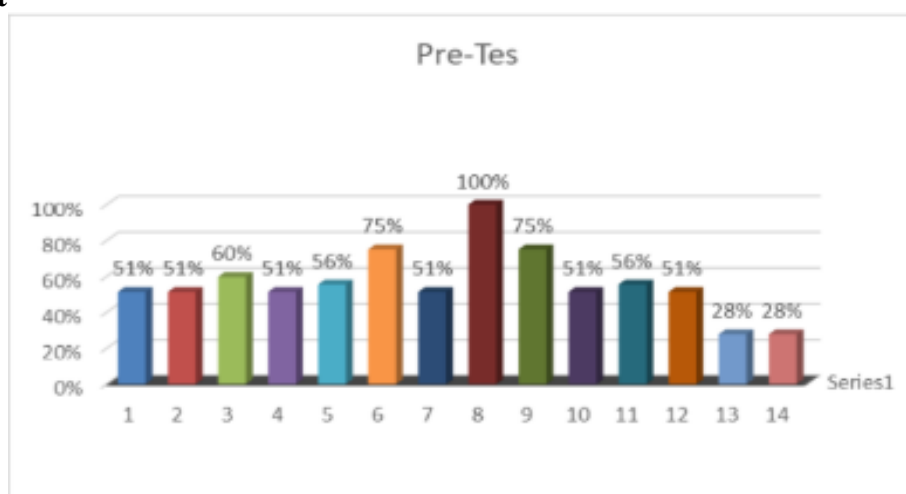


Figure. 1: Pre-Test Results Diagram

Source: IBM SPSS Statistic Viewers, Analyzed by the Author (2024)

The results of the average value calculation can be illustrated in the diagram above. It can be explained that during the pre-test, 51% of the children were unable to find a way out of the school fire, indicating that they still fall into the Developing (MB) category. Furthermore, 51% were unable to select images of fire extinguishers (fire trucks and extinguishers), which also indicates that they remain in the Developing (MB) category. In the third question regarding the children's ability to connect the act of extinguishing cigarette butts before disposal with fire prevention in schools, 60% of the children indicated that they still belong to the Developing (MB) category. In the fourth question (P4), concerning the children's ability to analyze their first sight of a burning object, 51% of the children indicated that they still fall into the Developing (MB) category. In the fifth question (P5) regarding children's ability to conclude the cause of the fire, which is discarding cigarette butts carelessly, 56% of children indicate that they still fall into the Developing Slowly (MB) category. In the sixth indicator (P6) regarding children's ability to remember each image with its position, 75% of children indicate that they still fall into the Expected Development (BSH) category. In the seventh indicator (P7) regarding children's ability to demonstrate the correct behavior during a fire (seeking evacuation routes and taking shelter under a table), 51% of children indicate that they still fall into the Developing Slowly (MB) category.

In the eighth indicator (P8), children are able to distinguish between images of a school fire and a forest fire, with 100% of children indicating that they are still categorized as Developing Very Well (BSB). In the ninth indicator (P9), regarding children's ability to differentiate between images of a fire truck and a regular truck, 75% indicate that they are still categorized as Developing as Expected (BSH). In the tenth indicator (P10), concerning children's ability to determine the actions to take when experiencing a fire at school, 51% of children indicate that they are still categorized as Starting to Develop (MB).

In the eleventh indicator (P11) regarding children's ability to analyze the occurrence of fire disasters in schools, 56% of children indicate that they are still categorized as Beginning to Develop (MB). In the twelfth indicator (P12) regarding children's ability to select objects (Appar) based on size from smallest to largest or vice versa, 51% of children indicate that they are still categorized as Beginning to

Develop (MB). In the thirteenth indicator (P13) regarding children's ability to operate games according to the correct rules, 28% of children indicate that they are still categorized as Not Yet Developing (BB). In the fourteenth indicator (P14) regarding children's ability to use media and technology tools properly, 28% of children indicate that they are still categorized as Not Yet Developing (BB).

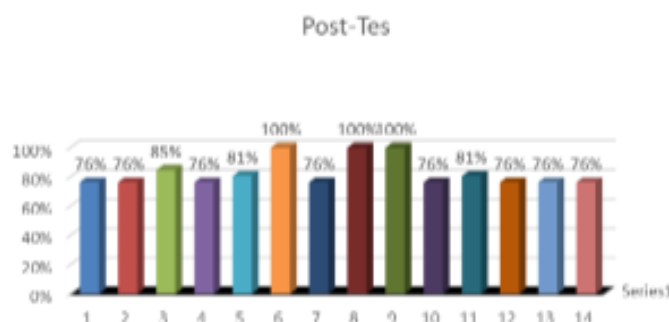


Figure. 2: Post-Test Results Diagram

Source: IBM SPSS Statistic Viewers, Analyzed by the Author (2024)

The diagram above illustrates that at the time of the post-test, 76% of children were unable to find a way out of the school fire, indicating that they still fall into the Developing as Expected (BSH) category. Furthermore, 76% were unable to select images of fire extinguishers (fire trucks and fire extinguishers), which also indicates that they remain in the Developing as Expected (BSH) category. In the third question (P3) regarding children's ability to connect the act of extinguishing a cigarette butt before discarding it with fire prevention in schools, 85% of children demonstrated that they fall into the Developing Very Well (BSB) category. In the fourth question (P4), concerning children's ability to analyze when they first see a burning object, 76% of children indicated that they still belong to the Developing as Expected (BSH) category.

In the fifth question (P5) regarding children's ability to conclude the cause of the fire, which is discarding cigarette butts carelessly, 81% of children indicated that they still fall into the Very Good Development category (BSB). In the sixth indicator (P6) regarding children's ability to remember each image with its position, 100% of children indicated that they have reached the Very Good Development category (BSB). In the seventh indicator (P7) regarding children's ability to demonstrate the correct attitude during a fire (seeking evacuation routes and taking shelter under a table), 76% of children indicated that they still fall into the Expected Development category.

In the eighth indicator (P8), children are able to distinguish between images of a school fire and a forest fire, with 100% of children demonstrating that they have reached the category of Very Good Development (BSB). In the ninth indicator (P9), regarding children's ability to differentiate between images of a fire truck and a truck, 100% of children show that they have reached the category of Very Good Development (BSB). In the tenth indicator (P10), concerning children's ability to determine the actions to take when experiencing a fire at school, 76% of children indicate that they are still classified in the category of Development as Expected (BSH). In the eleventh indicator (P11), regarding children's ability to analyze the occurrence of fire disasters at school, 81% of children indicate that they are still

classified in the category of Very Good Development (BSB).

In the twelfth indicator (P12) regarding children's ability to select objects (Apar) based on size from smallest to largest or vice versa, 76% of children demonstrate that they still fall within the Expected Development (BSH) category. In the thirteenth indicator (P13) regarding children's ability to operate games according to the correct rules, 76% of children demonstrate that they still fall within the Expected Development (BSH) category. In the fourteenth indicator (P14) regarding children's ability to use media and technology tools effectively, 76% of children demonstrate that they still fall within the Expected Development (BSH) category.

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-test	55.2222	18	6.46762	1.52443
	Post-test	75.3333	18	6.72134	1.58424

Figure. 3: Paired Samples Statistics

Source: IBM SPSS Statistic Viewers, Analyzed by the Author (2024)

Based on the results of the descriptive analysis, the average score of students during the pretest was 55.22, and during the post-test, the average increased to 75.33. From these results, it can be stated that there was an improvement in cognitive abilities (play and problem-solving, and logical thinking) of children when using gamification media in the form of online games. Therefore, it can be concluded that using gamification media in the form of online games has an impact on the improvement of cognitive abilities in children aged 5-6 years at TK Putra Harapan.

Paired Samples Test								
		Paired Differences			95% Confidence Interval of the Difference		t	df
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper		
Pair 1	Pre-test - Post-test	-20.11111	1.23140	.29024	-20.72347	-19.49875	-69.291	17
								Sig. (2-tailed)
								.000

Figure. 1: Hypothesis Testing

Source: IBM SPSS Statistic Viewers, Analyzed by the Author (2024)

If the significance value (2-tailed) < 0.05 , there is a significant difference between the learning outcomes in the pretest and posttest data. However, if the significance value (2-tailed) > 0.05 , there is no significant difference between the learning outcomes in the pretest and posttest data. The data processing results in this study indicate that the significance value (2-tailed) is 0.00. This means $0.00 < 0.05$, thus the null hypothesis is rejected and the alternative hypothesis is accepted, leading to the conclusion that there is a significant difference in the learning outcomes of children before using gamification media in the form of online games (pretest) and after using gamification media in the form of online games (posttest).

Discussion

Based on the data obtained, it shows that there is an influence of gamification media in the form of online games on the enhancement of cognitive abilities in children aged 5-6 years at TK Putra Harapan Surabaya, which includes play and problem-solving, as well as logical thinking. This can be interpreted that the use of engaging media that aligns with the interests and desires of children can lead to developmental improvements in children. Moncada defines gamification as a play tool to make learning more engaging, where the game is designed to involve players in various challenges, and within the game, there are also rules and feedback to measure outcomes (Moncada, 2014).

Creating learning innovations that can enhance the cognitive development of children aged 5-6 years must possess distinctive advantages that set them apart from other media. In this regard, gamification has emerged as a successful form of learning innovation applied to improve the cognitive development of children aged 5-6 years at TK Putra Harapan. The advantages of the gamification learning model compared to other learning models include (1) making learning more enjoyable; (2) encouraging students to complete their learning activities; (3) helping students to focus more and understand the material being studied; and (4) providing opportunities for students to compete, explore, and excel in the classroom (Jusuf, 2016).

Gamification is a method of utilizing game-based mechanics, aesthetics, and thinking styles to stimulate interest and motivation to act, promote learning, and solve problems (Alsawaier, 2018). Learning through gamification incorporates elements of games or video games into the educational process, aimed at motivating children during learning and creating a sense of enjoyment and interest in the learning process. Glover concludes that gamification provides additional motivation to ensure that children can fully engage in learning activities (Wangi *et al*, 2018). Interest or engagement in a child's learning process can be defined as the willingness to participate; Costello *et al* (2020) defined student engagement as a metacognitive action that includes behavioral, emotional, and cognitive involvement of children in learning. By applying gamification in the learning process, it can enhance children's cognitive abilities in learning and problem-solving skills.

Gamification is a concept that utilizes game-based mechanics, aesthetics, and thinking games to engage individuals, motivate actions, promote learning, and solve problems. With gamified learning, children can train their logical thinking by considering how they can answer questions or tackle challenges at each level within the game. The gamification media is designed according to the needs of children, with levels in each game created in accordance with the stages of development and age of the child. Learning using such media can enhance motivation and enthusiasm for learning in children. Furthermore, this game can improve aspects of child development, particularly in cognitive aspects. Learning through gamification is designed so that children can solve problems and think logically about this game. Through gamification, children will gain a good learning experience that can enter their minds, stick, and be easily understood by them.

CONCLUSION

The results of the research conducted indicate that there is an influence of gamification on logical thinking and problem-solving skills concerning the cognitive development aspects of children at TK Putra Harapan Surabaya. During the implementation of gamification, there was a difference in cognitive development between the pre-test and post-test. In the pre-test activity, the children had not yet

received treatment with gamification, resulting in confusion when asked questions. The cognitive development results after the application of gamification media in children were better than before. From the implementation of the gamification media, it can be concluded that the games in this context significantly affect the cognitive development of children, particularly in logical thinking and problem-solving in Group B of TK Putra Harapan Surabaya.

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