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Enhancing Childrens Cognitive Abilities Through "Jelajah Alam" Apllication : Promoting Well-being

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Abstrak
The use of technology in the early childhood learning process is rarely found despite the numerous benefits it offers. This study aimed to examine the effectiveness of the "Jelajah Alam" application in enhancing children's cognitive abilities. Research utilized quantitavive quasi-experimental : one sample pre-test post-test design. Research sample consisted of 19 kindergarten children selected through purposive sampling technique. Data measurement used was Nijmeegse Schoolbekwaamheids Test and Coloured Progressive Matrices Test. Data analysis use Wilcoxon signed-rank test. Findings revealed a significant difference between the pre-test and post-test score after implementing the "Jelajah Alam" application. Results indicated that the use of the application was effective in improving children's cognitive abilities. Results suggest that by playing "Jelajah Alam" application, enhance their cognitive ability based on their developmental phase. Result imply that by using technology, Parents and teacher have additional fun alternative to enhance their children cognitive ability.

Keywords: android application**,** cognitive abilities, school readiness, well-being

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Introduction

Early childhood period is crucial in a person's educational journey because during this stage, particularly at the age of 5, important foundations for thinking, behavior, and emotions are developed (Bakken et al., 2017). Child experts also state that during this period, children develop linguistic, cognitive, social, emotional, and self-regulation skills that will determine their success in life (Trackwick-Smith, 2022). Therefore, providing good-quality education is essential to support children's learning process both inside and outside of school. Quality education and positive interactions between children and their environment contribute to their readiness for school and successful learning experiences (Williams et al., 2019).

School environment not only influences academic performance and behavior but also affects children's emotional well-being (Powdthavee et al., 2018). To be emotionally healthy and happy, individuals need to experience several elements in their lives, such as positive emotions, engagement in enjoyable activities, positive relationships, finding meaning, and a sense of accomplishment and achievement (Kangas et al., 2019). Learning through play can contribute to children's mental health and well-being (Kangas et al., 2019). Learning through play involves experiencing these five elements, which can contribute to a sense of happiness. Through play, children experience positive emotions, engage in enjoyable activities, and are

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motivated to complete tasks. Play is also considered a meaningful process for children's learning and development (Whitebread et al., 2009). Learning through play can enhance children's cognitive abilities, which are important for school readiness (Yogman et al., 2018).

Preparing children for school and learning is crucial to motivate them to explore their surroundings (Damayanti, Andia & Rachmawati, 2016). Children who lack basic skills such as counting, early reading, and social-emotional competence may struggle compared to their more prepared peers (Guernsey et al., 2014). Children are happier and more enthusiastic when they are ready for school (O'farrelly et al., 2019). Therefore, school readiness and children's learning before starting school are essential considerations for families. School readiness and learning readiness can be assessed based on psychological of three aspect mainly cognitive, social-emotional, and language motor aspects (Pratiwi, 2018; Umiarso et al., 2021). Cognitive abilities play a significant role in children's lives as they relate to their interpersonal behavior and building relationships with others (Rahmawati & Rukiyati, 2018; Tatminingsih, 2019).

Children's cognitive abilities develop rapidly during the early childhood period (Mungas et al., 2013; Wahyuningrum & Sa'diya, 2022). According to Piaget, cognitive abilities of 5-6-year-old children include understanding quantity and size, interest in letters and numbers, simple writing, color recognition, shape recognition, understanding time, and age-appropriate knowledge (Khaeriyah et al., 2018). Piaget's theory also explains that through interaction and stimuli from the environment, children's cognitive structures change, leading to intellectual development (Ibda, 2015). Cognitive maturity is also related to emotional, social, and language maturity, which contributes to children's overall development (Santrock, 2011).

Sadly, Some due to many factor, there are still children who cannot reach cognitive maturity because of lack of stimuli to train their capabilities. Kristina and Sari explain that lack of stimuli given to early childhood children can inhibit child's cognitive development, causing loss of brain function, and poor ability to receive and process information (Kristina & Sari, 2021). Stimuli that are given by school through a monotonous and lack of variety teaching method are not sufficient to grow child interest in learning, which in turn cause non optimal cognitive development (Agusniatih & R., 2022). Wati dan Yulsofriend added that lack of learning media and tools to support children learning process can cause children not having enough stimulus to stimulate their brain development (Helmi Rahma Wati & Yulsyofriend, 2019).

Parents and teacher have a significant role to make sure children develop optimally without any obstacle. Play is one way to develop cognitive abilities as it fosters curiosity, exploration, and the generation of new thoughts and ideas in children (Ahmad et al., 2016). Playing with educational applications and technology has been proven effective in enhancing children's knowledge, skills, and attitudes (Fadhli et al., 2020).

Previous research on using technology for children's cognitive development can be found in several studies (Ayuningrum & Afif, 2021; Humaida & Suyadi, 2021; Setiawan et al., 2018) and suggests that educational gaming applications can improve children's cognitive abilities. These findings align with research indicating that using different media and games allows children to enjoy the learning process without fear of making mistakes, fostering motivation and skill development (García et al., 2021). Integrating games into education also provides practical benefits as it enhances children's motivation and skills (Xezonaki, 2022). The use of technology and educational applications is a valuable learning option for children to acquire knowledge, engage in collaborative and independent learning, and engage in lifelong learning (Nikolopoulou, 2019).

Researchers have collected previous studies focused on the use of educational applications. The findings reveal a trend starting from 2016, with various studies exploring educational applications across different school levels, such as primary school (Findawati et al., 2021; Mashuri et al., 2021; Santosa et al., 2020; Umboh et al., 2021; Widiyatmoko et al., 2021), middle school (Arum Nissa et al., 2021; Graceota et al., 2021; Qohar et al., 2021; Setiyani et al., 2021; Setyaningrum & Waryanto, 2018), and high school (Fitriyana et al., 2020; Hidayat et al.,

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2021; Marbun, 2021; Martin N.~A. et al., 2021; Nur et al., 2021). Studies on Android gaming applications for preschool children were primarily conducted in 2019 and generally showed positive impacts on the skills targeted in children (Callaghan, 2018; Hendrawan et al., 2020; Noori, 2018; Saidah & Damariswara, 2021). However lately in this year it is rare to found a study on the using of android gaming application based on specific early childhood *psychology* aspect.

Information Technology serves as a tool to assist humans in facilitating information processing, and to date, an immeasurable amount of information has been discovered to support this function (Budiyono, 2020; Cahyati et al., 2022). Android applications represent one such innovation, wherein the design feature allows for the creation of applications utilized as learning media, incorporating game-like designs to engage learners in a fun learning process (Fitriana et al., 2021). Android serves as an effective learning medium, as indicated by Ramdani et al (2020), who explain that educational media encompass various elements such as audio, animation, video, text, and graphics, enabling interactive use between users and the application's features. This aligns with the modern era, where many children understand and are adept at using smartphone technology (Mahendri et al., 2022). The utilization of Android applications also facilitates students' learning processes anytime, anywhere, enhancing their understanding of the learning materials (Mahendri et al., 2022).

Some research explain about how the integration of technology and using game learning media by android can enhance children learning process. Research shows that the use of youtube kids, quizzes and some others educative games in playstore can increase children cognitive abilities (Ayuningrum & Afif, 2021; Hidayati & Budiarti, 2022). However, is is still not found research that spesifically explain the effectivity of anroid education game based on some dimension of psychology test to improve cognitive ability and early childhood children readiness. This research will try to explain that topic and issue comprehensively.

Current phenomenon emphasizes the importance of integrating technology into classrooms and children's learning processes. This integration should be embraced by educators, parents, and families to help children prepare for school. This aim to determine the effectiveness of Android game application 'Jelajah Alam' to support children's learning process and enhance their cognitive abilities. The expected outcome of this research is that with the 'Jelajah Alam' application, parents and schools will find it easier to train children's cognitive skills and prepare them for school, using the application as a learning tool.

Methodology

This study utilized a quasi-experimental research method. The specific type of research design employed was a one-group pre-test-post-test design. Procedure of the research are as followed: 1) Participants are first classified on their intelligence capabilities based on Coloured Progressive Matrices Test (CPM) Test, 2) Then based on their capabilities, participant were selected and Nijmeegse Schoolbekwaamheids Test (NST) are to be administered to test their cognitive abilities, 3) The treatment was conducted over a two-week period, with approximately 30 minutes of supervised gameplay per session, overseen by parents, 4) After two weeks of treatment, NST were given to participant to re-measure the difference and cognitive abilities

The scheme of the research is the following:

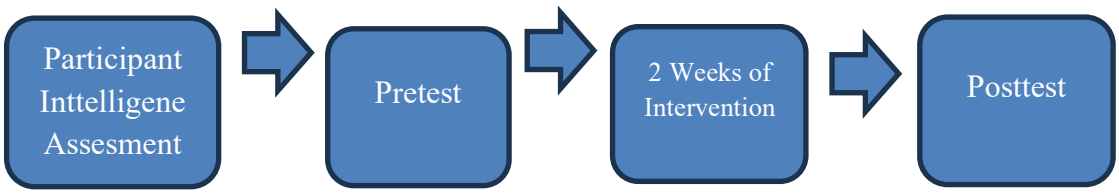

Figure 1. Reseach Scheme

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"Jelajah Alam" application was developed and consisted of three themes. The questions in the application were based on subtests from the NST measurement tool, which assesses various cognitive abilities, including shape observation and discrimination, understanding of size, quantity, and comparison, keen observation, critical thinking skills, concentration, memory, object comprehension and situational judgment, and comprehension of stories. "Jelajah Alam" application has already been tested and approved by some of expert in the field of early childhood education which is 2 child psychologist and 2 kindergarten teacher and 1 elementary school.

The Application is divided into 3 themes with theme 1 called "Buku-buku dan objek Disekitar Tubuhku", theme 2 called "mengenal Hewan dan Alamnya", and theme 3 called "Mengenal Dunia Buah dan Bunga". The user interface of "Jelajah Alam" Application and some sample question in each theme is presented in figure 2, figure 3, and figure 4.

Figure 1 Theme 1

Figure 2 Theme 2

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Figure 3. Theme

The sampling technique used was purposive sampling, where the sample was selected based on the research needs and predetermined criteria. Criteria for this study included early childhood children in TK A and TK B classes, with CPM scores ranging from 50 to 95, categorizing the children's intelligence level. Sample for this study was drawn from three selected TK schools based on their geographical location which are in urban areas, rural areas, and the outskirt of the city. Three schools were dubbed TK A, TK B, and TK C in which the headmasters of three respective schools have agreed to let research to be conducted in school environment and inform the parents about the research. The total number of participants in the study, consisting of 11 kindergarten students class A and 8 class B students.

The Nijmeegse Schoolbekwaamheids Test (NST) was used as the measurement tool for the pre-test and post-test. This test is designed to assess children's cognitive aspects and school readiness, with a measured reliability score of 0.851 (Mariyati & Affandi, 2016). The participants' IQ abilities were also measured using the CPM test (Raven, 2003). The obtained data were then analyzed using Jeffreys Amazing Analytic Program (JASP) 0.16.1, followed by classical assumption testing. The data analysis method employed in this study was the Paired Sample Wilcoxon Signed Rank Test, where the alternative hypothesis (Ha) would be accepted if the z-score value is above 1.96 or below -1.96, with a significance level of P>0.05.

Result and Discussion

Table 1. Analysis Results

Measure 1		Measure 2	W	Z	SP
Post Test	-	Pre Test	188.000	3.743	< .001

Table 3. Mean Score

Measure	N	Mean	SD	SE
Post Test	19	79.211	18.884	4.332
Pre Test	19	39.789	13.994	3.211

The analysis results indicate that the pretest and posttest scores obtained a z-score of 3.743 with a significance value of p=<0.001. This indicates a significant change between the

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pretest and posttest scores of the NST. It suggests that there is learning outcome or knowledge enhancement among children after playing the "Jelajah Alam" Android game application. Several other analysis results will also be discussed further in the discussion section.

Discussion

The research findings indicate a significant difference between the pretest scores taken before the subjects received the treatment and the posttest scores taken after the subjects played the "Jelajah Alam" application ($Z=3.743$, $P<0.001$). The mean pretest and posttest scores also show a substantial difference, with a mean posttest score of 79.211 and a mean pretest score of 39.798, resulting in a difference of 39.798. This indicates that the use of the "Jelajah Alam" application can influence children's cognitive abilities, as assessed by the NST test. These results are consistent with previous studies using game-based applications, which showed improvements in language skills (Puspitasari & Subiyanto, 2017; Wijayanti et al., 2021), early reading abilities (Mustadi et al., 2022), learning abilities (Azizah et al., 2022; Nawangnugraeni & Subiyanto, 2016), and memory skills (Alzubi et al., 2018). Previous research has demonstrated that the use of game applications for early childhood learning can support the learning process and cognitive abilities of children (Behnamnia et al., 2022).

Research result also in line with some of the research result in previous study. Rakimahwati et al explain that the use android game application can enhance and significantly can affect early childhood children cognitive abilities (Rakimahwati et al., 2022). Other study by Nawangnugraeni and Subianto shows that using android educational games can help children to know and learn basic number better in a much more fun way, in which can enhance their cognitive abilities (Nawangnugraeni & Subiyanto, 2016). This result however, can prove that not all game based education in app store are only teach child in a surface level but not deep learning (Papadakis et al., 2018), as “Jelajah Alam” application were developed based on NST test which one of the dimension are critical thinking skills.

Plass et al. argue that game-based learning is effective in education due to several reasons, including motivation, engagement, adaptive features, and graceful failure. Motivation refers to the factors that engage children in game-based learning within a specified timeframe, while engagement involves cognitive, affective, behavioral, and sociocultural aspects that keep players focused and involved in the game. Adaptive features allow games to be customized according to players' needs, and graceful failure enables players to learn from their mistakes (Plass et al., 2015).

These three points can be found in the "Jelajah Alam" application: 1) Motivation, where the game design is suitable for young children, making them interested in playing the application. 2) Engagement, where playing the application stimulates children cognitively, affectively, and behaviorally, fostering focus and involvement. 3) Graceful failure, allowing children to learn from their mistakes while answering game questions, with no limitations on retries. These explanations provide a basis for why the "Jelajah Alam" application is effective for learning and improving children's cognitive abilities.

These explanations are supported by previous research conducted by the researcher in previous years. Previous research, through interviews with parents, showed that children responded positively to the application, found it easy to play, appreciated the good design, and enjoyed the colorful and age-appropriate visuals. Parents also mentioned that the "Jelajah Alam" application can be used as a means for parents to observe their children's abilities, allowing them to focus on specific learning materials. The researcher's observations during children's gameplay also showed positive responses, as seen in their cheerful and enthusiastic facial expressions, and expressions of "Hooray" or "Yes" when answering correctly, without displaying negative emotions or behaviors.

The appealing and stimulating design of the application explains the significant learning improvements observed. Roul explains that proper audiovisual materials contribute significantly to the learning process and reinforce the role of textbooks (Batubara, 2023; Roul,

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2014). Learning through multimedia or applications stimulates the brain to interpret words, images, and sounds. The brain then organizes and integrates this information to form logical and coherent constructs (Elimelech & Aram, 2020). Effective synchronization of audio and visual information also contributes to children's language development, particularly in alphabetic skills (King et al., 2007).

"*Jelajah Alam*" Application is design based on children knowledge development, which is by introducing some of knowledge concept of a child by using audi and visual media. Then Early childhood children acquire a new knowledge concept in vocabulary ranging from verb, object, number, color, and other word that relevant, so children can receive and understand an instruction well and better and then give a right response and on point answer. This is also supported by this research results which show a gain between pre-test and post test in NST form that are given to the sample during the research process ($Z=3.743$, $P<0.001$). Understanding language and verb word is important for an early childhood children as language is used to thinking, listening, hearing, talking and writing, and also telling opinion and what they want to other people (Pebriana, 2017).

The repetitive gameplay process supports learning and strengthens the information received by children. Jones et al. state that learning requires consistent repetition and practice (Jones et al., 2013). Tabibian et al. also note that an individual's ability to remember information depends on how often and how long they repeat and receive the information (Tabibian et al., 2019). These statements reinforce the idea that consistent learning through repetition and practice facilitates learning.

The design of the application, Z scores, and the response of the study sample indicate that the use of the "Jelajah Alam" application can enhance children's well-being by eliciting positive feelings, engagement, and motivation to complete the game, as suggested by Kangas et al (2019). Strong cognitive abilities also contribute to a child's readiness for school, as a prepared child tends to be happier and more motivated to engage in the learning process (Pratiwi, 2018).

Age, as one of the factors considered in this study, also shows differences among the 4-year-old, 5-year-old, and 6-year-old groups. The highest gain is observed in the 4-year-old group, with an average score of 50.800. This aligns with the neuroscience assertion that the optimal age for a child's learning is from 0 to 8 years old (Yulianingsih et al., 2020). This age range is crucial for children to learn and play to enhance their abilities. This might take effect as class A and class B have different teaching material so participant in class B might have gain more knowledge than their class A peers.

Another factor that might take effect in this research are school location between urban school and school placed in more rural location. Some research suggest that school location can affect the way children learn (Akinwumi, 2017; Fasasi, 2017; Lavalley, 2018). However Further research is needed to strengthen the findings related to school location in this study.

Limitation of this research is the lack of control over children's play at home under parental supervision. Suggestion for further research, it is recommended to investigate some factor that might take effect on this research like IQ and school location.

Conclusion

This research shows that statistically, the use of the "Jelajah Alam" gaming application is effective for children's learning through play, as it enhances their cognitive abilities by introducing a new word and knowledge concept which will prepares them for entering school. The findings of this study also support the use of learning media as an effective method to accompany young children's learning under parental supervision, and the use of the "Jelajah Alam" application to enhance children's well-being and happiness. This findings also suggest the integration of technology in learning and education as this will bring benefit to children who are closer to technology especially smartphone more than ever.

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