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The Impact of Technology-Based Games on The Fine Motor Development of Special Needs Children

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Abstract

The development of fine motor skills in children is a crucial ability that can be nurtured. The development of fine motor skills is frequently delayed in children with exceptional disabilities. Technology-based games, available in a variety of specialized smartphone applications, are one way to gradually and entertainingly improve children's fine motor skills. The purpose of this study is to assess the effectiveness technology-based games in helping children with special needs develop their fine motor skills. The research design uses a quasi-experimental method with a one-group pre-post test approach. A total of 28 children with special needs were the subjects of the study. Data were collected through observation using the Bender Visual Motor Gestalt Test instrument and analyzed using the Wilcoxon statistical test. The research results show that after engaging in technology-based games, the percentage of those surveyed with high fine motor abilities rose from 21.4% to 57.1% after playing technology-based games. Statistical test analysis showed a significant improvement in the fine motor skills of children with special needs after being given technology-based games, with a p-value of 0.000 and $\alpha < 0.05$. The results of this study provide evidence of the influence of technology-based games on fine motor skills in special needs children. The implications of the research on technology-based games can be an effective alternative for developing fine motor skills in special needs children.

INTRODUCTION

Motor development is a continuous change in motor behavior throughout the life cycle, in the form of fine motor and gross motor movements. The ability to control small movements using fine muscles, such as grasping, writing, and tying, is a crucial component of a child's development. These abilities are influenced by biological factors, environmental factors, and the stages of motor tasks(Safitri et al., 2022; Suhada, 2016; Vilela et al., 2022). Children with special needs often experience delays in their gross motor, fine motor, emotional, and social development. They are children who have obstacles from the average condition of normal children, generally in terms of physical, mental, and social behavioral characteristics. This can be caused by prenatal, natal, or postnatal factors such as emotional instability, learning difficulties, or neurological disorders (Jannah et al., 2022a;(Jauhari et al., 2020), such as Development Coordination Disorder (DCD), Attention Deficit Hyperactivity Disorder (ADHD), and Down syndrome(Jannah et al., 2022).

Motor development obstacles are found in many Children with special needs, one of which is children with ADHD, 30% to 50% have motor development delays(Lelong et al., 2021). The average disability rate is 3.3% in children aged 5 to 19 years, according to statistics released by the Coordinating Ministry for Human Development and Culture in June 2022(Key issues for children with disabilities in Indonesia, 2023)(Liputan 6, 2023). The number of children with disabilities in East Java continues to increase, from 23.99 percent in 2015 to 29.16 percent in 2019 (RKPD, 2020). The number of children with special needs in Surabaya

recorded in January 2025 reached 224, enrolled in 15 inclusive primary schools(opendata.surabaya.go.id, 2025), with many of them facing barriers in fine motor activities.

In the digital era, technology has become an integral part of everyday life, including in communication, education, and therapy needs. It is not uncommon for children to be able to use technology, such as smartphones, in their daily lives. Smartphones are media that are used as modern communication tools, further facilitating human communication activities. Now, communication activities have developed more advanced with the emergence of smartphones. Smartphones such as iPhone, Android, and notebooks are increasingly needed by humans supporting all their needs, including in supporting child development, which is utilized as one of the solutions.

Conventional approaches that rely on manual therapy are often perceived as monotonous, uninteresting, and old-fashioned by children and parents, thus affecting their effectiveness. Technology-based games are games that utilize digital technology to enhance the play experience. These technology-based games include the use of computers, smartphones, virtual reality, or augmented reality(Jannah et al., 2022). The use of smartphones as a therapeutic tool has been widely developed in the treatment of children with special needs in recent years, and has shown good results in children with various types of special needs(Rukmini et al., 2022). Technology-based games, found on smartphones such as digital applications and interactive devices, Android games offer a more engaging, interactive, and adaptive approach widely developed to measure and improve children's fine motor skills(Saha et al., 2023).

Smartphones that can utilize various Android games applications allow children to practice fine motor skills designed to improve hand-eye coordination and stimulate fine muscles gradually through activities such as assembling dot patterns, drawing, and coloring. Fine motor skills can be achieved by doing exercise therapy that is carried out continuously, in one’s free time, easy to do, fun, and interactive. Smartphones that can utilize various Android game applications allow children to practice fine motor skills designed to improve hand-eye coordination and stimulate fine muscles gradually through activities such as assembling dot patterns, drawing, and coloring. Fine motor skills can be achieved by carrying out exercise therapy that is carried out continuously, at free time, easy to do, fun interactive(McGlashan et al., 2017). The purpose of this study is to assess the effectiveness technology-based games in helping children with special needs develop their fine motor skills.

RESEARCH METHODS

The study used a quasi-experimental design with a one-group pre-test post-test design. This design involves a group of subjects, namely children with special needs, who are observed before technology-based games are carried out continuously for 3 weeks and then observed again. The sample consisted of 28 children with special needs in School for Special Needs (SLB) Surabaya, who experienced fine motor delays, and were able to touch and control the mobile phone screen using their fingers. The research process began with the measurement of fine motor skills in children using the standardized instrument, the Bender Visual Motor Gestalt

Test Data(Nazari, 2015). The next process was technology-based Games intervention. The child was instructed to draw by pressing the fingers on the mobile phone screen, following the dotted lines to form a geometric image. The game was conducted with a duration of 30 minutes per action. Actions were carried out with a frequency of three times a week and carried out for three consecutive weeks(Tryandoko et al., 2025) (Mia et al., 2024). Fine motor skills measurements were repeated after the procedure in the third week. The Wilcoxon test was used to analyze the data measurements' results, which were recommended based on the overall score on a Likert scale: good (11–16), sufficient (6–10), and insufficient (0–5). Letter of Ethical Clearance from Ethical Review Board Adi Husada Health Science College number 021.A/Ket/PPM/STIKES-AH/I/2025 date 7 January, 2025.

RESULT

The results of the study are presented in the following table:

Table 1. Characteristics of Respondents at SLB Surabaya

Characteristics	F	%
Gender		
Male	17	60.7
Female	11	39.3
Children with special needs Type		
ADHD	3	10.7
CP	5	17.9
Down Syndrom	5	17.9
Autism	7	25.0
Others type	8	28.5

Based on Table 1, data were obtained from 28 children with special needs, most of whom were male, 60.7%. The most common types of Children with special needs: Autism 25% and others type, 28.6%.

Table 2. Motor Development, Before and after the game in SLB Surabaya

Characteristics	F	%
Before		
Good	6	21.4
Sufficient	13	46.4
Insufficient	9	32.1
After		
Good	16	57.1
Sufficient	7	25.0
Insufficient	5	17.9

From the data in Table 2 above, it shows that there is a change in the fine motor skills of children who were previously in the good category of 21.4% and after technology-based games using smartphones, made the motor skills number of respondents in the good category increased to 16 (57.1%). So that it can be described that there is a positive change or influence from fine motor stimulation using technology-based games on fine motor development in IMR.

Table 3. Impact Technology-Based Games for Fine Motor Skills

		N	Mean Rank	Sum of Ranks
Score_posttes Score_Pretest	Positive Ranks	13	7.00	91.00
	Negative Ranks	0	.00	.00
	Ties	15		
	Total	28		
			Score_Posttest-Score_Pretes	
Z				-3.500
Asymp.Sig.(2-tailed)				.000

The results of the Wilcoxon Signed Rank Test, obtained a value of Z = -3.500 with a significance value of p = 0.000 (p < 0.05). This shows that there is a significant difference between the scores before and after the technology-based game. Furthermore, the value of positive ranks (13) is higher than negative ranks (0), with Ties 15, which indicates that the scores after treatment tend to be higher than the previous scores, although there are still children whose scores before and after remain unchanged.

DISCUSSION

Technology-based games have proven to have a positive influence on the fine motor development of children with special needs in Surabaya. In the initial survey, many respondents experienced difficulties in controlling hand and finger movements, such as grasping small objects, controlling movements when writing or drawing, and coordinating hand and eye movements. The results of fine motor measurements using the Bender Visual Motor Gestalt Test obtained initial data in table 2 show that there are still many respondents whose fine motor development is in the moderate category 46.4% and 32.1%. Their test results are still not perfect in making straight lines according to the points provided. Many respondents still have difficulty controlling hand movements, cannot hold a pencil properly and correctly and are unable to make lines, curved shapes according to the drawing points provided. These delays are caused by various factors, including neurological conditions, lack of stimulation, and lack of access to effective therapeutic methods. Fine motor development in children is highly dependent on the environmental stimulation provided, without proper intervention, this delay can hinder the child's ability to perform daily activities that require optimal hand and finger coordination (John Santrock, 2008).

The findings of the observation demonstrated a change in fine motor skills following stimulation with technology-based games three times a week for three weeks in a row. Based on the data above, the survey results in table 3, that there was an increase in respondents who were able to make lines well and correctly, namely 57.1% of respondents. The results of the Wilcoxon Signed Ranks test, the Asymp.sig. (-2-tailed) value was 0.000 <0.05. These findings suggest that children with special needs' fine motor development was significantly affected by technology-based games both before and after they played them. Additionally, the number of children whose fine motor skills improved after playing technology-based games increased, as indicated by the positive ranks value (13) being higher than the negative ranks value (0). The visible increase in fine motor skills was in the form of hand coordination, grip strength, and

movement control when using writing tools. It has been demonstrated that playing games with technology helps kids with special needs develop their fine motor skills. Children with special needs' development of fine and gross motor skills is impacted by the use of fine motor stimulation games(Jannah et al., 2022).

Technology-based games by utilizing smartphones that provide items for children to learn while playing by making vertical, horizontal, right/left sloping, right/left curved, and circular lines with various colors can increase children's attractiveness. This game provides stimulation to children's fine motor skills, making children practice pressing firmly and shifting fingers by following the dots according to the shape with various colors, this game also trains children to be calm and coordinate between hand movements with what is seen. So that they are able to carry out commands to move their fingers to bring one point to another to form a line (Gral, 2024). Games that are carried out repeatedly and continuously, will make children become trained, as can be seen from the increase in speed and also the strength of the fine muscles in the fingers while playing. Motor development is influenced by repeated practice and direct experience in a supportive environment. Technology utilizing smartphones involving touch screens, movement of virtual objects, and other interactive activities has been shown to be effective in improving motor development, balance, and muscle strength, which has the effect of improving motor skills in early childhood(Tryandoko et al., 2025).

Other research suggests that interactive technology-based games can stimulate fine motor skills by training dexterity and coordination and impact cognitive function(Zhang et al., 2024). The fun experience of play also makes children more motivated to practice, so that fine motor training becomes more consistent and effective than conventional methods. Children can improve their motor skills through activities that stimulate movement coordination and control. Children who received technology-based game interventions experienced significant improvements compared to those who did not receive similar treatment. Thus the use of technology by utilizing smartphones can improve fine motor development in children with disabilities, not only providing functional benefits but also increasing children's motivation to learn and develop. Thus, technology-based games can be one of the innovative solutions in supporting the development of children with disabilities, especially in improving their fine motor skills. Other research suggests that technology gradually trains fine motor skills in an engaging way tailored to individual needs. Furthermore, devices with visual and auditory feedback can provide additional motivation. These findings align with previous research by(Lutfio et al., 2023) entitled "The Influence of Technology as a Learning Medium for Children with Special Needs," which found that adaptive and interactive technology has been shown to be effective in increasing children's attention and engagement in motor activities. The technology-based games in which there are many types of games presented are aimed at training children's fine motor skills with attractive designs so that children do not get bored easily and increase their attraction to children, but there are limitations in this study, namely the age limit and variations in types of ABK, therefore, further specific research is needed with a larger number of respondents to validate these findings.

CONCLUSION

Technology-based games utilizing smartphones have a significant influence on fine motor development in children with disabilities in Surabaya. With technology-based games, children get the opportunity to practice their motor skills through interesting, fun, and interactive activities, so they are more motivated to practice. Technology-based games can be one of the innovative solutions in helping children with disabilities develop fine motor skills, increasing children's motivation to learn and practice. Therefore, the use of technology by utilizing smartphones can be considered as part of a broader intervention strategy to support fine motor development in children with disabilities in both educational and therapeutic settings.

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