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Circuit-based basic motor activity games: An innovative solution to improve the movement skills of children with dyspraxia in the context of physical education

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ABSTRACT

Dyspraxia in children is not a hindrance in training motor skills. The purpose of this study was to analyze the effect of gaming circuit-based interventions on their motor skills. This research method used one group experimental design with pretest-posttest design. The population of the study subjects were students with dyspraxia, with a sample consisting of seven purposively selected students. The instrument used was a series of four-pole games designed to measure students' motor skills. The research procedure began by pretesting the students' motor skills before the intervention. Then, a game circuit-based intervention was performed on all students over a period of time. After the intervention was completed, a posttest was performed to re-measure the students' motor skills. Data from pretest and posttest were analyzed using SPSS statistical software version 23 to compare scores before and after the intervention. These findings provide positive support to the use of a game-based approach in improving the gross motor skills of children with dyspraxia in the context of physical education. The positive implication of this study is that the circuit game approach can enrich educational interventions for children with dyspraxia and provide better insight into the development of motor skills in this population through innovative approaches. It is recommended that further research focus on specific elements of circuit play that are most effective in improving gross motor skills in children with dyspraxia, with the potential to form better guidelines in physical education.

Keywords: Motor activity; fundamental motor skills; circuit games; motor skills; dyspraxia child

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INTRODUCTION

Fundamental Motor skills (FMS) of walking, running, jumping, and throwing, form the essential basis of physical activity throughout life (Kokstejn & Musalek, 2019; Webster et al., 2019). Learning Group community interventions were more effective in improving FMS in children, providing concrete evidence of a positive impact on the development of basic motor skills in the younger generation (Mukherjee et al., 2017). A more adapted approach in the teaching of FMS in the physical education environment has significant differences in progress between boys and girls on basic motor skills (Engel et al., 2022; Jiménez Díaz et al., 2015). Physical education has a central role in the development of the FMS, improving the approach to physical education can develop basic motor skills as an

integral part of the school curriculum. The promotion of sustainable physical activity within the school environment can be effectively integrated in the physical education curriculum to support the overall physical health and development of students (Lorente, 2017; Vella et al., 2023).

Motor development is one aspect that is very important in the early stages of development of children (Endrawan & Aliriad, 2023; Edwarsyah et al., 2017; Satria et al., 2023). The ability to develop gross and fine motor skills is a cornerstone for children's participation in daily activities, as well as being instrumental in improving overall quality of life (Aliriad et al., 2023b). However, for children who have dyspraxia, or impaired motor coordination, a great challenge approaches them in planning and executing complex motor movements (Multahada et al., 2022). Dyspraxia is a condition that can hinder motor development in children, impairing their ability to perform various physical activities (Anderson-Mooney et al., 2016; Scott et al., 2021). Therefore, an effective intervention approach is urgently needed to help children with dyspraxia overcome obstacles in daily activities (Miller et al., 2014; Waber et al., 2021).

Basically, children with dyspraxia also need the same treatment as other normal children, such as exercising, playing, and learning (de Marchena et al., 2023; Meachon et al., 2022). Interact with peers so as to cause feelings of pleasure, joy and cheerful. Familiarity between peers for children with dyspraxia can directly train and learn, especially on the move and move (Christmas & Van de Weyer, 2019; Yani & Sina, 2022). So that growth and development can be optimal. Physical activity is a form of movement that can be done by children with dyspraxia to help problems with motor skills (Avila-Pesantez et al., 2018; Pedro et al., 2019). One of them uses fundamental motor skills or basic movements. Fundamental motor skills are movements involving different parts of the body such as movements in the legs, arm movements, and movements in the head, to perform movements such as running, jumping movements, throwing movements, catching movements, and hitting movements (Bakhtiar, 2014; Lloyd et al., 2014; Valentini et al., 2016). It is a basic movement that must be mastered by children aged 3 years to 8 years as a preliminary movement.

Some strategies that can be used to overcome motor difficulties by integrating fun and challenging motion games into learning (Castaño et al., 2023). Motor development is one aspect that is very important in the early stages of development of children (Endrawan & Aliriad, 2023; Edwarsyah et al., 2017). The ability to develop gross and fine motor skills is a cornerstone for children's participation in daily activities, as well as being instrumental in improving overall quality of life (Aliriad et al., 2023a). However, for children who have dyspraxia, or impaired motor coordination, a great challenge approaches them in planning and executing complex motor movements (Multahada et al., 2022). Dyspraxia is a condition that can hinder motor development in children, impairing their ability to perform various physical activities. Therefore, an effective intervention approach is urgently needed to help children with dyspraxia overcome obstacles in daily activities (Miller et al., 2014; Waber et al., 2021).

So, the importance of basic motion for the growth and development of children even in the world of basic motion therapy in the form and adjusted using patterns in accordance with the needs and development of motion in accordance with age. According to Schwarzer et al. (2018) explained that the ability in basic movement skills or fundamental motor skills greatly contributes to the development of physical abilities, cognitive abilities, and social adaptation of children (Masteller & Sirard, 2019). Motor development is one aspect that is very important in the early stages of development of children. The ability to develop gross and fine motor skills is a cornerstone for children's participation in daily activities, as well as being instrumental in improving overall quality

of life (Aliriad et al., 2023b). However, for children who have dyspraxia, or impaired motor coordination, a great challenge approaches them in planning and executing complex motor movements. Dyspraxia is a condition that can hinder motor development in children, impairing their ability to perform various physical activities (Anderson-Mooney et al., 2016; Scott et al., 2021). Therefore, an effective intervention approach is urgently needed to help children with dyspraxia overcome obstacles in daily activities.

Some strategies that can be used to overcome motor difficulties by integrating fun and challenging motion games into learning (Clark et al., 2023; Lee-Cultura et al., 2022). It aims to help children with dyspraxia improve motor skills through activities that are interactive and entertaining. The results of field observations still found a less structured approach and less instruction understood by learners (Meachon et al., 2022). This results in negative feedback in increasing the motivation and enthusiasm of students. In addition, giving enough time for children to complete tasks is the right step to train movement skills. In teaching, teachers can take advantage of appropriate learning methods. One of them is to use gaming circuits that can help the child with dyspraxia understand the movements to be performed better.

So, the importance of basic motion for the growth and development of children even in the world of basic motion therapy in the form and adjusted using patterns in accordance with the needs and development of motion in accordance with age. Basic motor skills greatly contribute to the development of physical abilities (Ginanjar & Suherman, 2018). For example, children who go through the crawling phase are feared to have some disturbances in both gross motor and fine motor skills. Includes: posture, muscle strength, coordination, and concentration (Puspita & Umar, 2020; Romlah, 2017) In performing the basic movements or FMS researchers designed a pattern that is expected to facilitate understanding and movement to be given. The pattern is called a circuit game. In the series of games will be formed several posts, at each post will be grouped basic movements to children with dyspraxia which aims to facilitate basic movements (Dhanalakshmi et al., 2020; Ramadhan et al., 2023).

Circuit play approaches have been identified as an attractive alternative to stimulate the motor development of children with dyspraxia (Mylsidayu et al., 2020; Ningsih et al., 2020). For example, balloon games can improve their gross motor skills, while jumping rope serves as a tool to improve gross motor skills and balance (Hayati & Julia, 2018). Correspondingly, ball-catching games are integrated to improve gross motor skills and eye-hand coordination (Brantasari & Aslindah, 2018). Meanwhile, puzzle games and tasks to move objects from one place to another are considered effective exercises to improve fine motor skills and hand-eye coordination (Adhariah, 2018; Ardiyanto & Sukoco, 2014). By combining the game circuit approach and the right type of games, children with dyspraxia can stimulate their motor development in a way that is not only effective but also fun. Although several types of applied games have emerged as innovative and fun solutions in this approach, there is a weakness in this study regarding the absence of game instruments that specifically target children's basic movements, such as gross motor skills of hands, gross motor skills of feet, fine motor skills of eyes, and fine motor skills of hand-eye that have relevance to daily activities.

Recent trends in research suggest that game-and circuit-based approaches can have a significant impact in stimulating the motor development of children with dyspraxia. Several types of games included in the game circuit approach include balloon games (Hayati & Julia, 2018), rope jumping games, ball catching games (Fata et al., 2023), puzzle games (Permata, 2020), and moving objects games (Miharja et al., 2020). Although this positive potential is attracting attention, there is still a gap in the literature on how the development of gross motor skills in children with dyspraxia can be more focused and effective through this approach. Therefore, a careful research approach is needed to

identify the real impact of this approach in the development of motor skills in children with dyspraxia. The main purpose of this research is to test the fundamental activity of motor skills based on game circuits in improving the basic motion activities of students who experience dyspraxia, especially in the context of physical education.

METHOD

This research employed an experimental approach, specifically adopting the one-group pretest-posttest design (Allen, 2017). This design enables a comparison of children's motor skills both before and after undergoing an intervention involving circuit-based fundamental motor skill gaming activities. The study's population consisted of children with dyspraxia attending the inclusive kindergarten, Pelangiku Jombang. Utilising total sampling, a sample size of 7 children aged 5–6 years was derived from the population. The research procedure commenced with the implementation of a series of pretest activities, followed by posttest data collection.

Data collection utilized the Denver Developmental Screening Test (DDST II) instrument, developed by (Frankenburg & Dodds, 1967). Originally designed for developmental screening in normal pediatric well-child care settings, this test gained widespread recognition, being employed in 54 countries and standardised in 15. Demonstrating both validity and reliability, the instrument considered an indicator reliable if the Cronbach's alpha value exceeded 0.60. The Cronbach's alpha output for this study was 0.71, affirming the reliability of the indicators measuring constraints in assessing motor skills in children. Data analysis involved the use of the T-test, where in a comparison between pretest and posttest results was conducted to gauge the effectiveness of the intervention. SPSS 23.0 software facilitated this analytical process.

RESULTS AND DISCUSSION

The findings revealed the extent to which students excelled in three areas of motor skills - i.e., coarse manual dexterity, coarse footwork, and eye-hand coordination. Overall, most pupils displayed adequate proficiency levels in each of these categories. Specifically, the majority of students demonstrated good skill when performing coarse manual movements with even two of them displaying excellent ability. No students were rated as "low", suggesting that overall gross hand movement ability was satisfactory.

The assessment findings for gross footwork ability demonstrated excellent or good ability levels among most students. However, one student showed low gross footwork ability, illustrating the diversity of skill levels amongst students in this category. Hand-eye movement skills were rated as good to excellent, indicating adequate hand-eye coordination and an absence of students in the "low" category. However, there is sub-group variation in the real context, where most students carry out their daily tasks well, whilst one student requires additional support.

The statistical analysis revealed a significant increase from the Pretest to the Posttest with a higher "posttest" average. The reduced standard deviation and standard error of the "Posttest" suggested greater stability and accuracy of the data. Statistical analyses confirmed a noteworthy dissimilarity between the "pretest" and "posttest" groups, and an enhancement can be approximated with a 95% confidence interval. Overall, this study's findings offer significant insights into students' motor skills, providing a foundation for further development in supporting students who might require additional attention.

Table 1. First Post Results: Rough Hand Motion Ability

Category Value	Number of Students
Low	0
Enough	3
Good	2
Very Good	2
Total	7

Table 1 illustrates students' gross hand motion abilities. The data show that the majority of students had sufficient to good ability in this category, with two students who had excellent gross hand movements. None of the students were in the "Low" category, which indicates that their general gross hand motion ability reached an adequate level. These results show that the majority of students have the ability to rough hand movements are sufficient to good. Two students have excellent ability, which may indicate a level of ability above average. The description can be depicted in the following diagram:

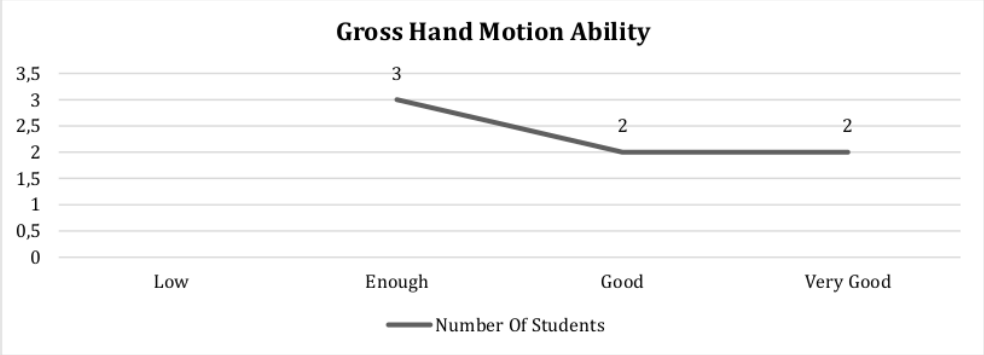

Figure 1. Rough Hand Motion Ability

Table 2. Results of the Second Post: Gross Leg Motion Ability

Category Value	Number of Students
Low	1
Enough	1
Good	3
Very Good	2
Total	7

Table 2 of gross footwork ability shows the variation in students' ability levels. Most of the students have good to excellent ability, but there is one student with low ability in this category. These data illustrate that most students have good gross foot movement skills, while other students may need further assistance in the development of these abilities. These results show variation in gross foot movement ability of average students in the good category with 3 students and excellent 2 students. The description can be seen in the following diagram:

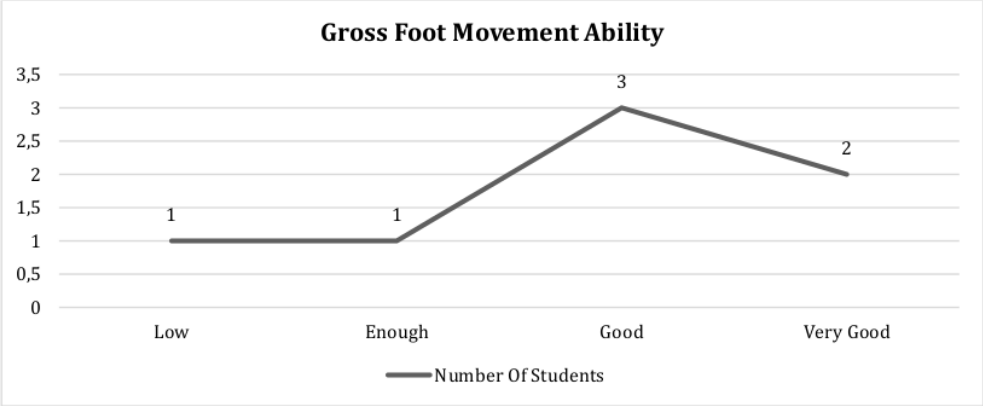

Figure 2. Second Post Results: Gross Foot Movement Ability

Table 3. Third Post: Eye-Hand Fine Motion Ability

Category Value	Number ofStudents
Low	0
Enough	2
Good	4
Very Good	1
Total	7

Table 3 reflects the fine eye-hand movement ability of students. The results show that the majority of students had good to excellent fine eye-hand movement skills, with four students falling into the "good" category. There were no students in the "low" category, indicating that they all had sufficient hand-eye coordination. The description can be seen in the following diagram:

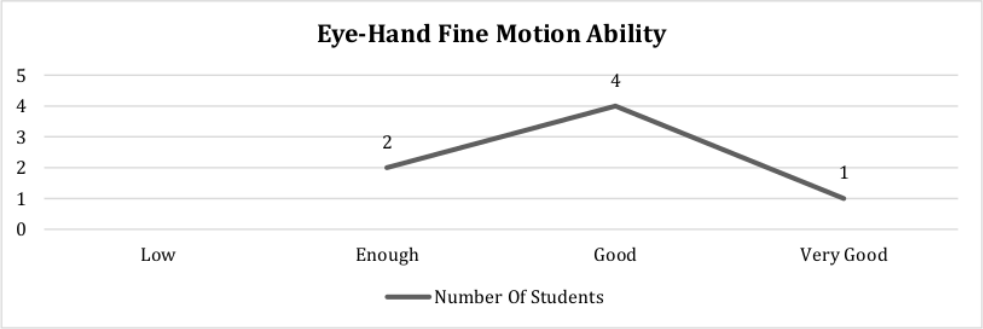

Figure 2. Third Post: Eye-Hand Fine Motion Ability

Table 4. Fourth Post: The Ability of Fine Eye-Hand Movements in Everyday Life

Category Value	Number of Students
Low	1
Enough	3
Good	2
Very Good	1
Total	7

Table 4. focuses on the ability of fine eye-hand motion in everyday life. The majority of students were able to perform their daily tasks fairly well, with three students having

sufficient ability. However, one student needs more support in this regard. It shows the variation in students' fine eye-hand motion ability when applied in real situations.

Overall, the results show that the majority of students had good to excellent movement skills in certain categories, but there was still some variation in their abilities in some categories. This evaluation can be used to identify areas where students may need additional help or support in the development of their motor skills.

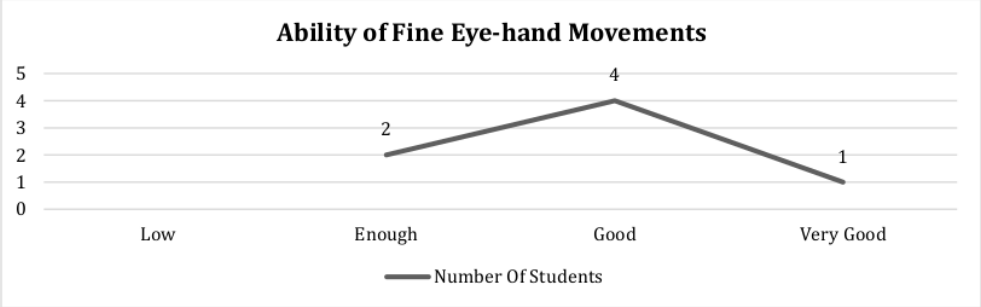

Figure 3. Fourth Post: The Ability of Fine Eye-Hand Movements in Everyday Life

Table 5. Pre-Test and Post-Test

No.	Students	Pre-Test Scores	Post-Test Scores
1	A	45	62
2	B	38	56
3	C	29	48
4	D	41	60
5	E	33	55
6	F	50	68
7	G	36	51

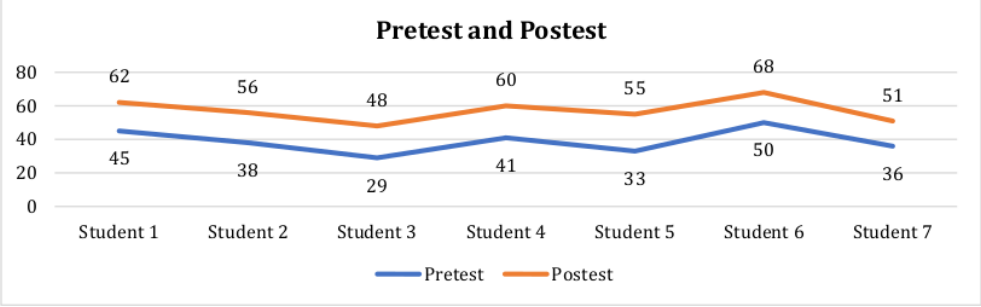

Figure 4. Pretest and Posttest Assessment

Table 6. One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Pretest	7	388.571	715.142	270.298
Posttest	7	571.429	679.285	256.746

With the information from this table, it can be concluded that the "posttest" average (57.1429) is higher than the "pretest" average (38.8571). In addition, we can also see that the standard deviation and standard error mean for the "posttest" are lower than for the "pretest," which may indicate that the data in the "posttest" group tends to be more stable and closer to the population average than the data in the "pretest" group.

Table 7. Pretest dan Posttest One-Sample Test

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Pretest	14.376	6	.000	3.885.714	322.432	454.711
Posttest	22.257	6	.000	5.714.286	508.605	634.252

Based on the results in Table 7, it can be concluded that there are statistically significant differences between the "pretest" and "posttest" groups. High statistical t-values and very low significance values indicate that the increase between the two groups is statistically significant. Moreover, a 95% confidence interval indicates that the increase can be estimated with a 95% confidence level.

The study's findings imply the possible advantages of employing engaging and circuit-based approaches to ameliorate motor skills in dyspraxia children. Furthermore, these results expand our comprehension of motor skill growth and offer concrete proof that integrating circuit-based methodologies in games is an effective means of prompting gross motor development. The results suggest that using circuit-based activity games to improve basic motor skills could make interventions aimed at improving children with dyspraxia's gross motor skills much more effective in both school and family settings.

These outcomes continuously authenticate the conclusions of preceding research that acknowledge the favourable impact of play and circuit-based methods on the advancement of motor skills in children facing an array of motor-related afflictions. As part of a constructive critique, it is crucial to recognise the limitations and weaknesses of the study. The research sample is reasonably representative of the research procedure. Other variables that could impact the findings include individual variability in dyspraxia severity. Appreciating these constraints aids in interpreting the findings. Furthermore, it is essential to consider other factors that may influence the gross motor abilities of children with dyspraxia in the learning process. The analysis indicates that the interpretation is intricate and profound. This condition affects the gross motor skills of dyspraxia children.

These findings are consistent with previous studies highlighting the positive potential of play and circuit-based approaches in improving motor skills in children with a variety of challenged motor conditions (Malika et al., 2022; Sistiarini, 2021). This study confirms that the use of game circuit-based fundamental motor skill activities can be an effective solution in stimulating gross motor development of children with dyspraxia (Carballo-Fazanes et al., 2023; Kasih, 2018).

These results also contribute to our understanding of the development of motor skills in children with dyspraxia (Sugino & Ushiyama, 2021). This study provides empirical evidence that this approach has the potential to be applied in the context of interventions, both in schools and in the family environment. However, these findings also suggest the need for further research to explore the specific elements of fundamental motor skill activity-based gaming circuits that are most effective in improving gross motor skills.

In the context of theory, these findings support the concept that the use of circuit-based approaches to games can be an effective learning alternative for children with dyspraxia. In confirmation of existing theories, these results are in line with the view that the use of game-based interventions can help overcome motor inhibition and increase children's participation in physical activity (Loprinzi et al., 2012; Shields & Synnot, 2016; Verschuren et al., 2012). As anticipated in the theoretical framework, this approach helps

to complement or redevelop existing theories, given the lack of particular focus on the development of motor skills in this population. This approach will facilitate the understanding of motor concepts. By combining research measures and can create a learning environment that supports the motor development of children with dyspraxia, as well as help achieve potential in physical education and other physical activities. The novelty of this research finding lies in the application of a circuit-based approach to gaming that focuses on groups that have specific motor barriers. In this context, the approach has a positive effect on improving gross motor skills, which were previously a challenge for children with dyspraxia.

CONCLUSION

This research makes a significant contribution to the realm of physical education, particularly regarding the motor development of students with dyspraxia. By offering valuable insights into the motor development of these students, the study provides empirical evidence supporting the effectiveness of game-based interventions and gaming circuits in enhancing the gross motor abilities of children with dyspraxia. The implications of these findings extend to the realms of education and support for children with dyspraxia, shedding light on the potential of innovative approaches to motor skill development.

The positive outcomes observed in this study suggest that game-based approaches and gaming circuits can serve as viable solutions for improving the gross motor skills of children with dyspraxia, presenting promising prospects for educational interventions and overall motor skill enhancement. The study, however, underscores the need for further research to delve into the specific elements of game circuit-based fundamental motor skill activities that prove most effective in enhancing gross motor skills in children with dyspraxia.

Ultimately, the insights derived from this research have the potential to pave the way for targeted interventions and initiatives tailored to improving basic locomotion skills among students with dyspraxia in educational settings. Continued research in this area holds the promise of developing more focused and customised intervention programmes, addressing specific motor barriers, and refining detailed strategies to empower children with dyspraxia to overcome motor challenges.

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CONFLICTS OF INTERESTS

The authors declare that they have no competition.

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