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Original Article

DO FUNDAMENTAL MOVEMENT SKILLS, PHYSICAL ACTIVITY AND ENJOYMENT AMONG INACTIVE STUDENT DURING THE COVID-19 ERA IMPROVE AFTER EXERGAME?

HABILIDADES FUNDAMENTAIS DE MOVIMENTO, ATIVIDADE FÍSICA E PRAZER EM ESTUDANTES INATIVOS DURANTE A PANDEMIA DE COVID-19 MELHORAM APÓS O EXERGAME?

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RESUMO

As baixas habilidades fundamentais de movimento, atividade física e diversão dos alunos da era COVID-19 são lacunas neste estudo. Este estudo tem como objetivo examinar os efeitos do exergame nas habilidades fundamentais de movimento, atividade física e diversão em alunos inativos durante a era COVID-19. Pesquisa quantitativa com métodos experimentais foi utilizada neste estudo. Havia 26 crianças alocadas no grupo exergame (n = 13; idade: 7,20 ± 1,30 anos; altura: 1,38 ± 2,38 cm; peso: 31,60 ± 4,50 kg e um grupo controle n = 13; idade: 7,40 ± 1,14 anos; altura : 1,36 ± 3,08 cm; peso: 28,40 ± 3,43 kg). O programa de intervenção durou nove semanas. As crianças com habilidades fundamentais de movimento foram avaliadas usando Test of Gross Motor Development-Third Edition e a atividade física foi medida usando o acelerômetro ActiGraph GT9X Link, enquanto o prazer foi avaliado usando a escala de prazer do currículo de educação física. Os resultados mostraram que a implementação do exergame demonstrou melhorar significativamente as habilidades fundamentais de movimento, atividade física e prazer. No entanto, não houve aumento no grupo controle. Esta pesquisa é uma evidência de que o exergame é uma ferramenta eficaz para melhorar as habilidades fundamentais de movimento, atividade física e diversão em alunos durante a era COVID-19.

Palavras-chave: Exergame, habilidade fundamental de movimento, atividade física, prazer, COVID-19

ABSTRACT

The low fundamental movement skills, physical activity and enjoyment students in the COVID-19 era are gaps in this study. This study aims to examine the effects of exergame on fundamental movement skills, physical activity and enjoyment in among inactive students during the COVID-19 era. Quantitative research with experimental methods was used in this study. There were 26 children allocated to the exergame group (n=13; age: 7.20±1.30 years; height: 1.38±2.38 cm; weight: 31.60±4.50 kg and a control group n=13; age: 7.40±1.14 years; height: 1.36±3.08 cm; weight: 28.40±3.43 kg). The intervention program was conducted for nine weeks. Fundamental movement skills children were assessed using the Test of Gross Motor Development-Third Edition and physical activity was measured using the ActiGraph GT9X Link accelerometer, while enjoyment was assessed using the physical education curriculum enjoyment scale. The results showed that the implementation of exergame was proven to improve fundamental movement skills, physical activity and enjoyment significantly, however there was no increase in the control group. This research is evidence that exergame is an effective tool to improve fundamental movement skills, physical activity and enjoyment in students during the COVID-19 era.

Keywords: Exergame, Fundamental movement skill, Physical activity, Enjoyment, COVID-19

Introduction

Entering 2021 Corona virus still has a causing harm to the entire community including elementary school students, for example the experience of student movement is hampered and the student's fundamental movement skills (FMS) are low[1]. FMS is the ability to perform three basic movement skills such as locomotor skills, stability skills[2] and manipulative or object control skills. A study found that improving aspects of FMS have the potential to create a healthy lifestyle in the future[3]. Another benefit of FMS is that it can reduce overweight or obesity in students[4]. Previous studies in the UK and internationally reported that the rates of FMS among primary school students has decreased over time[5]. Similar to data found in

Indonesia, the FMS of primary school students is still low and continues to decline due to an unhealthy lifestyle and rarely doing sports[6].

Another factor that is currently being highlighted is the decreased level of physical activity (PA). Survey data reported that before the pandemic crisis the time spent on PA was 540 minutes/week, but after and during the pandemic it decreased to 105/week[7]. Other data reports that the inactivity of community in the world globally during the COVID-19 pandemic is estimated at 28% (1.4 billion people)[8]. The decline in PA levels was caused by several factors, such as the policy of orders to continue to work and school from home, the closure of public sports venues, fitness centers and a ban on exercise or mass PA in public places[9]. In addition, several recent studies reported that the decline in PA was due to the effect of lockdown[10] and social distancing during a pandemic[8].

Enjoyment is one of the psychological factors that has decreased due to the impact of COVID-19. Enjoyment is a positive effect that reflects general feelings such as pleasure, liking and is most recently defined as a multidimensional structure associated with enthusiasm for certain activities[11]. In addition, enjoyment is also defined as a feeling of joy, or not feeling bored in carrying out all sports activities, physical activity, or while participating in PE class. Enjoyment will be created if someone thinks that the sports experience is enjoyable. Most previous studies have shown that enjoyment is a key factor that positively triggers motivation, for further involvement in sports activities in PE class[12]. The data reports that people's enjoyment of exercising is reduced, because they often feel anxious, afraid when doing sports in the COVID-19 era[13].

A potential new training strategy to improve FMS, PA and enjoyment is through exergames (i.e., Xbox 36). Exergame is an innovative and interactive video game that combines training and video[14]. It requires full-body movement from the player. Activities in exergame include cycling[15], fitness games, tennis, baseball, soccer, basketball, boxing, dance. The advantages of exergame are able to conduct training at home safely[16] and comfortably without being disturbed by bad weather[17] especially to avoid the spread of COVID-19. Exergame has proven to be a fun activity for kids to adults[18]. Research by Andrade et al[19] reported that exergame causes boys and girls to experience a significant improvement in psychological aspects. Some researchers claim that exergame is attractive to children and effective in helping them improve motor skills and develop motivation to participate in PA[20]. However, different results reported by the study of Wu et al[21] found that exergame can cause lower motivation compared to traditional training methods for exercise and exergame can also cause poor motor skills, so it is difficult to repair[22]. Then recent studies have shown that exergames have an inconsistent impact on children's motor skill competence in the short term[23]. With the results of the previous exergame with the gap, it is the reason for us to uncover this problem.

Many previous studies have examined exergame[24,25]. However, there is no research that explores how the effects of exergames on FMS, PA and enjoyment of students during the COVID-19 era. The this study will implicate the development of FMS, PA and enjoyment and provide information knowledge to teachers, lecturers and practitioners about the benefits obtained from the exergame. Therefore, the aim of this study was to exam the effectiveness of exergames on increase FMS, PA and enjoyment in among inactive students during the COVID-19 era.

Methods

Subjects

Twenty-six male children agreed to be subjects in this study after obtaining permission from parents and school authorities. 13 subjects came from elementary school I and 13 subjects came from elementary school II located in the territory of Indonesia. These two elementary schools were chosen because they have large funds and have exergame facilities. Subjects were selected using a purposive technique, namely choosing subjects from among students who were not active during physical education learning in the COVID-19 era. The criteria for determining inactive students is through their attendance book in physical education classes based on the information provided by the teacher. Subjects characteristics are presented in Table 1.

Table 1. The characteristics of the subjects (Mean±SD)

Subjects (n=26)	EG (n=13)	CG (n=13)
Age (y)	7.20±1.30	7.40±1.14
Height (cm)	1.38±2.38	1.36±3.08
Weight (kg)	31.60±4.50	28.40±3.43

Note: EG: Experimental group, CG: Control group
Source: authors

Measures

Fundamental Movement Skill. To assess FMS children can use Test of Gross Motor Development-Third Edition, consists of tests run, skip, leap, hop and horizontal jump (locomotor), then tests catch, kick, underhand roll, one-hand strike and two-hand strike (object-control) and finally balance tests (Bruininks–Oseretsky Test of Motor Proficiency 2). The balance assessment consists of two tasks, walking forward along a straight line and standing on one leg[26]. Each FMS in TGMD-3 is accompanied by performance criteria. For example, locomotor motion with criteria if the movement of running, leap, jumping, and jumping horizontally is done correctly according to the assessment norm, then it gets a value of 1 to 4 and if it does not match the assessment norms it is given a value of 0. As for control objects, there are three performance criteria to capture: a) the preparatory phase in which the hands are in front of the body and the elbows are bent, b) the arms are outstretched as they reach the ball as it comes in, and, c) the ball is caught with the hands only. Each child is evaluated against these criteria. If the performance criteria are met, grades 1 to 4 are assigned. If a performance criterion is not met, a score of 0 is assigned. Meanwhile, the assessment for stability component balance is by assessing how long the child can do walking straight lines, and standing on one leg. Each child tried two experiments for each movement skill and was assessed based on performance criteria[(24)]. The total score of the child (the sum of their individual scores) is calculated.

Physical Activity Levels. To measure PA students can use the ActiGraph GT9X Link accelerometer, namely ActiGraph light and resembles a watch. This instrument is valid and reliable. Students are instructed to use the accelerometer in their arms every time they go to school. The activity counts recorded were interpreted using empirically-based cut points that defined different intensities (sedentary: 0820; light PA: 8212830; moderate-to-vigorous PA (MVPA): 2831 for ActiGraph vector magnitude) of preschool children's PA. Student average percentages of time in sedentary, light and MVPA at school were used as the outcome[(25)].

Enjoyment. To assess the enjoyment level of a child in the physical education class can use the Physical Education Curriculum Enjoyment Scale. The question consists of five items (1) "I like this game", (2) "I don't like this game", (3) "I can play this game all day long". (4) "I feel bored with this game" (5) "This game makes me excited". The Physical Education Curriculum Enjoyment Scale has been adjusted for children aged 6-9 years to have retest

reliability (r = 0.70-0.90) and construct validity. For filling out this instrument using a Likert scale consisting of (1) "strongly disagree" to (5) "strongly agree".

Procedures

This research has been approved by the Ethics Committee of Public Elementary Schools, Cianjur, Indonesia (approve date 01.02.2021 and number 38/02/2021) and this research is in accordance with Helsinki declaration. Subjects from elementary school 1 school entered the experimental group, namely getting the exergame program and subjects from elementary school II school entered control group II, namely getting traditional games that they do every day in the physical education class or not getting any program from the researchers. Then the intervention program was carried out for 9 weeks, three times per week and 60 minutes per week. The intervention program began with pre-test activities on February and ended in post-test on March 2021. Flow studies are presented in Figure I.

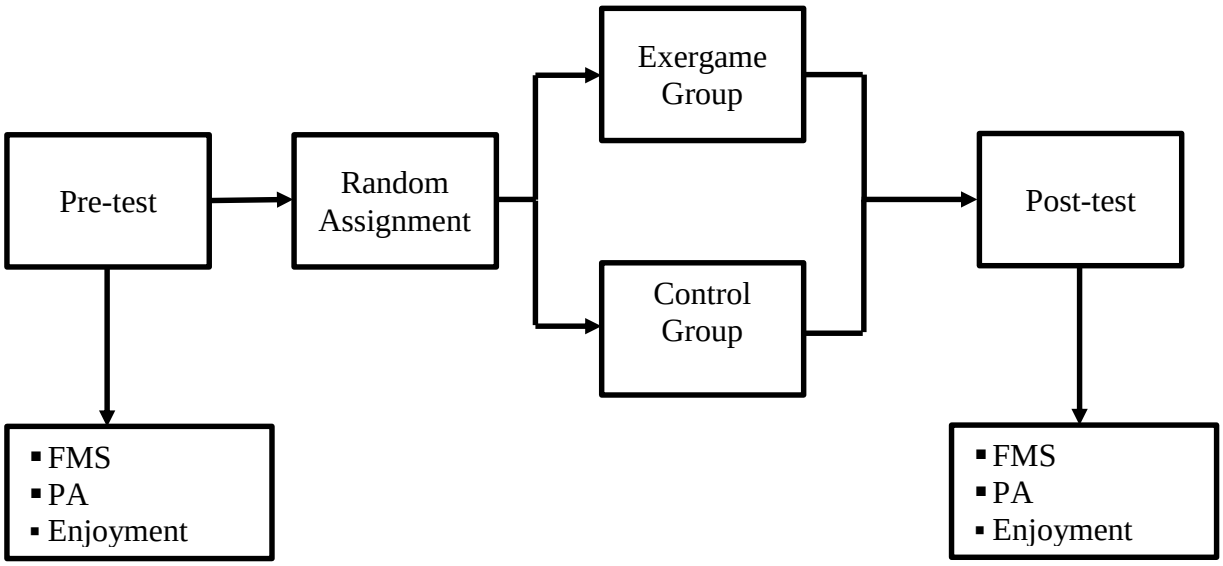

Figure 1. Study Flow
Source: authors

Intervention programs

Exergame Program. For the experimental group, the exergame was conducted on Monday, Wednesday and Thursday from 09.00-10.00 hours, for nine weeks, it aims to develop FMS, PA and enjoyment owned by children aged 6-9 years. The program is carried out in the gym twice a week for 60 minutes. The Exergame program items used are (1) Bowling games, (2) Tennis games, (3) Basketball games, (4) Standing twists games, (5) Running games, (6) Dancing games. Each game lasts 10 minutes.

Statistics Analysis

All data in this study will be analyzed using IBM SPSS 25.0, which will later obtain descriptive statistical values (mean±standard deviation), data normality values (Shapiro-Wilk). Independent t-test was used to see the difference between pre-test and posttest scores on FMS, PA and enjoyment in the experimental and control groups. The level of significance used is 0.05.

Results

The results of this study report that the data is normally distributed, in addition, based on the results of the Independent t-test, there is a significant difference between the pre-test and post-test exergame program intervention, such as the FMS run variable which has a value (F =

122.454, $p<.05$), skip (F = 119.163, $p<.05$), leap (F = 135.542, $p<.05$), hop (F = 147.449, $p<.05$), horizontal jump (F = 117.751, $p<.05$), catch (F = 44.262, $p<.05$), kick (F = 213.33, $p<.05$), underhand roll (F = 147.059, $p<.05$), one-hand strike (F = 255.682, $p<.05$), two-hand strike (F = 112.668, $p<.05$), walking straight line (F = 408.33, $p<.05$), and standing on one leg (F = 304.710, $p<.05$) (Table 2). In addition, the application of exergame also shows a high increase in the PA aspect (F = 90.98, $p<.05$) and enjoyment (F = 70.81, $p<.05$). However, the control group showed different results namely, there was no improvement in the aspects of FMS ($p>.05$), PA ($p>.05$) and enjoyment ($p>.05$) (Table 2).

Table 2. Pre-test and post-test changes in FMS, PA and Enjoyment (Mean±SD)

Variable	EG (n=13)			CG (n=13)		
	Pre	Post	*p*	Pre	Post	*p*
	M(SD)	M(SD)		M(SD)	M(SD)	
Run	1.96±0.36	3.73±0.94	.000	2.35±0.49	1.69±0.27	.233
Skip	2.35±0.49	3.65±0.87	.000	2.19±0.42	1.58±0.22	.121
Leap	1.42±0.12	3.70±0.90	.000	1.77±0.29	1.50±0.18	.145
Hop	1.65±0.25	3.69±0.89	.000	1.69±0.27	1.58±0.22	.133
Horizontal jump	1.46±0.17	3.27±0.71	.000	1.46±0.17	1.27±0.21	.119
Catch	1.46±0.17	2.85±0.55	.008	2.31±0.47	1.15±0.11	.227
Kick	1.62±0.23	2.85±0.55	.006	1.15±0.11	1.11±0.09	.178
Underhand roll	2.00±0.40	3.54±0.82	.000	1.08±0.06	1.01±0.02	.241
One-hand strike	1.42±0.15	2.58±0.51	.003	1.40±0.14	1.22±0.20	.356
Two-hand strike	1.92±0.32	3.50±0.80	.000	1.65±0.25	1.16±0.12	.244
Walking straight line	3.15±0.69	3.08±0.42	.000	3.10±0.67	2.85±0.59	.145
Standing on one leg	3.42±0.74	3.31±0.70	.000	3.39±0. 70	2.92±0.62	.271
Sedentary (min)	5.44±1.40	6.55±1.81	.000	5.23±1.20	5.02±1.13	.177
Light (min)	7.32±2.26	8.25±2.75	.000	5.49±1.47	5.27±1.29	.234
MVPA (min)	9.85±2.90	10.77±3.44	.000	7.10±2.16	6.11±1.17	.104
Enjoyment	13.63±3.49	20.8±4.75	.000	13.43±3.28	11.61 ±2.90	.433

Note: M: Mean, SD: Standard deviation, MVPA: Moderate-to-vigorous PA, EG: Experimental group, CG: Control group
Source: authors

Discussion

The purpose of this study was to examine the effects of exergame on increase FMS, PA and enjoyment in among inactive students during the COVID-19 era.

The results of this study showed that exergame intervention can improve the FMS component, it is because exergame had the characteristics of a very fun game, easy to play and can be done at any time, so that children who are not interested in sports activities become more enthusiastic and actively move in PE class than the control group. Fogel et al[27] confirmed that exergame can provide opportunities to engage in higher physical activity than doing standard exercise programs. Exergame had been proven to be an effective game and worthy of use in PE class, because it has the power to trigger interest, motivation and the ability to move children to sustainably participate in sports activities. Previous studies conducted in a school context have identified that the exergames practice can increase physical activity, mental health, and motor skill competence in children[19], as well as becoming a potential educational tool today.

Then this research also proved that exergame could positively increase student's PA inactive during the COVID-19 era to be higher. The increase in PA occurred because exergames had interesting games, so that through these games inactive students became more

enthusiastic[28], and have the motivation to move. One of the keys to changing PA behavior is because exergames offer an interesting, safe game experience that can be played at home, so students can continue to actively move. The results of this study support previous research which reported that exergame can be used as a tool to encourage students to participate in PA[20]. As for the control group, students showed behaviors such as bored and not enthusiastic in the learning process because the teacher had often taught them.

Another finding from this study was that the subjects reported that they really enjoy doing sports activities with exergame intervention, it showed that children were likely to continue playing basketball games, running games, standing twists games that were game features in exergame. Exergame is a great activity for children to use in the long term and on a sustainable basis. The results of this study are in line with the research of Vernadakis et al[24] reported that the XbK-based balance exergame program was significantly more enjoyable than traditional physiotherapy. The main reason why exergame programs were more fun than traditional physiotherapy was that exergames provide more interesting challenges for athletes. Exergame activities are fun psychological teaching activities for children that can help improve their physicality[29]. According to Mohold et al[15] the use of fun exergames can be a useful strategy for promoting physical activity, especially for those who were less motivated by traditional sports. The results of this study support previous research that has shown that children's FMS was more developed through exergame than traditional sports and that subject enjoyment levels were higher for exergames than traditional activities[30]. One reason for answering these results is because children in the current era are more familiar with exergame than traditional games, besides that the number of children's movement activities is more often in exergame than traditional games. However, it is important to note that the use of exergame programs is not found in many schools or is limited to schools that have large enough funding, so that they can provide exergame facilities.

Conclusion

The main conclusion in this study shows that the implementation of exergame can positively improve FMS, PA and enjoyment in among inactive students during the COVID-19 era. However, the use of exergame will provide effectiveness if the school has large enough funding in a country.

The limitations in this study are: (1) the subject of the study is relatively small, (2) the subjects are only from two urban elementary schools in region (Indonesia). Then the further research must use more subjects and come from several elementary schools in Indonesia. Apart from the limitations of this study, several implications arise from this study namely that exergame can be used as an effective pedagogical tool to increase FMS, PA and enjoyment in among inactive student and can be used by all students during COVID-19.

Besides that the results of this study provide important information for teachers, lecturers and practitioners about the advantages of exergame. The findings of this study could potentially be applied to future studies involving exergame with other platforms (Nickelodeon Fit and Just Dance).

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