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## **Analysis of the impact of game-based physical education learning on physical fitness of junior high school students**

**Khairuddin<sup>1</sup>, Masrun<sup>2</sup>, Syahril Baktiar<sup>1</sup>, Syahrudin<sup>3</sup>**

<sup>1</sup>Departement of Sport Education, Sport Science Faculty, Padang State University, Indonesia

<sup>2</sup>Department of Coaching, Sport Science Faculty, Padang State University, Indonesia

<sup>3</sup>Departement of Sport Education, Sport Science Faculty, Makasar State University, Indonesia

\*Corresponding Author: [khairuddins2@fik.unp.ac.id](mailto:khairuddins2@fik.unp.ac.id)

### **ABSTRACT**

8 This study aims to analyze and determine the effect of game modifications and movement activity approaches in the physical education learning on the level of physical fitness of student's Junior High Schools. The quasi-experimental study with a pretest posttest design was used in this study. The sampling technique was carried out using a proportional random sampling using the Slovin formula and then a sample of 100 people was obtained. Indonesian Physical Fitness Test for 13-15 years old was used to measure the student's physical fitness. The data were analyzed descriptively and using t-test to analyze mean differences. There is a significant effect of the game modification and movement activity approaches on the level of physical fitness of junior high school students. There is a significant difference of the effect between game modification and movement activity approaches on the physical fitness level of junior high school students. It means that the Game Modification is better than Movement activity approaches in improving students' physical fitness.

**Keywords:** physical education; physical fitness; learning, model

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### **INTRODUCTION**

Physical education is an integral part of holistic education and physical activity is taught in schools to promote an active lifestyle (Drijevers et al., 2022) an active lifestyle can improve physical fitness (Khairuddin et al., 2022). Students who have excellent physical fitness obtain good health, good health is the foundation to be able to improve physical fitness (Liu Y et al., 2022). Physical fitness is considered as one of the basic health indicators for adolescents (i.e. boys and girls aged 11 and 17 years) (Iserbyt. et al., 2020).

Schools, through Physical Education are the ideal thing to make students aware of the benefits of having fitness that affect their physical and psychological well-being (Pan D et al., 2022). Furthermore, the teacher as the main role in Physical Education greatly influences student involvement in physical activity (Chang CK et al., 2022). A teacher/trainer needs to know and understand the stages in a given motor learning (Komaini et al., 2021). A good level of physical fitness is positively related to mental health and a better quality of life (Iermakov S et al., 2021). In addition, physical fitness has also been shown to have a positive relationship with academic students at school (Liu Y et al., 2023). Motivation has been defined as the psychological features that drive a person to act towards a desired goal. Sun et al. explore that impact Self-Determination Theory (SDT) in Physical Education learning is related to the cognitive, psychomotor, and affective domains (Sun et al., 2017).

In fact, the implementation of Physical Education learning in schools is currently not running effectively and efficiently, so that the goal of Physical Education, which is to improve students' physical fitness, has not been achieved optimally. This is evidenced by the results of research conducted by the Ministry of National Education's Physical Quality Development Center on Indonesian students: in 2003, students at the elementary, junior high, high school and vocational levels showed that 11% of students had physical fitness in the very poor category, 45.8 % less category (Widodo, 2003). Furthermore, the results of research show that there were no male students who had a very good category of physical fitness, 22.7% of students who had good physical fitness, 27.27% the category moderate, 13.64% less category, and 36.36% less category (Arman, 2007). Conditions like this indicate that the existence of Physical Education learning in schools does not contribute enough to the physical fitness of students. From these facts, the quality of the Physical Education program in Indonesia is still low.

Currently, Physical Education teachers still use conventional (traditional) approaches in teaching, namely the learning process is centered on the teacher. Where students carry out learning activities based on orders and movements determined by the teacher. This learning places more emphasis on students on mastering sports skill techniques, this is the same as coaches in training their athletes. The traditional learning model is less favored by students at the junior high school level, causing the physical fitness of students to decrease. Research has noted a lack of evidence supporting the effectiveness of teacher professional processes because there is no single method or strategy for teacher professional development to ensure teacher quality (Kennedy, 2014). However, it is recognized that quality teacher professional development must take into account the context of teaching that focuses on teacher needs, and is delivered in a challenging, collaborative and social process where interaction is paramount (Tannehill, 2016).

Physical fitness is the ability of the body to adjust (adaptation) to the physical liberation given to him without causing excessive fatigue (Pan D, et al ,2022). Physical fitness is very important for every student; however, the fitness level of each student is different depending on the activities carried out. The components of physical fitness are divided into physical fitness related to health and performance. There are four components of physical fitness related to health, namely; (a) aerobic endurance, (b) muscle strength, (c) muscular endurance, and (d) flexibility. While physical fitness related to performance, there are 6 components namely; (a) coordination, (b) balance, (c) speed, (d) agility, (e) power, (f) reaction time (França C, et al , 2022). The most important components of physical fitness are (a) cardiac fitness, the ability to transport and use oxygen optimally. Cardiac fitness bestows endurance 'namely the ability to perform physical activity for long periods, (b) muscle strength refers to the ability of certain muscles or muscle groups to exert force. Strength is associated with the ability to perform vigorous movements such as pushing or lifting, (c) muscular strength refers to the degree to which work muscles can be performed during a single explosive contraction (Miller A, et al, 2019).

In addition, other components of fitness can enhance the ability to perform physical activities, including flexibility (range of motion about specific joints), balance (ability to maintain stability and posture), and body composition (e.g. relative amounts of fat and fat-free mass) (Cowley ES, et al , 2021) factors that affect physical fitness are as follows: (a) age, physical fitness increases until it reaches a maximum at the age of 25 to 30 years, then there will be a decrease in the functional capacity of the whole body of approximately 0.81% per year, but if you exercise diligently it decreases this can be reduced by half, (b) gender, male puberty is almost the same as female, after puberty boys usually have greater values., (c) genetics, affects heart capacity, lungs, body posture, obesity, hemoglobin or blood cells and muscle fiber, (d) food, high endurance when consuming high carbohydrates (60-70%) a high protein diet, especially for building muscles and sports requiring great muscle strength, (e) smoking, inhaled CO levels will break down the VO<sub>2</sub> max value which affects endurance (Drijvers H, et al, 2021). Physical fitness is very important in everyday life. The higher the degree of physical fitness of a person, the higher the ability to work physically, and can prevent heart disease, stroke, hypertension, and osteoporosis (Pedro, et al, 2022).

Modification of games and sports is one of the efforts that can be carried out in the learning process of physical education, sports, and health in schools (Khairuddin. et al, 2022). This

means that a given teaching assignment must pay attention to changes in children's abilities and can help encourage these changes. Thus, the teaching assignments must be in accordance with the level of development of students who are learning. modified games, children will get the quality of body fitness and the values or norms contained in various forms of games with more enjoyable practical learning conditions (Duffey K, et al, 2021). Various kinds of values contained in the game, for example: cooperation, responsibility, respect for friends and others opponent, discipline, confidence, courage, sportsmanship, and others. Modified game is a special version of the game in which certain rules have changed to suit the needs and abilities of the players, the special experiences of the players when learning Physical Education, Sports and Health in schools (Preece, et al 2022). Modifications are needed by teachers in the process of teaching and learning activities. This is very helpful for teachers in the teaching and learning process. by making modifications, the physical education teacher will present difficult subject matter to be easier and simplified without having to be afraid of losing meaning and what will be given. Children will be freer to move in various situations and conditions modified (Vist Hagen R, et al, 2022).

Physical movement activity is any body movement that increases the expenditure of energy /energy for burning. There are several kinds of activities non-locomotor movements are movements that are performed on the spot. Without any space for movement using non-locomotor abilities consisting of bending and stretching, pushing and pulling, lifting and lowering, folding and rotating, shuffling, circular, bouncing and others (Marmeleira, J, et al 2022). Examples of non-locomotor movements are: stretching, bending, swinging, swaying, turning, turning, twisting, pushing, lifting, and landing (Drijvers, et al, 2022). Therefore, this study aims to investigate the effect of the Game Modification Approach with the movement activity approach on students' physical fitness

## METHODS

### Design

This research is a quasi-experimental study with a pretest posttest design. This aims to examine the comparison of the level of physical fitness of students who are carried out with the Game Modification learning method and conventional physical activity learning methods (Arifi, 2020). There two group of treatment in this study namely the Game Modification Group (GMG) and Movement Activity Group (MAG). Pretest of the level of physical fitness of the students was carried out. The grouping results were carried out by an independent t-test before treatment to make sure that there was no significant difference between groups. The both groups were given treatment for 16 meetings.

### Participants

The study involved male students at Junior High School in Padang City with aged 13-15 years, physically and mentally healthy, had no history of heart disease, normal weight, with a total of 133 people. The sampling technique was carried out using a proportional random sampling technique using the Slovin formula. Based on the formula, a sample of 100 people was obtained, after that the matching ordinary pairing from score ranking of physical fitness level used to make groups.

### Instruments

The instrument used in this study was the Indonesian Physical Fitness Test for the 13–15-year age group, Validity = 0.950 Reliability = 0.960 consisting of 5 male test items; (1) 50 meters sprint, measuring the "speed" fitness component; (2) pull up measures the components of physical fitness, strength, and endurance of the arm muscles for 60 seconds; (3) sit-up measure the components of physical fitness, strength, and endurance of the abdominal muscles; (4) vertical jump measures the explosive power of the leg muscles; and (5) 1000 meters running for boys and 800 meters running for girls to measure cardiovascular and respiratory endurance test items (Nurhasan et al 2020). Before carrying out measuring instruments such as: meters, stop watch, calibrated to the Geophysics Metrology Agency for the Province of West Sumatra with the aim of standard measuring instruments. The implementation of the physical fitness test is carried out

sequentially at the same time, then the scores of the 5 round and female test items are converted to the score of the Indonesian Physical Fitness Test aged 13-15 years as shown in tables 1 and 2 below.

**Table 1. Indonesian Physical Fitness Test Scores for Boys Age 13-15 Years**

Score	Sprint 50 M	Pull Up	Sit Up	Vertical Jump	Run 1000 M	Score
5	S.d-6,7"	16-to the top	38-to the top	66-to the top	S.d 3'04"	5
4	6.8"-7,6"	11-15	28-37	53-65	3'05-3'53"	4
3	7,7"-8,7"	6-10	19-27	42-52	3'54-4'46"	3
2	8,8"-10,3"	2-5	8-18	31-41	4'47-6'04"	2
1	≥10.4"	0-1	0-7	0-30	≥6,05"	1

Source: Nurhasan (2022)

**Table 2. Indonesian Physical Fitness Test Scores for Girls Age 13-15 Years**

Score	Sprint 50 M	Pull Up	Sit Up	Vertical Jum	Run 800 M	Score
5	S.d-7,7"	41"-to the top	28-to the top	50-to the top	S.d 3'06"	5
4	7.8"-8,7"	22"-21"	19-27	39-47	3'07"-3'55"	4
3	8,8"-9,9"	10"-21"	9-18	30-38	3'56-4'58"	3
2	10,0"-11,9"	3"-9"	3-8	21-29	4'59-6'40"	2
1	≥12.0"	0"-2"	0-2	0-20	≥6,41"	1

Source: Nurhasan (2022)

The results of the test scores obtained by students from 5 (five) test items for the Indonesian Physical Fitness Test Age 13-15 years for each participant are called "rough numbers" because the units of measurement used for each test item are different, which includes units time, meter, repetition of motion, height measurement, then to get the result replaced in the same unit "value" numbers 1 to 5 as tables 1 and 2 and added up for each respondent. Then the results of the number of each respondent to determine the category of physical fitness of students are connected to table 3.

**Table 3. Indonesian Physical Fitness Test Norms for Boys and Girls**

No	Total Scores	Fitness Classification
1	22-25	Very good
2	18-21	Good
3	14-17	Currently
4	10-13	Low
5	5-9	Very low

Source: Nurhasan (2022)

### Statistical Analysis

All collected data were processed and analyzed using descriptive analysis techniques, preliminary tests for normality and homogeneity of the data, the paired sample t-test to examine the differences within groups, and the independent sample t-test to examine the differences between groups.

## FINDINGS AND DISCUSSIONS

## Findings

### Data Description and Preliminary test

21 There is a difference between the pre- and post-test scores of students' physical fitness in the Game Modification Group (GMG) and the Movement Activity Group (MAG) as shown in table 4. The fitness score in the posttest is greater than the pretest score.

**Table 4. Data Summary of two groups in pre and post-test of physical fitness**

Groups	Test	N	M	SD
GMG	Pre	50	14.72	3.57
	Post		18.26	2.34
MAG	Pre	50	14.00	3.17
	Post		15.86	3.66

6 The data normality test was conducted to determine whether the analyzed data were normally distributed, while the homogeneity test was conducted to determine whether the distribution of the data obtained was homogeneous. The normality test was carried out using the Kolmogorov-Smirnov formula. The all pre and posttest data were normally distributed because of the value of significance (sig.) was  $\geq 0.05$ . Furthermore, the homogeneity test was carried out using Levene's Test. The all data has a homogeneous distribution because of the significant value of the homogeneity test obtained is 0.200 ( $\geq 0.05$ ).

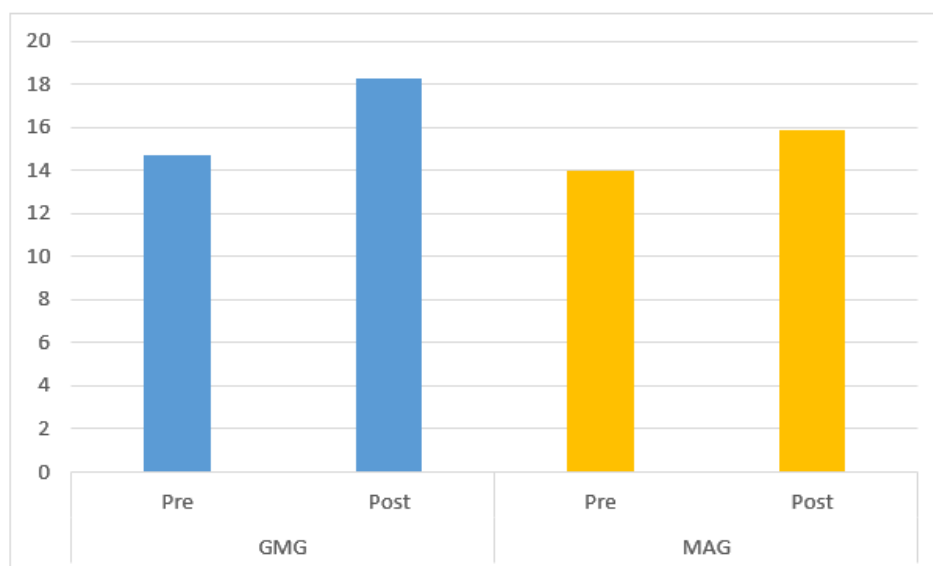
### Impact of Learning Approaches on Student's Physical Fitness

**Table 5. Differences between pre and posttest of physical fitness scores in both groups**

Groups	Test	N	M	SD	t	Sig.
GMG	Pre	50	14.72	3.57	49.807	0.000
	Post		18.26	2.34		
MAG	Pre	50	14.00	3.17	41.647	0.000
	Post		15.86	3.66		

The results of the analysis in Table 5 showed that a significant difference ( $t=49.807$ ;  $p=0.000$ ) between pre ( $M = 14.72$ ;  $SD = 3.57$ ) and post-test ( $M = 18.26$ ;  $SD = 2.34$ ) of student's physical fitness score in the Game Modification Group. It means that there is a significant effect of the game modification approach to improve student's physical fitness in the learning process of physical education sport and health subject at school. It is also showed that a significant difference ( $t = 41.647$ ;  $p = 0.000$ ) between pre ( $M = 14.00$ ;  $SD = 3.17$ ) and post-test ( $M = 15.86$ ;  $SD = 3.66$ ) of student's physical fitness score in the Movement Activity Group. It means that there is a significant effect of the movement activity approach to improve student's physical fitness. The description of the analysis results as shown in figure 1.





**Figure 1. Differences of pre and posttest of student’s physical fitness scores in both groups**

22 The researcher also conducted an analysis of the posttest scores of students' physical fitness using the independent t-test to show that there were significant differences in the effect of the game modification and movement activities approach on the level of physical fitness of junior high school students. 19 The results of the analysis show that there is a significant difference ( $t=29.850$ ;  $p=0.000$ ) between the posttest data on the physical fitness scores of students in the Game Modification Group and Movement Activity Groups, so it can mean that the game modification approach has a greater influence on the physical fitness of junior high school students.

## DISCUSSIONS

26 This study aims to examine the differences in the effect of increasing the physical fitness of students who are taught using a game modification approach with a movement activity approach. Based on the results, it was shown that there was a significant difference in the increase in physical fitness of students who were taught with the game modification approach compared to students who were taught with the movement activity approach. Padang city junior high school students enjoy moving around with teachers who use the Game Modification Approach. This finding is supported by states that to improve the physical fitness of students aged 13-15 years, many motions are in the form of games and can generate enthusiasm for movement (Bezzub et al, 2021). Components of physical fitness that can increase physical fitness that need to be leveled up in the process of learning physical education in schools, namely cardiovascular-respiratory endurance, speed, strength, explosive power, flexibility (Khairuddin, et al 2022). Students who have a high level of physical fitness affect academic achievement at school (liu et al, 2020). To improve physical fitness there are several factors that influence it, namely, do regular exercise, get enough rest at least 6-8 hours a day and night. Consuming balanced nutrition and keeping the environment clean (Iserbyt et al. 2022) The practical learning approach to physical education that is active, innovative, and independent and by modifying rules, facilities and infrastructure can increase student motivation in carrying out physical education learning at school (Nurhasan et al, 2022).

11 Motivation is a psychological element that needs to be questioned in Physical Education. Students who have motivation towards learning Physical Education have been shown to be positively related to the level of physical activity they (Owen et al., 2014). When students have high motivation towards Physical Education, they tend to be more active during learning (Mayorga-Vega & Viciano, 2014). According to Self-Determination Theory (SDT), motivation is conceptualized as a multidimensional construct that can be ordered on a continuum according to the extent to which motivation is self-determined (or autonomous): amotivation (unintentional), extrinsic motivation or intrinsic (self-determining) motivation (Hagger & Chatzisarantis, 2008). Amotivation is characterized by the absence of the learner's intention to act due to different reasons 16

such as lack of knowledge or certain skills required to act. Extrinsic motivation refers to the external reasons why people take part in activities such as avoiding punishment, achieving rewards, or gaining recognition. SDT also identifies four types of extrinsic motivation that vary in degree of self-determination: external regulation, introjection regulation, identified regulation, and integrated regulation. On the other hand, intrinsic motivation refers to the satisfaction and enjoyment of students in a given activity (Hagger & Chatzisarantis, 2008). Many studies emphasize the importance of learning motivation because it has an impact on learning outcomes (Law et al., 2019; Law & Breznik, 2017; Ngan & Law, 2015).

Sports learning has long been a major concern of Physical Education practitioners, researchers and teachers (Hastie & Mesquita, 2016). In line with the demands of society to develop human beings who are independent, critical, and responsible and able to adapt to their environment. The teaching of Physical Education in schools has moved away from the explicit and formal character of instructional processes, evident in traditional teaching (so-called teacher-centered approaches) (Collins, 2015), with a student-centered Physical Education curriculum approach. A teacher is required to be creative and have careful planning, so that the material and learning process provided can be carried out well and enjoyable. Likewise, how (method) or approach is used, a teacher needs to find an approach that is appropriate to the circumstances of the students themselves. The results of Cuellar & Moreno's research, the use of a more varied teaching style can increase the involvement and activeness of students and provide a better experience in learning Physical Education (Cuellar & Moreno, 2016). Spectrum continues to influence and provide important theoretical foundations for Physical Education teachers (Parker & Curtner-Smith, 2012), being a versatile tool used by teachers can express their creativity and individuality (Goldberger et al., 2012). This fact, coupled with growing recognition of the constructivist nature of learning and the diversity of learner learning styles, highlights the need for teachers to employ different teaching styles (Kulinna & Cothran, 2003), both in their initial training and throughout their career (Blasco et al., 2011). An effective teacher will be able to creatively choose and apply the right method or approach according to the situation. Whatever approach is used by the teacher, attention should be paid to the suitability of the learning approach to the conditions of the students and the environmental situation. Thus, the teacher must be familiar with the teaching style that is carried out, and how to combine it properly and change it to create new teaching, style and achieve the intended learning goals (Cuellar & Moreno, 2016). In other words, students are expected to be active and teachers are also creative in learning Physical Education.

This signifies the learning process of sports and health physical education subjects at the first high school in the city of Padang. Students are enthusiastic about doing the movement, with the game modification approach as stated (Khudoli O., et al 2021). In addition, the results of this study are in accordance with research (Khairuddin et al, 2022) concluded that the Play Modification Approach can improve students' physical fitness, students who are less active in the physical education learning process at school can reduce fitness levels. therefore students who do less movement in the learning process of physical education in schools reduce the level of physical fitness of students.

The findings in this study also support previous findings by Houston et al. (2016) and Mahmoodabad et al. (2019), which states that regular exercise and physical activity can efficiently improve physical and mental health, including reducing anxiety and depression, so that good physical function, general health, social function, and mental health can provide a better quality of life in a athlete group. Yavuz et al. (2012) states that the life satisfaction and quality of life of athletes with physical disabilities is higher than non-athletes with physical disabilities. Maybe this is the positive impact of physical exercise on students. Therefore, physical activity is the main factor that can improve a person's mental health, because it can reduce emotional problems or improve mental health which can result in better life satisfaction. However, the research findings obtained are different from the research conducted by Ivantchev & Stoyanova (2019) which concluded that in general there was no significant difference in life satisfaction between participants who did any sport regularly and participants who did not do any sport. This shows that physical activity that is carried out regularly by children, adolescents and students will have an impact on the development of their PYD (Armor et al., 2013; Hambali et al., 2019). there was no significant difference in life



satisfaction between participants who did any sport regularly and participants who did no sport. However, athletes are more satisfied with several life domains such as health status, peer relationships, and performance than non-athlete (Ivantchev & Stoyanova, 2019). This shows that physical activity that is carried out regularly by children, adolescents and students will have an impact on the development of their PYD (Armour et al., 2013; Hambali et al., 2019). There was no significant difference in life satisfaction between participants who did any sport regularly and participants who did no sport. However, athletes are more satisfied with several life domains such as health status, peer relationships, and performance than non-athletes (Ivantchev & Stoyanova, 2019). This shows that physical activity that is carried out regularly by children, adolescents and students will have an impact on the development of their PYD (Armour et al., 2013; Hambali et al., 2019).

Sports learning has long been a major concern of Physical Education practitioners, researchers and teachers (Hastie & Mesquita, 2016). In line with the demands of society to develop human beings who are independent, critical, and responsible and able to adapt to their environment. The teaching of Physical Education in schools has moved away from the explicit and formal character of instructional processes, evident in traditional teaching (so-called teacher-centred approaches) (Collins, 2015), with a student-centered Physical Education curriculum approach. A teacher is required to be creative and have careful planning, so that the material and learning process provided can be carried out well and enjoyable. Likewise, how (method) or approach is used, a teacher needs to find an approach that is appropriate to the circumstances of the students themselves. The results of Cuellar & Moreno's research, the use of a more varied teaching style can increase the involvement and activeness of students and provide a better experience in learning Physical Education (Cuellar & Moreno, 2016). Spectrum continues to influence and provide important theoretical foundations for Physical Education teachers (Parker & Curtner-Smith, 2012), being a versatile tool used by teachers can express their creativity and individuality (Goldberger et al., 2012). This fact, coupled with growing recognition of the constructivist nature of learning and the diversity of learner learning styles, highlights the need for teachers to employ different teaching styles (Kulinna & Cothran, 2003), both in their initial training and throughout their career (Blasco et al., 2011). An effective teacher will be able to creatively choose and apply the right method or approach according to the situation. Whatever approach is used by the teacher, attention should be paid to the suitability of the learning approach to the conditions of the students and the environmental situation. Thus, the teacher must be familiar with the teaching style that is carried out, and how to combine it properly and change it to create new teaching, style and achieve the intended learning goals (Cuellar & Moreno, 2016). In other words, students are expected to be active and teachers are also creative in learning Physical Education.

Physical Education has a fundamental role in increasing students' daily physical activity (Sanz-Martín et al., 2021). From the results of research on junior high school students in the city of Padang, Indonesia, it turns out that students who have a level of physical fitness below the average are 53 people (53%) in the less and very less categories. Physical fitness is defined as the ability to do work efficiently, without causing significant fatigue (Gorski et al., 2019; Maslach & Leiter, 2017). A person is said to be fit, characterized by a body that does not contain much fat, strong bones and muscles, flexible joints and good respiratory endurance (Chambers et al., 2019; Metsios et al., 2020). Students who have physical fitness can certainly carry out their daily activities productively (Moghaddam & Lowe, 2019). Systematic reviews and meta-analyses found that doing physical activity is one of the most effective strategies for improving physical fitness during Physical Education learning (Lonsdale et al., 2013). In general, the impact of physical activity is the release of calories, weight loss, reducing stress, social interaction, avoiding the risk of bad health and improving self-image (Evans et al., 2019; Zelle et al., 2017). Moderate to vigorous physical activity during adolescence has been positively associated with a number of physiological and psychological outcomes, such as cardiorespiratory fitness (Gutin et al., 2005), metabolic disease (Ortega et al., 2008) and better mental health (Biddle et al., 2011; Sabiston et al., 2013). WHO recommends that children and adolescents aged 5-17 years engage in moderate to vigorous physical activity for 60 minutes each day (World Health Organization, 2010). Internationally, only

20% of youth meet this recommendation (Hallal et al., 2012).<sup>15</sup> Therefore, schools as places of learning and play have an important role in facilitating them to engage in physical activity.

The health benefits of a physically active lifestyle in adolescence are widely documented in various research results, both on increasing metabolism (Ekelund et al., 2019) and psycho-social behavior (De Rezende et al., 2014). However, the total amount of physical activity carried out by adolescents is still insufficient (Guthold et al., 2020) and leads to a sedentary lifestyle (Varma et al., 2017). The results showed a significant difference between the percentage of adolescents who fulfilled physical activity on school days in Physical Education compared to non-Physical Education school days. Percentage of students meeting physical activity targets on school days in non-Physical Education classes (i.e., less than 50%), in line with other studies (Kalman et al., 2015; Sanz-Martín et al., 2021). Several studies have shown that learning physical education has a positive effect on the health of children and adolescents (Arday et al., 2014; Singerland et al., 2011). This certainly has a significant influence on the academic achievement of students in Physical Education.

## CONCLUSION

The game modification approach improves students' physical fitness better than the movement activity approach. The game modification approach has an impact on increasing the physical fitness of junior high school students, as well as the movement activity approach which also has a significant impact. Both approaches can be used by physical education teachers in learning with the aim of achieving a better degree of student physical fitness. The game modification approach can have a greater impact on students' physical fitness because in its implementation there is a sense of fun that increases motivation to be more active in learning. Further research by analyzing more complex physical fitness variables before and after being given a learning approach needs to be done.

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