

Effectiveness of Physical Activity Model Based on Circuit for Physical Fitness of Primary School Students

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The development of a model of physical activity for physical education will improve physical fitness. This study aims to determine the effectiveness of a physical activity model based on circuit for physical fitness. The method used in this research is an experiment with a pre-test, post-test control group design. The analysis test used in this research is the average difference test using t-test (paired t-test). The result of the experimental and control group showed a significant difference between pre-test and post-test physical fitness of $0.00 < 0.05$ ($T\text{-count} < T\text{-table}$), thus the variable of the physical activity model based on circuit is predicted to have a significant correlation to physical fitness for primary school students. Therefore, physical education teachers can use a physical activity model based on circuit to increase the physical fitness of students in the first class of primary school.

Key words: *Physical fitness model, Physical education, Primary school students.*

Introduction

Children are born to be physically active. There is little doubting the central importance of movement and physical activity in the lives of children and young people. Consider the following recent research findings: (a) physical activity play is the first appearing and most frequently occurring expression of play in infants, (b) children in all cultures around the world engage in both spontaneous and rule-governed forms of physical activity, (c) most children would rather take part in physical activities than in any other endeavour, (d) they would prefer to succeed in these activities than in classroom-based work, (e) physical

competence is a major factor influencing social acceptance in children of all ages and both sexes, and (f) regular physical activity can make significant positive contributions to physical, mental, and emotional well-being in children (Bailey, 2007). Physical activity is critical for childhood growth processes in the brain, in the nerves, in bone and muscle, and in the other parts of the body. It also promotes students' health and academic development; in fact, when students spend physical activity throughout their day and limit their daytime inactivity to two hours, they are both readier to learn and able to achieve more (Ministry of Education and Culture, 2013). The physical activities of primary school low class students include basic movements (locomotor, non-locomotor, manipulative), physical activity for balance, and body agility (Donnelly et al., 2017).

Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure. Elements of physical activity: (1) bodily movement via skeletal muscle, (2) results in energy expenditure, (3) energy expenditure (kilo calories) varies continuously from low to high, and (4) positively correlated with physical fitness (Caspersen et al., 1985).

Physical activity helps in the development of not only muscles and physical abilities, but also the brain and mental abilities (Tomprowski et al., 2015). By using physical activity, children can learn other skills such as social skills, teamwork, problem-solving, making moral and aesthetic judgements, understanding tactics and strategies of games, and appreciating the relationship between exercise, health and well-being. All these can be delivered through a high-quality physical education programme without detracting from the skills children need to develop to participate in physical activity and sport (Lavin, 2008).

Characteristics of elementary school-age children are related to physical activity, that is generally children love to play, like to move, like to work in groups, and like to practice directly (Burhaein, 2017). Therefore, physical education teachers must pay attention to the following things: (1) teachers must provide physical activity in the form of fun games, (2) teachers must develop physical education learning that is always moving dynamically, and interesting games stimulate interest in motion, (3) the teacher can conceptualise group task learning to be completed together, (4) the teacher provides the child's learning experience directly.

At present, the enthusiasm of primary school children to do physical activity shows symptoms of decline. This is due to the increasingly sophisticated technology in the modern era. Children prefer to hold gadgets or mobile phone which results in many children who are moving less, because they just sit in front of the television, mobile phone, or a computer, and in the end do not have a fit body, then lack of motion can eventually lead to degenerative diseases. In addition, the physical activities of children in the open field are increasingly

limited due to increasingly densely packed subsidised and commercial housing developments. Indirectly, this has an impact on the low level of physical fitness of children, especially the biomotor component of endurance.

As professionals, physical educators need to develop their own philosophy of teaching, one that guides their practice and the character of their daily encounters with pupils (Bailey, 2007). Physical education teachers are eager to take charge of helping hundreds of young people learn to take full advantage of their physical capabilities and to make the best of their opportunities for health and fitness (Lynn et al., 2007). A physical educator hopes: (a) our students will succeed in our physical education classes, (b) students acquire the knowledge and skills that provide a foundation for an enjoyable life, (c) physically active lifestyle, (d) the students understand the relationship between physical activity and health, and (e) the PE experience are fun so that our students will enjoy physical activity now and for the rest of their lives (Fleming and Bunting, 2007).

A physical activity model based on circuit is one of the developments in teaching physical education. Basically, circuit training means doing the exercises and still having fun, as well as being able to have a little chat if necessary, and gives us a simple but effective concept for carrying out circuit training (Heldt, 2001). Children participate in a circuit twice a week and perform the same number of repetitions at each station every time the circuit is completed. However, it is often more desirable to gradually raise levels of strength and fitness, especially if children initially start the circuit with fairly low levels. For children to gradually increase their strength and fitness, they will need to work harder to complete the circuit, gradually increasing the amount of effort they put in (Fishburne et al., 2005).

Participation in 6-week circuit training significantly improved body esteem scores post-intervention (Duncan et al., 2009). The results of Kobel's (Kobel et al., 2014) study on children, with a double PE-period and one single lesson engaged in significantly less MVPA than children who had three single periods of PE (6.7 ± 6.9 minutes/45 minutes vs. 9.4 ± 7.4 minutes/45 minutes, respectively; $p \leq .01$). In conclusion, single periods of PE seem to be more effective in getting primary school children to engage in more MVPA than one double period per week. Physical fitness is a personal matter; it differs from one person to another. Physical fitness is not necessarily positively correlated with body build (Parizkova and Hills, 1998). Fitness is an ongoing process, not a product to be obtained once and for all. Physical educators can't apply adult concepts of physical fitness and exercise to children (Pica, 2008).

Based on the explanation above, the development of a model of physical activity for physical education, will improve physical fitness. So, this study aims to determine the effectiveness of

physical activity models based on circuit to measure the physical fitness of primary school students.

Research Methods

The method used in this research is an experiment with a pre-test, post-test control group design. The basic principle of any experiment is changing only a certain single factor in each research procedure (the rest of the factors are fixed and controlled) (Novikov and Novikov, 2013). The research design is as follows.

Table 1: Pre-test post-test control group design

Group	Pre test	Treatment	Post test
Experiment	O ₁	X	O ₂
Control	O ₃		O ₄

Information:

O₁ = Pre-test the experiment group before treatment

O₂ = Post-test experiment group after treatment

O₃ = Control group pre-test before treatment

O₄ = Control group post-test after treatment

X = Physical activity model based on circuit

The population is a first class in the primary school Al-Azhar 17 Bintaro and SDIT Darussalam Cikarang Bekasi Regency. The research sample consisted of 108 students, consisting of 49 students from the primary School of IT Darussalam Cikarang in Bekasi Regency, and 59 students from the primary School of AL-Azhar 17 Bintaro Tangerang.

The modified physical fitness instrument test in this study included: (a) speed test with 25 meters run, (b) power leg test by jumping forward, (c) arm muscle strength test with 30 seconds push ups, (d) abdominal muscle strength test with 30 seconds sit ups, and (e) the endurance test by up and down bench test until it's no longer strong.

The **Speed test** procedure is as follows: (a) purpose: measure running speed, (b) tools: a straight, flat and not slippery track with a distance of 25 metres, metre, cones, chalk, whistle, stopwatch, test results & pens, (c) implementation: the test is standing behind the start line with a standing attitude; when the whistle is sounded, the testees run as fast as possible until the finish line; the stopwatch is turned on when the whistle sounds and is turned off when the testee steps on the finish line, (d) assessment: the results of the recorded test are the time obtained in seconds when traveling 25 metres.

Power leg test procedures include: (a) purpose: to measure leg muscle power, (b) tools: meter, whistle, mattress / flat grass / sandbox, test results and pens, (c) implementation: the testee stands on the starting line, with feet shoulder width apart; before jumping, knees are bent $> 45^\circ$ and arms are straight back, then the testee jumps forward as far as possible and lands with both feet; if the testee lands in a sitting position then the calculated limit is the closest distance from the start, and (d) the assessment: the test results recorded are the distance of the test jump from the start line to the heel of the foot/fall of the body.

Arm muscle strength test procedures include: (a) purpose: to measure the strength and endurance of the arm muscles, (b) tools: flat/clean grass, stopwatch, whistle, test results & pens, (c) implementation: the test position is to lie down with both arms beside the body and palms pressed to the ground; feet bent up $+ 90^\circ$; when the whistle sounds, the testee lifts the body with the position of the arms straight and then lies back down in the initial position; the movements are repeated over 30 seconds; the movement fails if: (1) the arms are not at the side of the body, (2) the knee is not bent upward, and (3) when the body is lifted the arm position is not straight, and (d) assessment: the test results recorded are the number of push ups done correctly for 30 seconds.

Abdominal strength test procedures include: (a) purpose: to measure the strength and endurance of the abdominal muscles, (b) tools: flat / clean grass, stopwatches, whistles, test results & pens, (c) implementation: the testees lie flat on the floor / grass with both knees bent $+ 90^\circ$ and hands placed behind the ears; another student holds and presses against the ankles; when the whistle sounds, the testee raises his/her body with the position of the elbow touching the side of the knee and then the body is lowered back into the initial attitude; it is done repeatedly without resting for 30 seconds; movement fails if: (1) the arms do not touch the ears, (2) the knees are bent too tight or too wide, and (3) the two elbows do not touch the thighs, and (d) the assessment: the test results are the number of sit ups done correctly for 30 seconds.

The procedure for the **endurance test** is as follows: (a) purpose: to measure cardio-respiratory endurance, (b) tools: bench/box as high as 30 cm, whistle, paper test result and pen, (c) procedure: tester gives cue "ready", when the whistle is blown, student rises up and down the bench until they can't any more, the legs must be straight when on the bench, if going up with the right foot then go down with the right foot, and (4) assessment: the results of the test recorded are the numbers obtained when riding the bench completely.

The pre-test and post-test physical fitness tests were modified with the results of validity and reliability determined by three expert judges, as follows:

Table 2: Result of reliability of physical fitness

No	Physical fitness test	Reliability
1.	Speed	0.992
2.	Power leg	0.978
3.	Arm muscle strength	0.980
4.	Abdominal muscle strength	0.989
5.	Endurance	0.970

The technique was analysed using IBM SPSS for Windows 21 with a normality test using kolmogorof smirnov, and a homogeneity test using the Levene test. The analysis test used in this research is the average difference test using t-test (paired t-test).

Results and Discussion

The sample of 108 students was divided into 2 groups; 54 experiment group students, and 54 control group students. The following is a description of the experiment and control group data.

Table 3: Description of experiment and control group data

Indicator	Experiment group		Control group	
	Pre-test	Post-test	Pre-test	Post-test
Mean	147.806	155.580	153.547	158.526
Std. Deviation	22.363	22.600	22.930	22.908
Max	187.81	193.78	188.65	192.16
Min	99.53	109.79	90.86	99.17

Based on the table above, the overall comparison can be seen from the standard deviation, variance, minimum, and the maximum post-test is greater than the pre-test.

Normality and Homogeneity Test

Table 4: The results of the normality test with Kolmogorov-Smirnov

	Experiment group		Control group	
	Pre-test	Post-test	Pre-test	Post-test
N	54	54	54	54
Test statistic	.106	.108	.095	.094
Asymp. Sig. (2-tailed)	.189	.172	.200	.200

Based on Table 4, the significance value of the experiment group with the pre-test had a value of 0.189 and post-test 0.172 ($p > 0.05$), while the control group pre-test and post-test was 0.2 ($p > 0.05$). Based on the Kolmogorov-Smirnov normality test the data are normally distributed.

Table 5: Homogeneity test results

Data	Levene Statistic	Sig.	Note
Pre-test	.027	.870	Homogen
Post-test	.061	.806	Homogen

From the table on the results of homogeneity testing above, it can be seen that the significance of the pre test homogeneity of $0.870 > 0.05$ indicates that the pre-test variables in the experiment and control groups are homogeneous, and the significance of the post-test $0.806 > 0.05$ indicates the homogeneous post-test variables in the experiment and control groups.

Effectiveness of Physical Activity Model Based on Circuit

In this study, physical activity was carried out using the circuit method, and the model used was guided by the first grade primary school curriculum. The physical activity model carried out uses the concepts of playing while learning. Students do some physical activity in each variation of the model during warm up, core learning, and cooling down. The type of physical activity carried out is fundamental movement consisting of locomotor, non locomotor, and manipulative. The physical educator can choose several physical activities in one lesson.

Table 6: Independent t test

Physical activity model based on circuit	df	Mean difference	f	Sig. (2-tailed)
Equal variances assumed	106	4.094	2.988	.000

The table above shows a 2-way (t-tailed) significance value of $0.000 < 0.05$, so there is a significant difference between the experiment and control groups.

Table 7: Paired sample t test

Kebugaran jasmani		Mean	t	df	Sig. (2-tailed)
Experiment group	Pre test	-7.77370	-21.112	53	.000

	Post test				
Control group	Pre test	-4.97981	-19.451	53	.000

The significance value (2-tailed) of the experiment and control groups was 0,000 ($p < 0.05$), meaning that the results of the pre-test and post-test experienced significant changes. This shows that there is a significant effect on the differences in treatment given to each group.

Based on differences in treatment results, physical activity models based on circuit can be used as a reference in teaching physical education for first grade students in primary school because this model provides an increase in student's physical fitness.

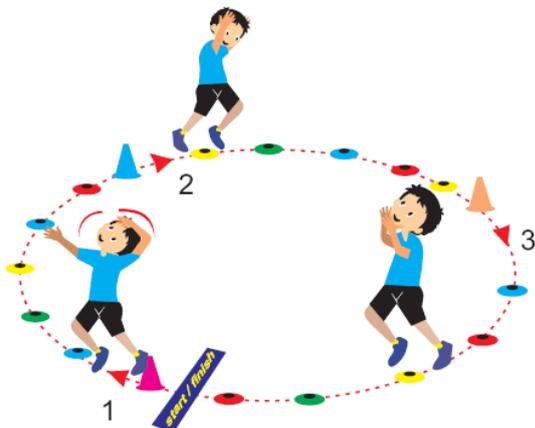
The Physical Activity Model Based on Circuit

The physical activity model consists of: (a) 12 kinds of plane used for warming up (circles, semicircles, equilateral triangles, isosceles, square, pentagons, hexagons, parallelogram, rectangles, rhombus, kite, and trapezoid), (b) 24 letters (alphabet) for core learning, and (c) 10 numbers (0-9) for cooling down. The following is an example of the form of physical activity on warming up, core learning, and cooling down.

Circle activity

- a. Target: locomotor (warming up).
- b. Tools: 3 cone cones, 15 cone bowls, meter, chalk, whistle.
- c. Play area: 7 x 7 meters.
- d. Procedure: students are in the starting position then do: (1) walk while bowing the head with the help of the hands, (2) walk while looking up with the hands on the chin, (3) ending with a walk while bending the head to the right side, assisted by the right hand.

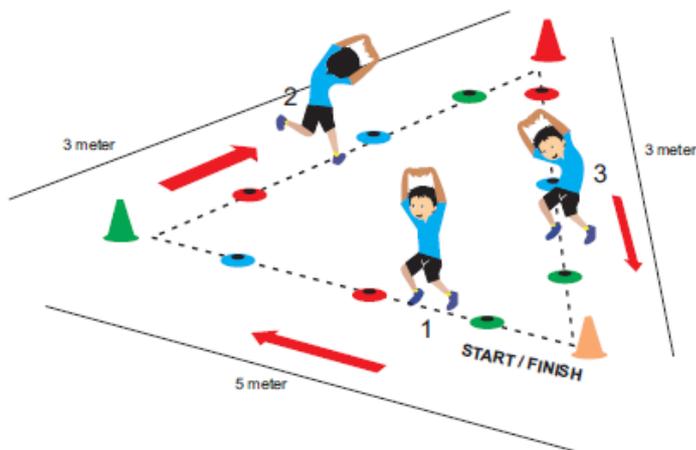
Fig 1. circle activity



Equilateral triangles activity

- a. Target: locomotor and non locomotor (warming up).
- b. Tools: hula hoops, goal post, cones, whistles, chalk.
- c. Play area: 5 x 3 meters.
- d. Procedure: students do: (1) Walking while stretching hands upwards, (2) walking while stretching hands to the right, (3) walking while stretching hands to the left.

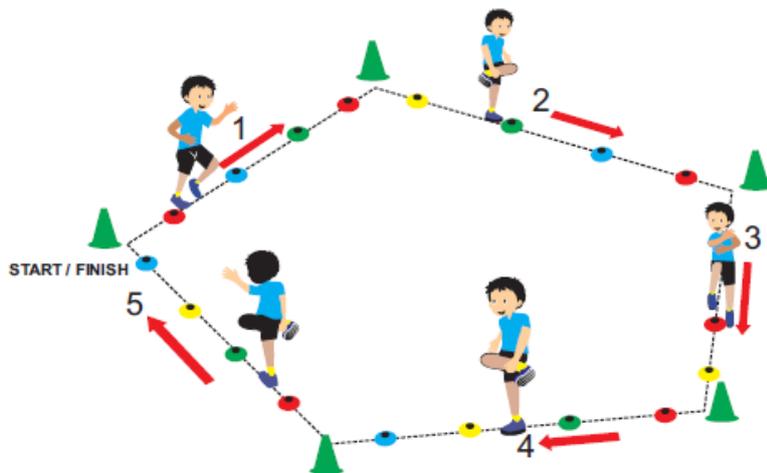
Fig 2. Equilateral triangles activity



Pentagons activity

- a. Target: locomotor (warming up)
- b. Tools: cones, boxes, chalk, whistles
- c. Play area: 5 x 3 meters
- d. Procedure: students do: (1) students jog (jogging), (2) students lift their right leg and bend in, (3) students jog (jogging), and (4) students lift their left leg and then bend inward, and (5) students jogging to the finish line.

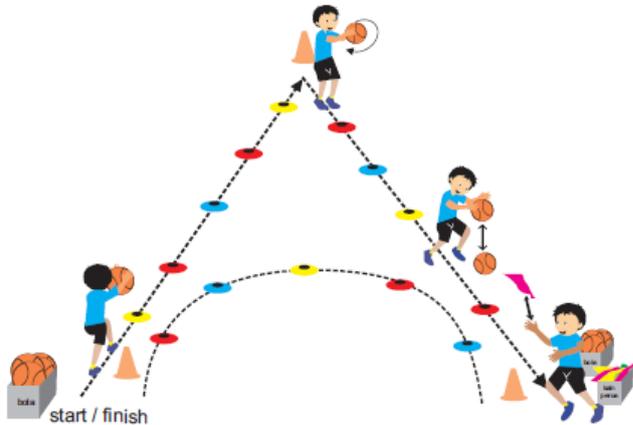
Fig 3. Pentagons



A circuit

- a. Targets: locomotor, non locomotor, and manipulative (core learning).
- b. Tools: (1) 3 markers, (2) 13 cones, (3) metre, (4) 4 basketballs, (5) patchwork 4 pieces, (6) 2 box squares, (7) whistles.
- c. Play area: 7 x 5 meters.
- d. Procedure: (1) Make a letter A pattern using markers. For the path between markers (1-2-3) cones are given with a distance of 1 metre, and the width of the letters given 1 cones with a distance of 2.5 meters, then students stand on the starting line. When the whistle sounds, students take basketball in the box then jog to the second cone, (2) When in the second post, students stand (standing still) holding the ball with their hands straight forward, then turning the ball clockwise 2 times, (3) Then walking while bouncing (dribble) ball using 2 hands to heading 3. After arriving at post 3, the ball is placed in a box then take the patchwork and throw a patchwork, catch until the finish at post 1 by placing the patchwork on the box, and (4) second student followed after the first student arrives at post 2.

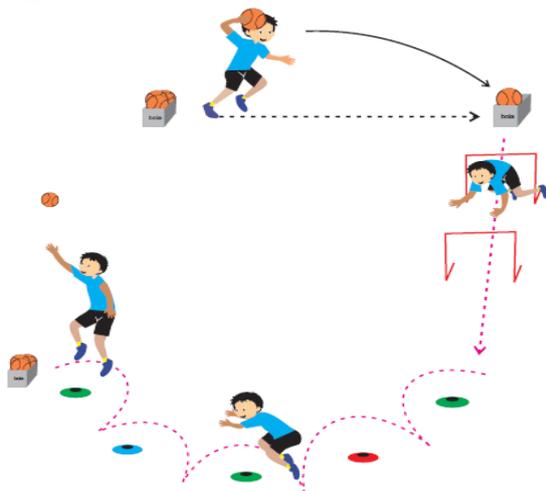
Fig 4. A circuit



J circuit

- a. Targets: locomotor, non locomotor, and manipulative (core learning).
- b. Tools: squares (2), colourful balls (5), cone cones (3), bowl cones (5), 60 cm goal post (3), basketball (5).
- c. Play area: 5 x 3 meters.
- d. Procedure: students do: (1) throw the ball into the box, (2) raise, (3) jump over the cones, and (4) end with throwing a ball.

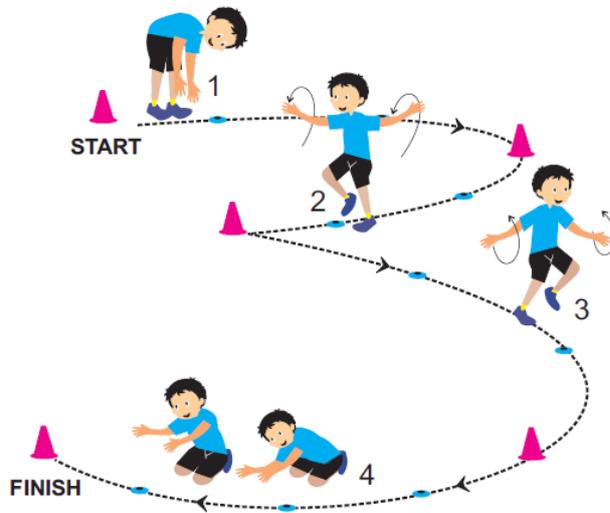
Fig 5. J circuit



S circuit

- a. Targets: locomotor, non locomotor, and manipulative (core learning).
- b. Tools: 60 cm goal post (2), 20 cm goal post (3), patchwork (5), cone cones (4), bowl cones (8), boxes (1).

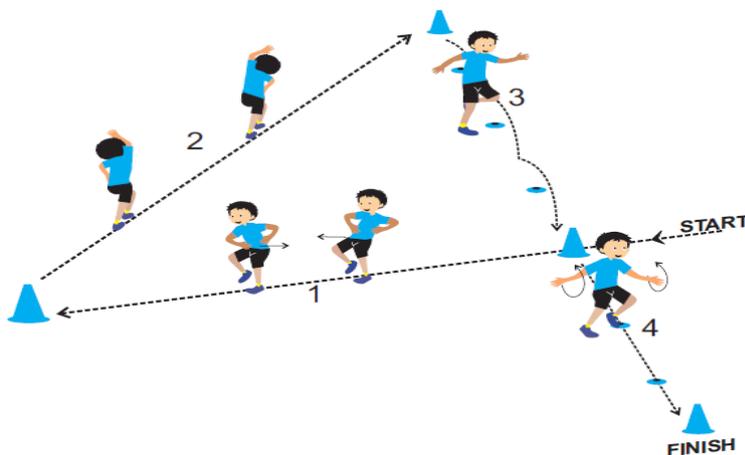
Fig 7. Number 3



Number 4

- a. Targets: locomotor, non locomotor, and manipulative (cooling down).
- b. Tools: chalk, whistle, balloon, circle, cones, chalk.
- c. Play area: 7 x 4.5 meters.
- d. Procedure: students do: (1) shake the body twice right-left (like playing hula hoop), (2) walk while the body is pulled, (3) walk over the cones, (4) rotate the arm from top to bottom (like clockwork).

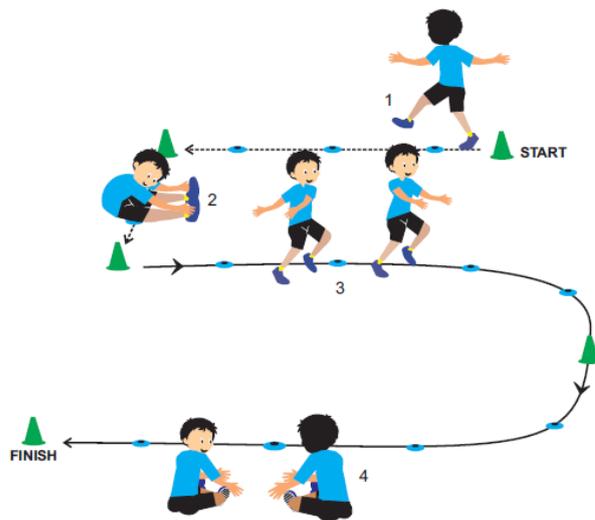
Fig 8. Number 4



Number 5

- a. Target: locomotor, and manipulative (cooling down).
- b. Tool: chalk, whistle.
- c. Play area: 8 x 5 metres.
- d. Procedure: students do: (1) sideways walking , (2) kissing the knee, (3) walking while turning the body (throwing the arms from right to left), (4) sitting cross-legged (feet touching each other).

Fig 9. Number 5



Physical activity carried out by children continuously can have a positive impact on the body, because there is an increase in vertical space and a decrease in resting heart rate, which indicates that the vital capacity of the child's heart is getting better. That is, the development of physical activity is as important as other aspects of development, because the inability of children to do physical activities can also reduce children's confidence (lack of confidence). In line with previous studies, participation in 6-week circuit training significantly improved body esteem post-intervention scores (Duncan et al., 2009). It is hoped that, by knowing information on physical activity through a circuit can improve physical fitness in children, parents can realise that physical activity in children is important and parents can help children to do physical activity at home through circuit games that have been studied.

The low physical activity among elementary school children is caused by several factors, such as the lack of adequate physical activity facilities in schools, as schools are more focused on learning facilities that support the cognitive aspects of student development and pay less attention to the development of physical aspects of children, as well as the school



curriculum's lack of facilitating the development of the physical aspects of children. This also contributes to the causes of low physical activity among students.

Conclusion

Based on statistic analysis, it can be concluded that there is an increase in physical activity significant in both the experiment and the control groups ($0.00 < 0.05$), but the physical activity model based on circuit is more effective than the control group. Thus, physical education teachers can use physical activity models with circuits for learning variations so that students don't feel lazy and bored. The recommendations that can be given based on the results of the study, include: (1) this physical activity model based on circuit can be used by physical education teachers to increase physical fitness in students in the first class of primary school, (2) for time effectiveness, the teacher must choose the same variety of tools to use in learning physical education based on circuit.

Acknowledgments

Thank you to Ministry of Research, Technology and Higher Education of the Republic of Indonesia as a sponsor, the Principal of the School of IT Darussalam Cikarang Bekasi Regency and SD AL-Azhar 17 Bintaro Tangerang who have given permission for research, and physical education, health, and recreation students who have assisted in data collection.



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