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Game-based exercise model for elementary school student's physical fitness

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ABSTRACT

BACKGROUND: Nowadays, many children have low physical fitness due to lack of movement or degenerative diseases. Various games should be designed to create a higher spirit for children to have physical activities as well as practice. The design of the planned game model is that each game will be able to increase the elements of students' physical fitness so that students will practice as well as play. The purpose of this study was to develop a game-based exercise model that is appropriate for elementary school student to improve physical fitness.

METHODS: This research was research and development. This research was conducted to develop a game model to improve physical fitness. The development procedure was modified according to the conditions which include: preliminary study, needs analysis, initial product design, validity, revision, trial, reliability, valid and reliable exercise model.

RESULTS: Expert validation test obtained a score of 83.33% and was categorized as feasible for use. The reliability test through field trials, related to the game-based exercise model to improve the physical fitness of elementary school students that was developed, obtained a score of 0.91 and was included in the high category.

CONCLUSIONS: The developed model was valid and reliable to be used to improve the physical fitness of elementary school students.

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KEY WORDS: Physical Fitness, Students; Athletes.

Elementary school students are the future generation of the nation that is growing and developing. As the next generation, it should be prepared and one effort to prepare it is through sports activities. Elementary school children (6-12 years) have started to have various kinds of activities both at school and outside of school, so they need good physical fitness.¹ Elementary school student is also an age where everyday life is very happy with playing.

At this time children are always filled with activities that are mostly related to cognitive and affective, while activities related to psychomotor are often neglected.² This is because of the perception that physical fitness is not important for children so that it causes parents to underestimate physical education lessons at school. Even some parents think physical education lessons only cause children to become tired so that when they take other lessons, they will ex-

perience fatigue. Not only that, at this time most elementary school children also prefer to do activities to fill their spare time or hobbies with activities that do not require a lot of movement such as the internet or online games.³ Many children have low physical fitness due to lack of movement or degenerative diseases and it can be seen by the increasing number of school-age children experiencing illness. According to Rusli Lutan, explaining that in developed countries such as the Netherlands, health care costs have increased by 2.5 percent, in Canada 6 percent, and in the USA, it has reached 8 percent, as a result of people doing less physical activity.⁴ Physical fitness efforts are health efforts that utilize physical activity to improve health status.⁵⁻⁷ This means that efforts to improve physical fitness will indirectly increase the degree of health or in other words, physical fitness is related to health.

Physical fitness of children and adolescents has become a critical issue in the world.⁸ Parents should be aware that physical fitness is very important for children and can also improve and affect learning achievement in school. Physical fitness is needed by every student to gain high dexterity, ability and learning ability.^{9, 10} Therefore, the way to improve physical fitness is to do regular exercise and daily physical activities.¹¹ In this case, it is necessary to reactivate physical education and health in schools. So, physical education and health subjects need to be implemented in every school in accordance with the educational curriculum to foster physical, health, and spiritual fitness of students. In addition, it is necessary to make an exercise model that is suitable for elementary school age, where that age is identical to playing age.

Materials and methods

This research was a development research.^{12, 13} This research was conducted to develop a game model to improve physical fitness. In this research, the development procedure was modified according to the constraints and conditions, including: preliminary study, needs analysis, initial product design, validity, revision, trial, reliabil-

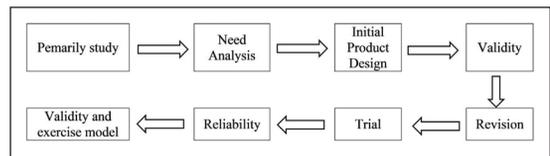


Figure 1.—Research and development steps.

ity, valid and reliable exercise model, as stated in Figure 1.

The instrument validity test was determined through data analysis from expert judgments assessed by 2 experts, namely experts of physical fitness and elementary school physical education. Then it was used to determine the validity of experts through descriptive analysis techniques in the form of percentages. Where the experts were asked to assess and provide answers based on a questionnaire that had been prepared in the expert validation instrument. The questionnaire used for experts was in the form of a number of aspects that must be assessed for feasibility. From the results obtained, the percentages were then classified to obtain the conclusions of the developed model. Expert validity was classified into several categories like Table I.¹⁴

Meanwhile, the instrument reliability test was conducted after the validity criteria were obtained. The reliability test of the instrument was determined by the test-retest method on different days, where an assessment of the training model practiced by students on different days was conducted by 2 judges. The reliability of the model was classified into several categories, as listed in Table II.¹⁵

TABLE I.—*Expert validity classification.*

Percentage	Criteria
0-20.0	Not valid
20.1-40.0	Very low
40.1-70.0	Moderate
70.1-90.0	High
90.1-100	Very high

TABLE II.—*Classification of reliability.*

Interval class	Category
0.93-1.00	Very high
0.88-0.92	High
0.68-0.87	Moderate
0.00-0.67	Low

TABLE III.—*Expert validation results.*

N.	Expert	Percentage (%)	Classification
1	Coaching and physical fitness	82.67	Feasible
2	Elementary school physical education teacher	84.00	Feasible
	Average	83.33	Feasible

Results

Based on the expert validity test from 2 experts, namely: 1) Coaching and physical fitness, and 2) elementary school physical education teacher, the expert validity was obtained as follows Table III. Based on the results in the table above, it can be seen that the exercise model developed after expert validation showed a percentage value of 83.33% and was classified as feasible for use as an exercise model in improving the physical fitness of elementary school students. After expert validation was carried out, various revisions were carried out where there were several forms of exercise that were combined and also removed so that after the revision, the training model that was structured as part of the game-based exercise model for the physical fitness of school students were:

The challenge and obstacle game

This game model intended to provide challenges to students in order to complete activities according to the set targets. In this exercise several obstacles are given. Games can be played on a flat and safe surface:

- tools and materials: cone, rope, beam, used tire;
- implementation: 1) the 1st challenge – students run back and forth as far as 5 meters carrying cones one by one and arrange the cones in a predetermined place with a mutually agreed amount. And the last cone continues to be brought to the next challenge. It aims to train students' agility; 2) after completing the 1st challenge, the next student does the 2nd challenge and so on until all challenges are completed; 3) the second challenge, while carrying one of the cones or the specified weight, the participants perform a crawling movement on the ground with a distance of 10 meters. This is to train the strength of the arm muscles and also the abdominal muscles of students; 4) in the 3rd challenge, students are

asked to jump with both feet into the tire circle until the entire tire has been skipped while still carrying the load that was carried during the 2nd challenge. This aims to train the explosive power of the leg muscles and also the student's coordination; 5) the 4th challenge, participants walk on the blocks that have been provided and the students' feet must not touch the ground or the cones that are brought fall. If that happens then it is repeated in the initial position; 6) challenge 5, participants sprint as far as 30 meters (maybe less or more) to reach the finish line. It aims to train speed; 7) students are said to have finished doing challenges and obstacles if they have reached the finish line or the end and put the cone behind the finish line; 8) after one member of the group who has done it, it is continued with other group members until all group members have finished; 9) to add to the challenge of this game so that students are enthusiastic about doing it, this game can be competed between groups and the losing group is given a penalty according to the agreement; and 10) this game if done repeatedly from beginning to end or swapped the challenge positions so that students do not get bored. And if done continuously will be able to improve the physical fitness of students.

Zig-zag run with the ball game

This game model intends to provide agility, coordination and accuracy training to students. Students are required to run as fast as possible while bringing the ball to a predetermined place and throwing the ball into the basket as a target as seen in the Figure 2. The goal is to train elements of agility, coordination and accuracy. Games can be played on a flat and safe surface. The game can be played in groups:

- tools and materials: cone, tennis ball and basket;
- implementation: 1) students line up behind the starting line in a standing position and prepare to run and each student brings a ball; 2) at

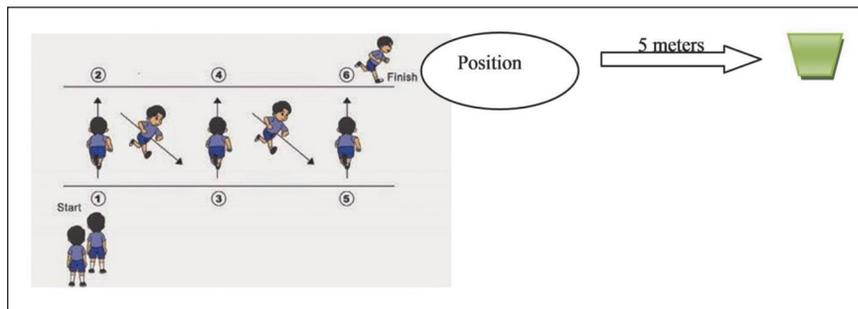


Figure 2.—“Zig-zag run with the ball” game.

the “start” signal, students who are in the first row from both teams run as fast as possible in a zigzag way according to the scheme to the finish line while carrying the ball; 3) then the first student who has reached the finish line, stands behind the finish line to throw the ball into the basket with a distance of 5 meters from the throwing position; 4) if the ball does not enter then the ball can be taken back until the student continues to throw until the ball enters the basket by means of each time the throw does not enter the student can take 1 step closer to the basket before throwing; 5) after one member of the group who has done it, continues with other group members until all group members have finished; and 6) the game ends when the last student throws the ball into the basket.

The fish and crane game

This game model is played with two teams, each of which acts as a guard (stork) and intruder (fish), where each team consists of 3-5 people. The essence of this game is that the stork team blocks and catches the fish team so that they cannot pass through the last line back and forth, and to get a win, it is calculated from the number of team members who are able to break through the line back and forth in a predetermined game area. This game aims to provide agility, coordination and accuracy training to students:

- tools and materials: chalk or materials for making lines on the field;
- implementation: 1) each consists of 5-6 people or can be adjusted according to the number of participants and the field. One team will be the “stork” team, which is the guard team, and the other team will be the “fish” team, the team that will break through; 2) the game is played

on a rectangular field measuring 12×5 meters (adjusting) which is divided into four parts. The boundaries of each section are usually marked with chalk. Group members who have a turn to guard the field are divided into two, namely group members who guard the horizontal and vertical boundaries. Like the following picture; 3) the team that gets a turn as the “crane” team will guard the field, keeping the horizontal and vertical lines. Team members in charge of maintaining the horizontal line will try to prevent the opponent from crossing the boundary line that has been determined as the free line. Meanwhile, team members in charge of maintaining the vertical boundary line will try to maintain the entire vertical boundary line in the middle of the field; 4) the team that acts as a “fish” team, will try to pass from line to line to the last line, then return again past the opponent’s guard to get to the starting line; 5) each member of the “fish” team who is touched by the “stork” team or leaves the playing area is considered a failure and must leave the playing field; and 6) the winner in this game is the team that collects the highest points. The number of points is determined by the number of participants who managed to pass each line of the game to the end.

The question and answer game

The game model is that students carry out activities by answering questions that are obtained in the shortest possible time. The number of questions that must be answered is a minimum of 5 questions or can be adjusted correctly. Questions are answered by conveying them to the teacher and if they are wrong, students can return to take other questions as seen in the Figure 3. Each student can do this activity in groups or individu-



Figure 3.—“Question and answer” game.

ally. The losing group or student can be penalized. The goal is to train the elements of speed, reaction, and concentration:

- tools and materials: cones, baskets, and question papers;
- implementation: 1) each consists of 5-6 people or can be adjusted according to the number of participants and the field; 2) students are asked to take pieces of paper in the question basket containing questions that have been provided by the teacher. The questions given contain about movement in sports; 3) pieces of paper are placed, at several points with a distance of 10 meters from the start; 4) if there is a signal, students immediately run to take pieces of paper in the question basket; 5) students who have taken pieces of paper containing questions immediately return by running and providing answers, accompanied by showing the movement in question as the answer; and 6) teams or students who lose can be sanctioned according to the agreement.

The touch me game

The model of the game is that students carry out activities by running after their friends in a circle with a diameter of 20 meters and then touching their friends as seen in the Figure 4.

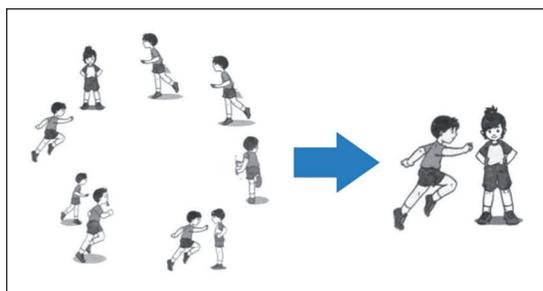


Figure 4.—The “touch me” game.

The goal is to train the elements of speed, reaction, and agility:

- tools and materials: meter, chalk or materials for making lines on the field;
- implementation: 1) each consists of 5-6 people or can be adjusted according to the number of participants and the field; 2) one of the students becomes a student who has to chase a friend who is in a circle with a diameter of 20 meters; 3) in addition to students who are tasked with chasing, students who will be touched are in the circle and may not leave the circle if they leave the student is considered a failure or considered touched; 4) students who have been touched must get out of the circle; and 5) the game is over if all have been touched by the student in charge of touching.

The circuits and math game

The model of this game is for students to make groups and do exercises with a circuit of 5 posts. Each post consists of different exercises. In moving between posts, the teacher will use mathematical formulas such as add, subtract, divide, or less and others. The goal is to train the elements of endurance, speed, reaction speed, explosive power, balance and concentration:

- tools and materials: cone and whistle;
- implementation: 1) the teacher makes 5 posts in the circuit using cones and the distance between posts is about 20 meters or more according to field conditions; 2) before the game starts, students will be given an explanation of what forms of movement are in each post; 3) students must perform the movement according to the movement in the post; 4) for transfers between posts, students must pay attention to mathematical cues conveyed by the teacher, for example add, subtract, divide, or less and others; 5) for example: post 1 sit-ups, post 2 run back and forth 5 meters, post 3 jump in place, post 4 push-ups, and post 5 airplane positions; 6) on the signal to start, the students make movements after the post occupied until there is a signal to stop with a maximum interval of 30 seconds in each post; 7) and after finishing at the post the students will jog around the circuit until there is a signal from the teacher; 8) when there will be a signal to move between posts with a mathematical formula, students immediately go to the post that should be

TABLE IV.—*Results of model reliability.*

No	Expert	Reliability	Criteria
1	Coaching and physical fitness	0.90	High
2	Elementary school physical education teacher	0.91	High
	Average	0.91	High

occupied. For example: add 1, then the student who was in post 1 goes to post 2, post 2 goes to post 3 and so on until those in post 5 enter post 1 and make movements according to the movements in that post; and 9) if there is a formula whose result exceeds the number of posts, for example times 2, then those who were in post 3 will be entered in heading $3 \times 2 = 6$, because heading 6 doesn't exist, the count is to continue heading 1 and so on. For example, after post 5, the 6th post is post 1 because after. And if you get $4 \times 2 = 8$, then after post 5, you have to add 3 then you will be in post 3. And so on.

After the revised exercise model was compiled, a field trial was conducted to see the reliability of the developed model, can be seen in Table IV. Based on the results in the table above, it can be seen that the training model developed after reliability testing was carried out through expert assessment by evaluating the exercise model practiced by students on different days, the reliability value was 0.91 and was classified as high. So that the developed model is valid and reliable is used to improve the physical fitness of elementary school students.

Discussion

Elementary school students are the future generation of the nation that is growing and developing. As the next generation, food should be prepared and one effort to prepare it is through sports activities. Elementary school children (6-12 years old) have started to have various kinds of activities both at school and outside of school, so they need good physical fitness. Elementary school age is also an age where everyday life is very happy with playing.

At this time children are always filled with activities that are mostly related to cognitive and affective, while activities related to psychomotor are often neglected. This is because of the view that physical fitness is not important for children

so that it causes parents to underestimate physical education lessons at school. Even some parents think physical education lessons only cause children to become tired so that when they take other lessons, they will experience fatigue.

Not only that, at this time most elementary school age children also prefer to do activities to fill their spare time or hobbies with activities that do not require a lot of movement such as the internet or online games. So, at this time many children who have low physical fitness due to lack of movement or degenerative diseases. This can be seen by the increasing number of school-age children experiencing illness. According to Rusli Lutan explained that in developed countries such as the Netherlands, health care costs increased by 2.5 percent, in Canada 6 percent, and in the United States (US) it reached 8 percent, as a result of citizens doing less physical activity.⁴ Furthermore, Hasibuan explains that physical fitness efforts are health efforts that utilize physical activity to improve health status.^{11, 16, 17} This means that efforts to improve physical fitness will indirectly increase the degree of health or in other words, physical fitness is related to health.

At this period, parents should be aware that physical fitness is very important for children and can also improve and affect learning achievement in school. Physical fitness is needed by every student to gain high dexterity, ability and learning ability.^{6, 18} Therefore, the way to improve physical fitness is to do regular exercise and daily physical activity.

In this regard, it is necessary to reactivate physical education and health in schools. So, physical education and health subjects need to be implemented in every school in accordance with the educational curriculum to foster physical, health, and spiritual fitness of students. In addition, it is necessary to make an exercise model that is suitable for elementary school student, where that age is identical to playing age. This physical fitness training model was designed to

make it easier for teachers and students to exercise physical fitness but by playing while playing so that the exercise will not feel like hard.

Conclusions

Based on expert validation tests and reliability tests through field trials related to the game-based exercise model to improve the physical fitness of elementary school students, it was concluded that a valid and reliable model was used to improve the physical fitness of elementary school students. The recommendations that can be given based on this research are: 1) Physical Education Teachers in Elementary Schools can use the model to improve the physical fitness of their students. 2) To get maximum results, teachers can adjust all the equipment used to the conditions in their respective schools.

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