ADOPTION OF THE TRAINING LOAD OF ASCENDING PYRAMID SYSTEM: EFFECT OF LADDER-DRILL TRAINING ON STUDENTS' AGILITY

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ABSTRACT

Physical Education (PE) is one subject in schools that focuses on meeting the adequacy of students' physical activities to achieve optimal physical fitness. However, the PE program has still not been found to have a significant direct impact on physical fitness and aspects of it. For this reason, such as Sallis et al, it was successful in proving that PE programs added with physical activity outside learning succeeded in having a significant impact on some aspects of physical fitness. (Sallis et al., 1997). *Likewise with this article, will explain the results of the study in the form of giving a program outside of PE learning in the form of ladder-drill training for six weeks using the loading of an ascending pyramid system to increase the students' agility. The study was included in a quasi-experimental type using the matching-only pretest-posttest control group design. Random sampling mechanism is done to select 30 students as subjects, then ordinal pairing is used to determine treatment and control groups. Agility is measured using Agility T-Test. The results showed that giving additional programs in the form of ladder-drill using an ascending pyramid loading system for 6 weeks succeeded in significantly increasing student agility. Agility improvement of students from pretest to posttest was 8.0%. In addition, a significant difference in the results of the treatment and control group exercise (d = 1,528) proves that this program should be a mainstay program for schools and other PE teachers to improve the agility of their students.*

Keywords: ladder-drill, adoption, ascending pyramid system, and agility.

INTRODUCTION

Physical education (PE) is a strategic subject in promoting the adequacy of students' physical activity even though research proves that PE programs through school scheduling are still unable to provide sufficient physical activity to students (Sallis et al., 1997). The low adequacy of students' physical activity will then have an impact on the low physical fitness of students. In Indonesia, physical education and sports team reports show that the impact of PE implementation on physical fitness has not been seen, affecting only 15% of the entire population (Penjas-2007, 2007). For this reason, PE teachers need to innovate in learning so that the impact of PE on student growth is more evident. At least there are two focuses of developing PE learning when teachers innovate, namely: providing adequate learning of physical activity and constructing positive values that are in the sport (Suroto et al., 2007). So that PE learning is not only focused on the physical, but also to improve good character is also a subject in the teacher to teach students.

In general, teachers make learning innovations in the form of playing activities to increase the number of students participating in learning. Because the game has the attraction to increase student participation. Like what was done by Tiza, Suroto, and Indahwati developed learning that contained games to improve students' long jump skills. The results showed that the

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development of the game model had successfully improved students' long jump skills, but the number of students participating in mobile activities had not been reported (Tiza, Suroto, & Indahwati, 2018). In addition, Setyorini, Suroto, and Indahwati also carried out the application of PE learning with games to provide students with sufficient movement. The results showed that as much as 60% of the time allocated for learning was spent on motion activities but the number of students who were active and walking still ranged from 18-38% (Setyorini, Suroto, & Indahwati, 2017). That is, game learning has indeed succeeded in increasing students' skills in learning motion and making time allocation dominated by physical activity, but the number of active students is still low.

It is indeed not easy to innovate, but PE teachers are obliged to hasten the business. The main capital in innovating in PE learning is PE teacher competence. Effective learning, only from teachers who have high competence (Suroto, Khory, Dinata, & Priambodo, 2017). The slow development of innovation in learning PE in Indonesia is also influenced by the level of PE in Indonesia which is still not as expected (Suroto, 2016a). For this reason, through research it is expected that a learning program product will emerge that can help teachers who have low competence. However the teacher's competence in Indonesia is, the role of the school is also important compared to the level of teacher competence. The implementation of learning development is included in teacher professional activities that must be supported and assisted by the school through the role of the principal (Suroto, 2016b). That way, it is expected that each learning program implementation made by PE teachers remains in line with the school's vision and mission as the implementation of the school program. So that the implementation of the program will get support starting from setting time, facilities, to access to students.

Based on the above discussion, the urgency of developing PE learning to improve physical fitness through the fulfillment of students' physical activity is higher. Do not mean to be haphazard about wanting to improve all components of physical fitness, this effort can be started from an important component in motion, namely agility. Agility is a functional requirement of many sports, challenging stability, and commonly cited as a mechanism of injury (Armstrong & Greig, 2018). The selection of this topic is based on the assumptions that often arise about PE learning activities from students, teachers, and parents. They perceive that the PE learning that is dominant in motion activity has the potential to cause injury.

Based on the desire to provide optimal services to students, an exercise program was developed as an additional program of PE subjects in schools to improve agility. The program in question is the provision of a ladder-drill training program using the adoption of a six-week ascending pyramid loading system for students. Provision of a ladder-drill exercise program for six weeks is considered sufficient to increase student agility (Ng, Cheung, & Sum, 2017; Sarapung, Pangkahila, Adiputra, & Adiatmika, 2012). For this reason, the purpose of this paper is to explain the results of the application of additional programs in the form of agility training using ladder-drill media with loading systems using ascending pyramids to students.

Ladder-Drill and Exercise Load using The Pyramid System

Ladder-drill is a form of ladder-shaped exercise equipment placed above the ground to be used to jump and or run as fast as possible with certain pattern rules. Ladder-drills can be used for training tools to increase agility in the number of athletes that are many and require a relatively short time (Harris, 2006; White, 2007). Types of ladder-drills selected for training are Icky Shuffle and Quick Feet Forward/ backward. The selection of the three types of

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ladder is deemed suitable for training student agility because it contains forward, backward, and sideways movements during training.

In accordance with the principle of training, which is to stimulate the body's functional work in the training zone, it is necessary to use the training load system. There are two types of loading systems, namely ascending and descending pyramid systems (Hartoto, 2017). Actually, the ascending and descending pyramid system is an exercise loading system that is commonly used for weight-training, but in this article the ascending system will be adopted to give students a training load. The ascending pyramid system is the provision of exercise loading the more time it rises. The maximum ability of students is measured using the ladder-drill test to the maximum extent that students are able to move above the ladder. The number of ladders that students can pass is a record of the maximum ability of students. Furthermore, based on these maximum capabilities, the burden is determined starting at 30%, 40%, and 50% of the maximum ability of each student.

METHOD

Type and Research Design

This study was included in a quasi-experimental type using the matching-only pretest-posttest control group design. The matching mechanism is carried out after the pretest. Pretest is done to measure students agility before giving treatment while posttest is done to measure students' agility as a result of training.

Research Subject

A total of 30 male students of 7-grade of Junior High School were selected as samples by simple random sampling of a total population of 134 male students. The sample age is in the range of 13-14 years. The number of samples selected is then divided into two groups, 15 students become treatment groups while others become control groups. Division of groups through matching or ordinal pairing mechanisms by putting together similar student agility values or equivalent in rank. So that an equal group composition will be obtained between treatment and control groups.

Instrument

The research instrument used is a special instrument to measure student agility. Agility measurement instruments generally use Agility T-Test compiled by Semenick in 1990 in an article entitled "Test and Measurement: Agility T-Test" contained in Strenght and Conditioning Journal 12:36 (Munro & Herrington, 2011). This instrument has been proven to have sufficient reliability and is the most suitable type of test for measuring agility (Sporis, Jukic, Milanovic, & Vucetic, 2010). Each subject will be given time to try the test until they feel comfortable in taking the test. Furthermore, the subjects will be given 3 times the opportunity to do the test. The best results from the three tests performed will be recorded as student agility achievements. Achievement records are expressed in seconds with two decimals.

Procedure

The research was carried out in 6 stages, namely: (1) sampling; (2) pretest agility; (3) determine the group; (4) determination of training load; (5) giving treatment; and (6) posttest agility. Determination of training load based on the maximum ability of students in doing ladder-drill exercises. The maximum ability of students is measured using the ladder-drill test to the maximum extent that students are able to move above the ladder. The number of boxes that students can pass is a record of the students' maximum ability. Furthermore, based on

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these maximum capabilities, the burden is determined starting at 30%, 40%, and 50% of the maximum ability of each student. 30% exercise load is given at training sessions on weeks 1-2, 40% at 3-4 weeks, and 50% at weeks 5-6. Maximum ability measurement results, exercise loads 30, 40, and 50% can be seen in table 1.

Table 1. Mean of Maximum Capacity and Training Load (30, 40, dan 50%)

Type of Ladder-Drill/ Schedule	100%	30%	40%	50%
Forward	946,7	284,7	379,3	473,3
Backward	746,7	224,0	298,7	373,3
Icky Shuffle	848,0	257,3	341,3	424,0
Schedule	-	Week 1-2	Week 3-4	Week 5-6

The number of meetings in each week is done 3 times, every two weeks the training load is increased and the length of the exercise is done for 6 weeks (Harris, 2006; Ng et al., 2017). During the treatment, each subject had a log-book for the treatment in accordance with the respective training load. The log-book is then validated to ensure students do treatment according to their respective schedules, procedures and training load. To ensure the suitability of filling in the log-book by students, the teacher will check the log-book of the student each exercise.

Data Analysis

Data analysis uses descriptive statistical techniques, which know the mean and standard deviation. To determine the significance of changes in pretest to posttest, the data were analyzed using t-test dependent. To find out the significance of the difference in the results of the exercise treatment group with the control, an independent t-test was used followed by calculating the mean difference between groups which were then classified into three categories, namely small (under 0.50), moderate (0.50-0.80), and large (above 0.80) (Doehring et al., 2011).

RESULTS AND DISCUSSION

The results of the study are presented in two ways, namely: (1) the significance of the difference between pretest and posttest scores and (2) the significance of the difference in gain between treatment and control groups.

Significance of Differences in Pretest and Posttest Values

Differences in pretest and posttest scores are considered as evidence of the effect of giving an exercise program on student agility. To determine the significance of differences in pretest and posttest values, t-test dependent was used. The results of testing the differences in pretest and posttest values can be seen in table 3.

In the treatment group: the mean agility value at pretest was 12.39 seconds changed to 11.48 seconds when the posttest occurred the mean change was 0.91 seconds. Significance testing produces t-count of 5.94 and sig. amounting to 0.000 <0.05 so that the change in mean is stated to be significantly different. The increase in value from pretest to posttest was 8.0%. In the control group: mean agility at pretest of 12.29 seconds changes to 12.26 seconds when the posttest changes the mean by 0.03 seconds. Significance testing produces t-count of 0.19 and sig. amounting to 0.853> 0.05 so that the change in mean is stated equal. The increase in value from pretest to posttest was 0.5%.

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Table 3. Results of Significance Tests on Differences in Mean Agility of Exercise Results at Pretest and Posttest

Group	Pretest / Posttest	N	Mean	Mean Differences	t	Sig.	% Gain
Treatment (ladder drill-ascending)	Pretest	15	12.39	0.91	5.94	0.000	8.0%
	Posttest	15	11.48				
Control	Pretest	15	12.29	0.03	0.19	0.853	0.5%
	Posttest	15	12.26				

The results of this study are in accordance with the results of research conducted by Setiyo Hartoto which states that weight training using a pyramid system has a significant impact on speed (Hartoto, 2017). The speed component is an important thing needed to improve agility in addition to the balance of the body in maintaining the position when performing(Ng et al., 2017). Ladder-drill exercises for 6 weeks to improve agility proved effective. Increased agility during ladder-drill training can occur due to changes in dynamic balence of students increases after doing exercises for six weeks (Ng et al., 2017). This shows that, using ladder drills using an ascending pyramid system can have a significant impact on improving student agility.

Significance of Gain Differences between Treatment Groups and Control

Gain is defined as the change in the value of the pretest to posttest. The gain value is considered as the result of students' training in following a ladder-drill exercise program for six weeks. The gain comparison of treatment and control groups aims to determine the reliability of the program compared to the natural conditions of the population. The test results of differences in gain values between treatment and control groups can be seen in table 4.

Table 4. Significance Test Results of Differences in Agility Gain between Treatment Group and Control Group

Group	N	Mean	SD	Mean Differences	Levene's Test for Equality of Variances		t-test for Equality of Means			
					F	Sig.	t	df	Sig.	d
Treatment	15	0.91	0.596	0.885	0.015	0.902	4.042	28	0.000	1.528 (large)
Control	15	0.03	0.603							

The mean gain value in the treatment group was 0.91, the standard deviation was 0.596 while in the control group, the mean value was 0.03, the standard deviation was 0.603. The difference in mean gain between treatment and control groups is 0.885. The test results of the variance equation are seen from the F score of 0.015 with sig. amounting to 0.902> 0.05 so that the variance between treatment and control groups is declared homogeneous. The result of the mean difference test is seen from the t score of 4.042 with sig. equal to 0.000 so that the mean between treatment and control groups is stated to be significantly different. The difference is expressed in the d score of 1.528 (large).

Agility training using ladder-drill that adopts an ascending pyramid system provides an opportunity for students to learn low intensity motion patterns. When students begin to become experts in carrying out movement patterns, students begin to produce heavier loads. So that the fatigue factor does not affect the learning capacity of students in remembering

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movement patterns at the beginning of training. This kind of incident is in accordance with the theory of motion learning delivered by Schmidt and Wrisberg that fatigue practicing in a person will interfere with cognitive capacity in understanding the movement patterns trained in an exercise program (Schmidt & Wrisberg, 2000).

Finally, based on the results and discussion in this study it can be recommended that this exercise program be implemented to improve student agility. Given that, agility is an important component in exercise, supports balance ability, and is considered a component that can reduce the risk of injury in sports (Armstrong & Greig, 2018). The results of this study are evidence that variations in exercise in the form of the use of stimulus variations in the form of differences in exercise load from 30, 40, and 50% provide significantly different training results. In addition, variations in exercise can be given based on the intensity of the stimulus that can be distinguished by volume, rest intervals, and type of muscles concentration (Charro et al., 2012). With the success of this training program, it is expected that it can provide a real contribution to the implementation of PE learning which is considered as a subject that often gives injury during the implementation of sports. Subsequent research can provide different variations in addition to using intensity, namely volume, rest intervals, and type of muscles contraction which contribute to agility.

CONCLUSION

In accordance with the research objectives it can be concluded that there is a significant effect of ladder-drill training by using the ascending pyramid load on agility from the mean value at pretest of 12.39 seconds to 11.48 seconds when the posttest increases by 8.0%. Furthermore, the results of the test of the difference in gain between treatment and control groups indicate that giving a ladder-drill exercise program adopts an ascending pyramid loading system proven to be effective compared to the natural condition of the population. The difference in the effect of the ladder-drill program is that the ascending pyramid loading system with the natural state of the population is d = 1.528 which is in the large category. This proves that this program should be a mainstay program for schools and other PE teachers to improve the agility of their students.

REFERENCES

[1]. Armstrong, R., & Greig, M. (2018). The functional movement screen and modified star excursion balance test as predictors of t-test agility performance in University Rugby Union and Netball Players. *Physical Therapy in Sport*, *31*.

[2]. Charro, M. A., Aoki, M. S., Nosaka, K., Foschini, D., Figueira, A., & Bacurau, R. F. (2012). Comparison between multiple sets and half-pyramid resistance exercise bouts for muscle damage profile. *European Journal of Sport Science*, *12*(3), 249–254.

[3]. Doehring, A., Küsener, N., Flühr, K., Neddermeyer, T. J., Schneider, G., & Lötsch, J. (2011). Effect sizes in experimental pain produced by gender, genetic variants and sensitization procedures. *PLoS ONE*, *6*(3).

[4]. Harris, G. (2006). Off-season conditioning for women's lacrosse. *Strength and Conditioning Journal*, *28*(1), 93-94.

[5]. Hartoto, S. (2017). Pengaruh latihan piramida descending dengan irama lambat dan cepat terhadap kekuatan, kecepatan, daya ledak dan hypertropy otot tungkai. *JOSSAE : Journal of Sport Science and Education*, *2*(2), 58–60.

[6]. Munro, A. G., & Herrington, L. C. (2011). Between-session reliability of four hop tests and the agility T-test. *Journal of Strength and Conditioning Research*, *25*(5),

ISSN: 2307-3721, e ISSN: 2307-3713

1470–1477.

[7]. Ng, R. S. K., Cheung, C. W., & Sum, K. W. (2017). Effects of 6-week agility ladder drills during recess intervention on dynamic balance performance. *Journal of Physical Education and Sport*, *17*(1), 306–311.

[8]. Penjas, T. K. K. K. M. (2007). *Naskah akademik pendidikan jasmani olahraga dan kesehatan*. Jakarta: Author.

[9]. Sallis, J. F., McKenzie, T. L., Alcaraz, J. E., Kolody, B., Faucette, N., & Hovell, M. F. (1997). The effects of a 2-year physical education program (SPARK) on physical activity and fitness in elementary school students. *American Journal of Public Health*, *87*(8), 1328–1334.

[10]. Sarapung, M., Pangkahila, J., Adiputra, N., & Adiatmika, I. P. (2012). Varies shuttle run exercise methods increase agility of students of SMK Negeri 2 tondano kabupaten minahasa. *Indonesia Journal of Biomedical Science*, *6*(1), 8-10.

[11]. Schmidt, R. A., & Wrisberg, C. A. (2000). *Motor learning and performance: A problem-based learning approach*. Champaign. IL: Human Kinetics.

[12]. Setyorini, S., & Indahwati, N. (2017). First grade primary school students' physical activity level on physical education subject through live life well at school program. *IOP Conf. Series: Materials Science and Engineering*, *180* (12178), 1-6.

[13]. Sporis, G., Jukic, I., Milanovic, L., & Vucetic, V. (2010). Reliability and factorial validity of agility tests for soccer players. *Journal of Strength and Conditioning Research*, *24*(3), 679–686.

[14]. Suroto, K. F. D., Dinata, V. C., & Priambodo, A. (2017). Core competency measurement model for prospective physical education teacher. *IOP Conf. Series: Materials Science and Engineering*, *180* (12181), 1-6.

[15]. Suroto, M. A., Kartiko, D. C., Nurhayati, F., Subagyo, P., & Wijaya, M. A. (2007). *Buku panduan pelaksanaan model pembelajaran inovatif pendidikan jasmani, olahraga, dan kesehatan IU-07-1*. Surabaya: Authors.

[16]. Tiza, O., Suroto, S., & Indahwati, N. (2018). The development of long jump learning strategy through game activity to fifth grade. *Educational Research International*, *7*, 48-54.

[17]. White, R. (2007). Speed: Agility ladders. *Coach and Athletic Director*, *76*, 77.

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