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The Effect of Problem Based Learning (PBL) and Cognitive Ability on Learning Outcomes of Sprint Running in Students of SMP Negeri 8 Tasikmalaya

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Abstract

This study aims to determine: (1) differences in learning outcomes for students who are taught by PBL and direct teaching methods, low and high cognitive abilities. (2) the interaction between learning methods and cognitive abilities on learning outcomes of sprints. (3) differences in learning outcomes of sprinting with the PBL and direct teaching methods in terms of high cognitive ability. (4) the difference in learning outcomes of sprinting with the PBL and direct teaching methods in terms of low cognitive ability. This research is a quasi-experimental research with a factorial design. The research sample was taken using random sampling technique, the number of samples used was 50 students of SMP Negeri 8 Tasikmalaya. Analysis of the data used is the requirements test and hypothesis testing. The results of the study show: (1) there are differences in learning outcomes between students taught by PBL and direct teaching methods, (2) there is an interaction between learning methods and cognitive abilities on learning outcomes of sprints. (3) there are differences in learning outcomes between students who are given learning using the PBL Model and the Direct Instruction Model in groups of students who have high cognitive, (4) there is no difference in the learning outcomes of sprints between students who are given learning using the PBL Model and the Direct Instruction Model in groups of students who have low cognitive abilities.

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INTRODUCTION

Education plays a very important role in ensuring the development and survival of stakeholders. High-quality education produces very thoughtful and creative results. Education is the key to all high-quality progress and development, because with the help of education, a person can realize his full potential both as an individual and as a member of society. According to Law no. 20 of 2003 concerning the National Education System, Education is a planned conscious effort to realize a learning and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character and the skills required of them, have knowledge and skills, spiritual and physical health, community, nation and state.

One of the efforts to improve the quality of education is updating the learning model. According to the Learning Model (Perdana & Puslitjak Dikbud, 2017), the learning model is “the process of consciously manipulating one's environment so that one can engage in certain behaviors or respond to certain situations. Learning is a decisive part of education”. According to the Statement (Hidayat et al., 2022), a learning model is said to be a plan or model that is used as a guide for class design or teacher learning. The learning model refers to the learning method used, including learning objectives, stages of learning activities, learning environment, and classroom management. Efforts to improve the quality of education is to update the learning model. According to the learning model (Alif & Lengkana, 2022), the learning model is "a process in which a person's environment is deliberately manipulated so that he can engage in certain behaviors or react in certain situations, learning is a special part of education". The learning environment must be managed properly, because learning plays an important role in education. According to the statement (Mubarok et al., 2022; Mulya & Lengkana, 2020), the learning model is said to be a plan or model that is used as a guide in designing classes or teacher learning. The learning model refers to the learning method used, which includes learning objectives, stages of learning activities, learning environment, and classroom management.

Reform of the relevant learning model is a transition from traditional learning (learning theory) to learning that emphasizes knowledge and skills (Redhana, 2010). Educational reform also includes a change in the paradigm of the learning model, namely the orientation of the learning model which was originally teacher-centric to become learner-centered instead of interactive class activities which were originally didactic in nature. The teacher who originally worked as an expert switched to the student's role as an expert, the focus of teaching which was originally memorized facts changed to the relationship between knowledge and findings, the perception of knowledge that was originally collected quantitative facts changed, the assessment was original. Multiple choice questions turned to portfolios, problems and aspects of problem solving, the use of technology which was originally practice and practice turned into communication, access, collaboration, and expression (Mulya et al., 2021; Widjayana et al., 2022).

Knowledge is the result of perceiving or knowing an object through the five senses. The five senses that humans use to perceive objects are sight, hearing, smell, taste, and touch (Marker et al., 2022). According to (Lengkana et al., 2020), knowledge is the result of curiosity produced by the sensory

processes of the eyes and ears for certain objects in particular. The information referenced in relation to the sport includes information about competition rules, techniques, scoring systems and more.

Skill is the ability to do work easily and carefully (Shah et al., 2021). According to (Amrullah, 2003), the term professionalism is also interpreted as an action or task and an indicator of the level of competence. According to Singer (Purwanto et al., 2021), skill is a consistent level of success in effectively achieving a goal. The skills referred to in sprints are movement, speed and distance covered. Developing practice skills is at the core of an exercise program. The development of children's movement skills in basic education is defined as the development and improvement of various basic movement skills and movement skills related to sports (Barnett et al., 2016; Čuljak et al., 2014; Fisher et al., 2005). These movement skills are then developed and perfected to a certain level which enables the child to apply them with effective energy and in accordance with the environmental conditions and their intended use. When a child's basic motor skills are mature, they can be used in various games, sports and exercises in everyday life.

Learning models that can increase knowledge and train skills are problem-based learning (PBL) and Direct Instruction. The direct learning model was put forward by (Allen et al., 2011; Hung et al., 2008): "The direct learning model is a learning model in which the teacher transforms knowledge or skills directly to students and becomes purposeful learning, and the teacher guides them directly". Students only become objects of teacher information transfer. According to (Metzler, 2017) understanding of direct instruction, `` “Teacher as instructional leader" mentioned above, the teacher has full control over learning and students only follow what is given by the teacher in learning. It is also possible that sports teachers always use the direct constraint model or are derived from elementary to high school teachers and that is the learning process. So when a student becomes a physical education teacher, they follow the learning procedure directly in class because they follow what they get when they become students. Another goal of using the direct teaching model is to improve physical education learning in physical education learning. The direct learning model is a teacher-centered learning model. One of the student characteristics that must be considered in choosing and applying learning models and achieving learning outcomes is the difference in students' cognitive styles. Cognitive style is closely related to students' learning methods and attitudes, and can affect students' knowledge and skills. Each cognitive style has strengths and weaknesses in terms of skills and knowledge. In learning, educators must be able to assess students' cognitive styles and choose and apply learning models that are appropriate to differences in students' cognitive styles.

(Loyens et al., 2008; Wood, 2003) suggests the importance of problem-based learning models: For students to learn to think, think critically, develop problem-solving skills, and acquire knowledge. According to (Sendaug & Odabacsi, 2009; De Graaf & Kolmos, 2003): PBL develops stimulating problem-solving strategies by placing students in an unstructured, daily active role as problem solvers, and developing curricula and educational systems that develop basic knowledge and skills. Teaching is not just a set of skills acquired, but also the use of those skills that teach through decision making and problem solving (Muhtar et al., 2020).

This definition means that PBL or PBM is a learning environment that is guided by everyday problems. From the definition above, the problem-based learning model is a learning approach that seeks to apply real-world problems as contexts for students to practice critical thinking and acquire problem-solving skills. Key concepts of the material discussed (Gijbels & Verhasselt, 2010).

Physical education is basically an educational process that uses physical activity to bring about a holistic change in the physical, mental and emotional qualities of an individual. PE treats children as a unified whole, not just seeing them as someone separate from their physical and mental characteristics (Lengkana & Sofa, 2017). According to (Alderman et al., 2006), physical education is part of a general program that specifically contributes to the overall development of children. Physical education is a learning process through physical activity that aims to improve physical fitness, improve motor skills, develop knowledge and behavior related to healthy and active living, motor skills, and emotional intelligence. The learning environment is carefully designed to encourage the growth and development of each student in all areas: physical, psychomotor, cognitive, and emotional (Samsudin et al., 2008). Physical education is simply a process of learning through movement. In addition to learning and educating through movement to achieve educational goals, physical education teaches children to move. Through this experience, changes occurred in the physical and mental aspects. In addition, the goal of physical education classes is to provide as many opportunities as possible for exercise, and it is hoped that students will be active and contribute to the development of their physical strength. The activity process involves executing training activities or learning tasks iteratively. In this way, the child will be able to use his body efficiently, even if it is based on understanding. On the other hand, the wider implication is that children are expected to develop habits and skills to fill their free time and then apply the skills they have throughout their lives.

Athletics is one of the materials for physical, sports and health education (PJOK) which requires learning cognitive and psychomotor aspects. Knowledge includes preparation and technique, skills include movement (Lengkana, 2016). One of the most important ingredients in athletics is sprinting or sprinting. Sprint is running 100m, 200m or 400m in the fastest sprint (sprint) on the track. Sprints can be performed by both male and female runners (Lengkana, 2013). In the sprint race, each runner may not leave the track. The first key that must be mastered by a sprinter is the start or rejection of the starting block. Late or inaccurate starts cost sprinters dearly. Therefore, to start well, it must be paid attention to, researched and trained as carefully as possible (Muhtar & Irawati, 2009). When studying, students with a field-independent cognitive style generally tend to process the information they receive, while students with a field-dependent cognitive style generally tend to accept existing information (Reta, 2012).

Students who have a field independent cognitive style are generally more independent in learning and have a great curiosity about a field and problem they like. Students like learning that involves their activities in finding knowledge and improving skills. The knowledge that he himself acquires will be understood more quickly and will be stored in his memory longer. Students who have a field dependent learning style generally need the help of others in understanding learning information.

Students prefer to learn something that is certain, less like independent assignments, and have good imagination skills (Ardana, 2003). Based on the description above, in this study we will observe the effect of the Problem Based Learning (PBL) Learning Model and Cognitive Ability on Learning Outcomes of Sprint Running in Students of SMP Negeri 8 Tasikmalaya.

METHODS

The method used in this research is the experimental method. According to Sugiyono (2016, p. 107) experimental research is "experimental research methods can be said to be research methods used to seek the effect of certain treatments on others under controlled conditions". The research design used in this research is factorial design.

Participants

This research was conducted at SMP Negeri 8 Tasikmalaya City which is located at Jalan Panututan, Tugu Jaya Village, Cihideung District, Tasikmalaya City, West Java. The subjects of this study were students of class VII, VIII, and class IX of SMP Negeri 8 Tasikmalaya City who took part in physical education lessons at school, who had different sports backgrounds with sprinting material. The population in this study were students who took part in athletics extracurriculars, namely from grades VII, VIII, and IX of SMP Negeri 8 Tasikmalaya Tasikmalaya City for the 2022/2023 academic year totaling 200 students. There is a technique in taking research samples, namely random sampling, according to (Sugiyono, 2008) the sample is part of the number and characteristics possessed by the population. (Arikunto, 2012) also said that if the subject is less than 100, then the entire population becomes the research sample, but if the subject is more than 100 then 10-15% or 15-25% can be taken. Then the sample of this study is (200 x 25% = 50) so that the total sample is 50 people. The instruments used were the initial test (pretest) and the final test after being given treatment (posttest). The test scores are taken from sprint knowledge and skill data. After the value or data is obtained, then a data analysis test is carried out. The analytical tool used in this study is the requirements test (normality test, homogeneity test, and hypothesis testing).

RESULT

The findings of this study are a description of the data obtained in data collection in the field through the pretest and posttest stages which were conducted on 50 students from SMPN 8 Tasikmalaya through sprint knowledge and skills tests. The following will describe the results of a description of the data from each group taken, including the average value for PBL of 45.02 (pre-test), 55.61 (post-test), standard deviation of 3.65 (pre-test), 4.56 (post-test). test), variance 13.42 (pre-test), 21.00 (post-test). While the average value for DI was 46.41 (pre-test), 53.3 (post-test), standard deviation 4.50 (pre-test), 3.41 (post-test), variance 17.36 (pre-test), 11.14 (post-tests). To further clarify the results of the participants' achievements, it can be seen in the following diagram;

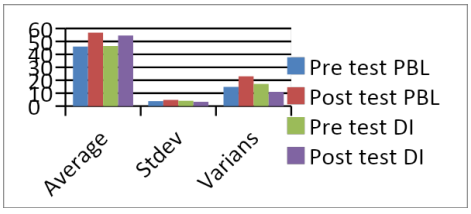

Figure 1. Data Description of Learning Outcomes of the PBL Model Group Sprint Run and Direct Instruction as a Whole

Based on Figure 1. Learning Outcomes of sprint running above, it can be seen that there was an increase in the average initial test when compared to the final test of each group. It can be assumed that there has been an increase in a better direction regarding the learning outcomes of sprints owned by each of these groups. The following describes the differences in learning outcomes of sprints from each group with high and low cognitive abilities. The PBL model with high Cognitive has an average of 12.63, a standard deviation of 2.12, a variance of 4.20. The PBL model with low Cognitive has an average of 8.58, a standard deviation of 1.67, a variance of 3.59. The DI model with high Cognitive has an average of 5.53, a standard deviation of 2.29, a variance of 5.27. The DI model with low Cognitive has an average of 10.67, a standard deviation of 1.72, a variance of 2.71.

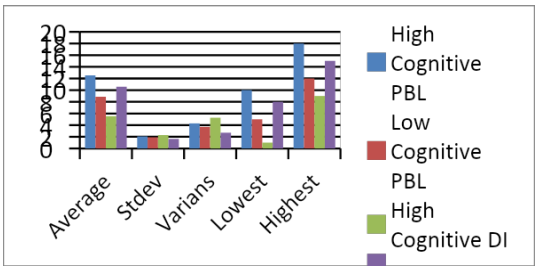

Figure 2. Data Description of Differences/Differences in Sprint Running Learning Outcomes from Each Group of High and Low Cognitive Ability

From the description of the difference/difference data between the sprint learning outcomes of each group, it can be seen that the average difference/difference in each group that has high cognitive ability is different from the group that has low cognitive ability. It can be assumed that there are differences in the influence caused by cognitive abilities or the interaction between learning models and cognitive abilities on learning outcomes for sprinting.

Table 2.
Data Normality Test Calculation Results

	Shapiro-Wilk		
Group	**Statistic**	**df**	**Sig.**
1	.975	30	.675
2	.968	30	.476
3	.868	15	.032
4	.968	15	.835
5	.957	15	.633
6	.894	15	.078

Based on the normality test results table above, the average value of Sig. >0.05. Then it can be stated that the data is normally distributed. As for the homogeneity test obtained Sig. or probability value > 0.05, data comes from populations that have the same variance (homogeneous). Referring to the decision criteria, it can be concluded that the data from each group has the same variance, meaning that the research data is homogeneous. Thus, the test for further data uses parametric statistical tests because the data is normally distributed and homogeneous.

Table 3. Hypothesis Testing "Tests of Between-Subjects Effects"

Dependent Variable: sprint test

Source	Type I Sum of Squares	df	Mean Square	F	Sig.
Model	5726.600[a]	4	1431.650	373.286	.000
X	5424.433	2	2712.217	722.427	.000
ϒ	302.167	1	151.083	37.704	.000
X * ϒ	170.017	1	170.017	46.641	.000
Error	204.133	56	3.645		
Total	5951.000	60			

a. R Squared = .964 (Adjusted R Squared = .961)

Based on the table of results of hypothesis testing using "Tests of Between-Subjects Effects" the average value of Sig. of 0.000, then with the coefficient criteria Sig. Count < 0.05u, it can be concluded that both models have an influence on students' sprint abilities. Berdasarkan hasil analisis yang disajikan dalam tabel uji between-subject effect, terlihat bahwa tingkat signifikansi hasil perhitungan dan koefisien F yang dihitung adalah sebagai berikut: Hasil analisis sebagaimana disajikan pada tabel di atas menunjukkan bahwa semua harga koefisien Sig untuk masing-masing kelompok adalah < 0,05. Dengan demikian dapat disimpulkan bahwa:

The results of the analysis as presented in the table above show that all Sig coefficient prices for each group are <0.05. Thus it can be concluded that:

1. There are differences in sprint learning outcomes between learning models (PBL and Direct Instruction Models) with cognitive abilities (high and low) as a whole.
2. There are differences in the learning outcomes of sprints between groups of students who are given the PBL model with Direct Instruction.
3. There are differences in the learning outcomes of sprinting between groups of students who have high and low cognitive abilities.
4. There is an interaction between the learning model and the students' cognitive abilities.

Based on the calculation results of the analysis of variance and the Tukey test above, the results of testing hypotheses 1-4 are presented below:

1. The PBL Model is Better than the Direct Instruction Model on Students' Sprint Running Learning Outcomes

The results of the calculation of the two-factor analysis of variance regarding the difference between the effectiveness of the PBL model and the Direct Instruction model as a whole as shown in table 4.7 (Test of Between-Subject Effects), show that Fcount = 373,286 is greater than Ftable = 2.56. Ho's decision stating that there was no difference between the PBL model and the direct instruction model was rejected. This means that learning using the PBL model (average increase of 10.70) is significantly better than learning the direct instruction model (average increase of 8.07) towards improving the overall student sprint test.

2. There is an interaction between the Learning Model and Cognitive Ability on Student Sprint Running Learning Outcomes

The results of the calculation of the two-factor analysis of variance regarding the interaction between learning models and cognitive abilities are shown in table 4.7 (Test of Between-Subject Effects). Shows that Fcount = 46,641 is greater than Ftable = 4.74. Ho's decision which stated that there was no interaction between learning models and cognitive abilities was successfully rejected. Thus it can be concluded that there is an interaction between the learning model and cognitive abilities on the learning outcomes of students' sprints.

3. There are differences in learning outcomes for sprinting between students who are given learning using the PBL model and the direct instruction model for groups of students who have high cognitive abilities.

The results of calculating the Tukey test on the difference between the effectiveness of the PBL model and the direct instruction model for groups of students who have high cognitive abilities are shown in table 4.9 (Multiple Comparisons). Ho's decision which stated that there was no difference between the PBL model and direct instruction in the group of students who had high cognitive ability was rejected (Sig. 0.00 <0.05). This means learning using the PBL model (average increase 12.53) is significantly better for groups of students who have cognitive abilities higher than the direct instruction model (mean increase of 5.53) on the student sprint test.

4. There are differences in the results of learning to run sprints between students who are given learning using the PBL model and the direct instruction model in groups of students who have low cognitive abilities

The results of calculating the Tukey test on the difference between the effectiveness of the PBL model and the Direct Instruction model for groups of students who have low cognitive abilities are shown in table 4.9 (Multiple Comparisons). Ho's decision which stated that there was no difference between the PBL and Direct Instruction Models for groups of students who had low cognitive abilities was not successfully rejected. This means that although the direct instruction model with an average increase of 10.60 is higher than the PBL model with an average increase of 8.87, there is no significant difference for students who have low cognitive abilities on the sprint test. (Sig. 1.00 > 0.05).

DISCUSSION

Based on the description of the results of data analysis and testing of the first hypothesis, it shows that overall the group of students who are given learning with the PBL model is better than the Direct Instruction model for learning outcomes in sprinting. Furthermore, in calculating the second hypothesis, it shows that there is an interaction between the learning model and cognitive abilities on the sprint test.

Likewise, the results of testing the third hypothesis showed that there were differences in learning outcomes for sprinting between students who were given learning using the PBL model and the Direct Instruction model in groups of students who had high cognitive abilities. In other words, the learning outcomes of sprints among students who are given learning with the PBL model are better than the direct instruction model in groups of students who have high cognitive abilities. While the results of testing the fourth hypothesis show that although based on the description of the data the increase in sprint learning outcomes among students who are given learning with the Direct Instruction model is better than the PBL model in groups of students who have low cognitive abilities, but based on the Multiple Comparisons test the difference in increased learning outcomes for running the sprint is not very significant. Because of that, there is no significant difference in effect between the PBL model and the direct instruction model for students who have low cognitive abilities on learning outcomes for sprinting.

These results are in accordance with what has been explained by (Allen et al., 2011) the PBL model is problem-based learning is a learning that presents various authentic and meaningful problem situations to students which serves as a basis for investigation and investigation. Thus, the PBL model is a learning model that places more emphasis on efforts to foster responsible motivation from within students and this is much better because it is able to be firmly embedded compared

to if the motivation taught comes from outside.

While the Direct Instruction model does not mean it is not good because this model has also been proven to be able to survive long ago. However, in improving the learning outcomes of sprint running this model is less effective because in the process according to (Burrowes, 2003) that the Direct Instruction model is a learning model that is usually carried out by teachers traditionally or places more emphasis on reciting content without giving sufficient time to students. students to reflect on the material presented without relating it to previous knowledge or without applying it to real life situations. Meanwhile, according to (Magliaro et al., 2005) Direct Instruction is a term for explicit teaching of a set of skills using lectures or demonstrations of material to students. From the explanation above it shows that the Direct Instruction model does not directly teach sprinting, even if the teacher teaches sprinting through this model it is only limited to explanations and examples put forward verbally or in practice by the teacher without giving opportunities to students to feel and act and determine themselves regarding the results of learning to sprint.

Meanwhile, to teach sprint running is not enough just with explanations and examples, but more than that every student must experience it directly, act in a real way so that from this process students' understanding of sprint running material can slowly be formed, of course, through a continuous process. Thus it can be said that the PBL model is significantly better than the direct instruction model on sprint learning outcomes. As for cognitive abilities, according to (Dohmen et al., 2010; Rushton & Jensen, 2005) that cognitive abilities are thinking processes such as solving problems, comparing, evaluating and creativity. From this explanation, the cognitive abilities of students are very important because they are related to the thinking abilities of students. The ability to think affects things related to daily life, how when faced with a problem, then what actions should be taken, because cognitive abilities affect the process of successful learning carried out.

Because of that cognitive abilities can support and determine the success of a learning process that is carried out only indeed every teacher must be able to see the conditions and abilities of students before using the learning model that will be used. So that the learning process is carried out much more effectively, not only limited to the formal activities of teachers teaching their students.

CONCLUSION

Based on the results of the analysis and discussion regarding the effect of problem based learning (PBL) learning model and cognitive ability on sprint running learning outcomes in students of smp negeri 8 tasikmalaya which refers to the formulation of the research problem is as follows:

1. There is a difference in the effect of the pbl model and the direct instruction model on the learning outcomes of students' sprints.
2. There is an interaction between the learning model and cognitive abilities towards a responsible attitude.
3. There are differences in learning outcomes between students who are given learning using the pbl model and the direct instruction model in groups of students who have high cognitive ability.
4. There is no difference in the learning outcomes of sprints between students who are given learning using the pbl model and

the direct instruction model in groups of students who have low cognitive abilities.

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