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Effectiveness of the Cooperative Learning Model in Physics Lessons at Vocational High School Level in Jambi, Indonesia

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ABSTRACT

The low physics learning outcomes of vocational school students in Jambi is a problem that needs to be solved. One solution to improve physics learning outcomes is to use an effective learning model, such as the cooperative learning model. This research used a quasi-experimental design with a pretest-posttest design with control group. The research sample was 60 class X students who were divided into two groups, namely the experimental group who studied with the cooperative learning model and the control group who studied with the conventional learning model. The research instrument used was a physics learning outcomes test. The research results showed that there were significant differences between student learning outcomes in the experimental group and the control group. The learning outcomes of students in the experimental group who studied with the cooperative learning model were higher than the learning outcomes of students in the control group who studied with the conventional learning model. The cooperative learning model is effective in improving the physics learning outcomes of vocational school students in Jambi.

1. Introduction

Physics is one of the important subjects at Vocational High Schools (SMK), which provides a foundation of basic knowledge and skills for students to continue their education to a higher level or enter the world of work. However, the physics learning outcomes of vocational school students in Jambi are still low. Based on data from the Jambi City Education Office in 2022, the average score for physics learning outcomes for vocational school students only reached 70.00. This shows that there are still many students who have not reached the minimum completion standard (KKM) set at 75.00. The low physics learning outcomes of vocational school students are caused by several factors, one of which is the learning model used. Conventional learning models that are often

used by teachers are less effective in attracting interest and increasing student participation in learning.¹⁻³

The cooperative learning model is a learning model that emphasizes cooperation between students in achieving learning goals. This learning model has several advantages compared to conventional learning models, namely, increasing student learning motivation, improving student learning outcomes, improving students' critical thinking skills, improving students' communication skills, and Increasing students' tolerance.^{4,5} This research is important to conduct to determine the effectiveness of the cooperative learning model in physics lessons at vocational schools in Jambi, Indonesia.

2. Methods

This research used a quasi-experimental design with a pretest-posttest design with the control group. This design was chosen because the researcher could not exercise full control over external variables that could influence the research results. The population of this study was all class X students of SMK Negeri 5 Jambi, Indonesia. The research sample was taken using a purposive sampling technique, namely by selecting two classes

Based on these criteria, two classes X of SMK Negeri 5 Jambi, Indonesia, were obtained with 30 students each. The two classes were then divided randomly into two groups, namely the experimental group and the control group. The research instrument used was a physics learning outcomes test. This test was prepared by researchers based on physics material taught in class X of SMK Negeri 5 Jambi, Indonesia. This test consists of 30 multiple-choice questions with varying levels of difficulty.

The procedure for this research is as follows: Carrying out a pretest on all students in both groups,

providing treatment to the experimental group with a cooperative learning model and the control group with a conventional learning model, and carrying out a posttest to all students in both groups. Data on student learning outcomes were analyzed using a test. t-test to determine whether there is a significant difference between student learning outcomes in the experimental group and the control group. The t-test was carried out using the SPSS version 25 program with $p < 0.05$.

3. Results and Discussion

Table 1 shows the results of the physics pretest and posttest in the experimental and control groups. In the pretest, there was no significant difference between the average physics learning outcomes of the two groups ($p > 0.05$). In the posttest, the average physics learning result for the experimental group (82.50) was higher than the average physics learning result for the control group (74.00). The results of the t-test show that there is a significant difference between the physics learning outcomes of the two groups ($p < 0.05$).

Table 1. Comparison of learning outcomes between treatment groups.

Group	Treatment	Mean (SD)	Score improvement	Sig. (2-tailed)
Experiment	Pretest	68 (7,5)	14,5	0,001
	Posttest	82,5 (6)		
Control	Pretest	67,5 (8)	6,5	0,001
	Posttest	74 (7)		

The results of this research indicate that the cooperative learning model is effective in improving physics learning outcomes for vocational school students. The human brain has a natural tendency to learn and thrive in social interactions. When students work together in groups, they are involved in a more active and dynamic learning process than studying alone. When students observe and interact with others, the mirror neurons in their brains activate. These mirror neurons simulate observed actions, helping students understand new concepts and strategies more easily. Social collaboration increases blood flow to areas of the brain associated with learning, memory, and problem-solving, such as the prefrontal cortex and hippocampus. Social

interactions trigger the release of neurotransmitters such as dopamine and serotonin, which increase motivation, focus, and information retention. Social learning experiences help build new synapses (connections between neurons) in the brain, strengthening the neural networks associated with new knowledge and skills. Social interactions increase the brain's neuroplasticity, namely its ability to adapt and change in response to new experiences. Various studies show that cooperative and collaborative learning produces significant improvements in learning outcomes compared to individual learning. Social learning not only improves conceptual understanding but also develops social, communication, and problem-solving skills that are

important for success in school and life. The human brain is designed to learn socially. When students work together in groups, they harness the power of social interaction to increase brain activity, strengthen neural connections, and ultimately, improve their learning outcomes.⁶⁻⁹

Cooperative learning has a positive effect on student learning motivation. In cooperative groups, students are mutually responsible for achieving common goals. This increases their sense of belonging and encourages them to be actively involved in the learning process. Group members support and help each other, creating a positive and safe learning environment. This increases students' self-confidence and motivation to learn. Working together with others from different backgrounds and abilities helps students learn to appreciate differences and develop tolerance. Social interactions in cooperative groups help students develop communication and collaboration skills that are important for working together effectively. Cooperative learning encourages students to be actively involved in the learning process, not just as passive recipients of information. This increases their curiosity and interest in the subject matter. Working together to achieve a common goal provides students with a sense of accomplishment and recognition. This increases their intrinsic motivation to learn and develop. In cooperative groups, each student has individual responsibility for contributing to the group assignment. This increases their focus and attention to the lesson material. Interaction and discussion in cooperative groups help keep students engaged and focused on tasks. Cooperative learning can increase students' learning motivation by increasing a sense of belonging, mutual respect, and tolerance, as well as encouraging active involvement and curiosity. This increases student focus and attention, which can ultimately improve learning outcomes.¹⁰⁻¹³

Cooperative learning has an important role in improving students' social skills. Students learn to convey their thoughts and ideas clearly and effectively and listen and understand others attentively. Students learn to understand and use body language, eye contact, and gestures to communicate effectively.

Students learn to negotiate and reach agreements in groups, considering the opinions and needs of all members. Students learn to resolve conflicts peacefully through mediation and negotiation, building win-win solutions for all parties. Students learn to compromise and tolerate differences of opinion, building mutual respect and appreciation. Students learn to manage their emotions well in stressful situations, building the ability to stay calm and focused. Students learn to work together effectively in teams, helping and supporting each other to achieve common goals. Students learn to take on leadership and follower roles in groups, developing the ability to lead and follow well. Students learn to take responsibility for their tasks and contributions within the group, building mutual trust and dependency. Students learn to understand and feel what other people feel, building a sense of empathy and concern for others. Students learn to build positive relationships with others, developing the ability to communicate and get along well. Students learn to manage their emotions, build positive relationships, and make responsible decisions. Cooperative learning helps students develop a variety of social skills that are important for success in school and in life. By working together in groups, students learn to communicate effectively, resolve conflicts, cooperate with others, and develop a variety of social and emotional skills.¹⁴⁻¹⁶

4. Conclusion

Based on the research results, it can be concluded that the cooperative learning model is effective in improving the physics learning outcomes of vocational school students in Jambi, Indonesia.

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