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Application of Interactive Cooperative Learning Models in Learning Microprocessor and Microcontroller Programming Techniques

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Abstract

Based on preliminary observations, researchers discovered that the teacher is frequently at the heart of the learning process. Instructors don't actively involve pupils in the learning process and don't employ a variety of techniques. Expository or lecture methods are what teachers typically employ when delivering material. In contrast, pupils only pay attention to what the teacher says while making notes in their books. The purpose of this study is to ascertain how the interactive cooperative learning paradigm at SMKS Muhammadiyah Banda Aceh affects the learning results in studying microprocessor and microcontroller programming techniques. This study takes a quantitative approach with an experimental methodology. There are 12 students in the study's sample. Pre-test and post-test methods were used to gather data. The study's findings show that the interactive cooperative learning model at SMKS Muhammadiyah Banda Aceh has an impact on the learning objectives of class XI students. An increase in the pre-test score from 70 to 80 in the post-test indicates this effect. The results of the hypothesis test indicate that the interactive cooperative learning model has an impact on the learning outcomes of class XI students at SMKS Muhammadiyah Banda Aceh in the topic of Microprocessor and Microcontroller Programming Techniques (p-value = 0.005 < 0.05), hence Ha is accepted. It is clear that interactive cooperative learning environments enhance students' learning results in vocational schools.

Keywords: *Interactive Cooperative Learning Setting, Learning Outcomes, Vocational School*

Abstrak

Berdasarkan observasi awal, peneliti menemukan bahwa guru sering menjadi pusat dari proses pembelajaran. Guru tidak melibatkan siswa secara aktif dan tidak menggunakan berbagai teknik pembelajaran. Metode ekspositori atau ceramah adalah yang biasanya digunakan oleh guru saat menyampaikan materi. Sebaliknya, siswa hanya memperhatikan apa yang dikatakan guru sambil mencatatnya di buku mereka. Sehingga penting untuk menerapkan metode pembelajaran inovatif untuk mengubah paradigma guru kini. Tujuan dari penelitian ini adalah untuk mengetahui bagaimana paradigma pembelajaran kooperatif interaktif di SMKS Muhammadiyah Banda Aceh mempengaruhi hasil belajar dalam mempelajari teknik pemrograman mikroprosesor dan mikrokontroler. Penelitian ini

menggunakan pendekatan kuantitatif dengan metodologi eksperimental. Sampel penelitian ini terdiri dari 12 siswa. Metode pre-test dan post-test digunakan untuk mengumpulkan data. Hasil penelitian menunjukkan bahwa model pembelajaran kooperatif interaktif di SMKS Muhammadiyah Banda Aceh memiliki dampak pada tujuan belajar siswa kelas XI. Peningkatan skor pre-test dari 70 menjadi 80 pada post-test menunjukkan efek ini. Hasil uji hipotesis menunjukkan bahwa model pembelajaran kooperatif interaktif memiliki dampak pada hasil belajar siswa kelas XI di SMKS Muhammadiyah Banda Aceh pada topik Teknik Pemrograman Mikroprosesor dan Mikrokontroler (nilai p = 0,005 < 0,05), sehingga Ha diterima. Jelas bahwa lingkungan pembelajaran kooperatif interaktif meningkatkan hasil belajar siswa di sekolah kejuruan.

Kata Kunci*: Model Pembelajaran Interaktif Seting Kooperatif, Hasil Belajar, SMK*

INTROUDCTION

Education is the key to improving the quality of human resources. The aim of education is to create individuals who are not only intelligent and skilled but also moral and capable of making positive contributions to society and the world as a whole. The government continues to strive to improve the quality of education through curriculum enhancement, preparing professional educators, and providing supporting facilities and infrastructure for learning. The government seeks to develop vocational and technical education programs that are relevant to industry needs to prepare a skilled and ready-to-work workforce.

The goal of vocational schools (SMK) in Indonesia is to prepare skilled labor by equipping students with the practical and technical skills required by industry and the job market, ensuring they are ready to work upon graduation. SMK is also expected to develop students' professional competencies. Graduates of SMK are expected to compete in the job market by mastering the latest technologies and best practices in their fields. The government established SMK to cultivate an entrepreneurial spirit, so students are not only prepared to work in companies but also capable of creating job opportunities and becoming entrepreneurs. Therefore, SMK must be supported by creative, innovative, and targeted learning processes to achieve the objectives set by the government.

Student learning outcomes are closely related to the quality of the learning process, which fundamentally involves behavior change to achieve specific goals. Understanding learning outcomes helps evaluate the effectiveness of the applied teaching methods and strategies. This enables teachers or educational institutions to assess whether the learning objectives have

been met. Learning is an active process in which students construct their own knowledge, seek definitions of the material being studied, adjust concepts, and discover new ideas.

Based on initial observations and interviews with one of the teachers at SMK Muhammadiyah Banda Aceh, the researcher found that the learning process is still often teacher-centered. The teacher rarely employs varied methods and has not actively engaged students in the learning process. During the delivery of material, the teacher dominates using expository methods or lectures. The teacher actively explains, gives examples, and summarizes the lesson, while students merely listen to the teacher's explanations and take notes.

Using varied teaching methods can help students construct concepts while actively engaging in social interactions during learning, particularly in subject matter. Interactive cooperative learning emphasizes collaboration among students, embracing diverse opinions and ideas within a common learning objective. In the interactive cooperative learning method, students are expected to have experiences such as forming hypotheses, manipulating objects, solving problems, searching for answers, illustrating, researching, dialoguing, reflecting, and resolving learning challenges. This model employs an approach that combines active interaction among students with group cooperation to achieve learning objectives. The aim is to enhance student participation, develop social skills, and improve learning outcomes through collaboration and discussion. Thus, this model is very suitable for application in SMK students, as informal communication among students facilitates quicker comprehension of the material being discussed in the teaching and learning activities.

METHOD

This type of research is a quantitative study using an experimental method. In other words, this quantitative approach examines student learning achievements closely related to numerical data to determine the level of student performance. This approach is used because the study focuses solely on the effect of implementing the interactive cooperative learning model on the activity and learning outcomes of TAV class XI students at SMK Muhammadiyah.

The experimental method is used to investigate the effect of a specific treatment on another variable under controlled conditions. In this study, the researcher employs a pre-experimental design using a single class to observe student learning outcomes. The design used is a One-Group Pre-test Post-test, which is conducted without using a control or comparison group.

The research instruments used include test sheets and observation sheets for teacher and student activities. Data collection techniques are carried out by administering tests and observing teacher and student activities.

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RESULTS

1. Description of Teacher and Student Activities

The observation indicators at this stage are the teaching and learning activities between the teacher and students. Below is the table of observation results for teacher activities in class XI SMK Muhammadiyah 1 Banda Aceh.

Table 1. Results of Teacher Activity Observations

No	Aspek yang diamati	Nilai			
		1	2	3	4
I.	**Pendahuluan**				
1	Kemampuan apersepsi yaitu mengkaitkan antara materi sebelumnya dengan materi yang dipelajari				√
2	Kemampuan dalam menyampaikan tujuan pembelajaran				√
3	Kemampuan menyampaikan langkah-langkah pembelajaran model pembelajaran *interaktif setting kooperatif*			√	
4	Kemampuan menyajikan materi dengan menggunakan model pembelajaran interaktif *setting*				√
5	Kemampuan memotivasi dan menumbuhkan minat siswa dengan menjelaskan manfaat materi yang akan dipelajari			√	
II.	**Kegiatan Inti**				
6	Guru menjelaskan materi prasyarat dan penjelasan lain yang dianggap perlu siswa dapat melakukan aktivitas kelompok dengan lancar.				√
7	Guru meminta siswa melakukan aktivitas yang telah dipersiapkan				√

	(memecahkan masalah, menemukan rumus atau prinsip, melakukan investigasi, dan sebagainya).				
8	Guru berkeliling kelas, mengamati dan memonitor aktivitas kelompok agar berjalan dengan tertib dan lancar, serta memberi bantuan jika ada kelompok yang menemui kesulitan.				√
9	Guru dapat mengajukan pertanyaan open-ended sebelum diskusi kelas				√
10	Guru meminta salah satu kelompok mempresentasikan hasil kerja kelompoknya dan mendiskusikan hasilnya di dalam kelas				√
11	Guru memimpin diskusi kelas sedemikian sehingga tercipta suasana akademik yang demokratis dan kebebasan mengajukan pertanyaan dan jawaban.				√
12	Guru dapat mengajukan pertanyaan				√
III.	**Penutup**				
13	Guru memberi kesempatan kepada siswa untuk memeriksa kembali apa yang telah dipelajari, memperbaiki catatannya atau melakukan refleksi				√
14	Guru membimbing siswa membuat rangkuman				√
15	Guru memberikan tugas lanjutan (PR)			√	
16	Guru memberikan tes yang telah dipersiapkan untuk menilai sejauh mana penguasaan siswa terhadap materi yang telah dipelajari.				√
17	Guru mengawasi siswa agar bekerja secara individu				√

Skor yang diperoleh	**65**
Skor maksimal	**68**
Jumlah $\frac{65}{68}$ **x 100 = 95%**	

Based on the table above, it shows that each aspect observed in managing the learning process received varying scores, with an overall average score of 95% for the teacher's performance, which falls into the "very good" category. Only 5% of the learning activities have not been carried out perfectly by the teacher.

1. **Student Activities in Learning**

   Analyzing student activities in learning is one of the most important factors in determining the effectiveness of a learning process. Below is the table of observation results for student activities in class XI SMK Muhammadiyah Banda Aceh.

Table 2. Results of Student Activity Observations in Learning

No	Aspek yang diamati	Nilai			
		1	2	3	4
I.	**Pendahuluan**				
1	Siswa menjawab pertanyaan kecil dari kegiatan apersepsi guru tentang materi yang kaitkan guru				√
2	Siswa antusias mendengarkan dan memperhatikan penyampaian tujuan pembelajaran oleh guru				√
3	Siswa antusias mendengarkan dan memperhatikan langkah-langkah model pembelajaran *interaktif setting kooperatif* yang disampaikan guru			√	
4	Siswa antusias mendengarkan dan memperhatikan materi pengantar yang disampaikan guru dengan menanggapinya				√
5	Siswa termotivasi untuk mempelajari materi setelah mengetahui			√	

	manfaat materi tersebut dari penyampaian guru				
II.	**Kegiatan Inti**				
6	Memperhatikan penjelasan guru mengenai materi prasyarat atau hal-hal yang berkaitan dengan penyelesaian tugas kelompok				√
7	Mengajukan pertanyaan berkaitan dengan materi prasyarat atau aktivitas/pemecahan masalah yang akan dilakukan				√
8	Membaca dan memahami bahan ajar				√
9	Mengerjakan soal secara berkelompok				√
10	Berdiskusi, saling berbagi dan saling membantu dalam mengerjakan soal atau memahami bahan ajar				√
11	Mempresentasikan hasil kerja kelompok				√
12	Menjelaskan, memberi tanggapan atau menyampaikan pendapat tentang hasil kerja kelompok				√
13	Mengajukan pertanyaan, meminta penjelasan/ klarifikasi.				√
14	Memperhatikan penjelasan teman/guru				√
15	Mencatat hal-hal yang dianggap penting.				√
III.	**Penutup**				
16	Menyampaikan pendapat mengenai materi yang telah dipelajari (merefleksi)				√
17	Memperhatikan penjelasan guru/teman				√
18	Membuat rangkuman			√	
19	Mengerjakan soal-soal tes secara individual				√
20	Mendengarkan informasi untuk pertemuan berikutnya				√
Skor yang diperoleh		**77**			

Skor maksimal	**80**
Jumlah $\frac{77}{80}$ **x 100 = 96%**	

Table 2 above shows that each aspect observed in student activities during learning received varying scores, with an overall average score of 96% for student activities, which also falls into the "very good" category. Only 4% of the activities have not been performed maximally by the students.

1. Description of *pre test* and *post testResults*

Data collection for the pre-test and post-test was conducted by administering multiple-choice questions consisting of 10 items before and after using the interactive cooperative learning model with the XI grade students in the subject of Microprocessor and Microcontroller Programming Techniques at SMK Muhammadiyah Banda Aceh. During the test, students completed the assessment individually. The results of the pre-test and post-test obtained by the students can be seen in the table below:

Table 3. *Pre-Test* and *Post-Test Results*

No	Nama Siswa	Nilai *Pre-Test*	Nilai *Post-Test*
1	S1	80	95
2	S2	80	90
3	S3	75	85
4	S4	75	85
5	S5	75	80
6	S6	75	80
7	S7	70	80
8	S8	70	80
9	S9	65	75

10	S10	65	75
11	S11	60	70
12	S12	50	70
Total		**840**	**965**
Rata-Rata		**70**	**80**

Based on the table above, it can be seen that the highest score in the pre-test was 80, and the lowest score was 50, while the Minimum Completeness Criteria (KKM) is 75. Observing the data in the table, it is clear that, in general, half of the students have not achieved mastery in the pre-test. In contrast, in the post-test, the highest score was 95, and the lowest score was 70. Considering the KKM of 75, only 2 students did not achieve mastery in their learning outcomes in the post-test.

Calculating N-Gain

After determining the pre-test and post-test scores, the next step is to calculate the N-Gain to assess the improvement in student learning outcomes after implementing the interactive cooperative learning model, as shown in Table 4.2 below..

Table 4. N-Gain Test

No	**Nama Siswa**	***Pre-Test***	***Post-Test***	**Skor Ideal (100)-*Pre Test***	**N-Gain Skor**	**Kategori**
1	S1	80	95	20	0,7	Sedang
2	S2	80	90	20	0,5	Sedang
3	S3	75	85	25	0,4	Sedang
4	S4	75	85	25	0,4	Sedang
5	S5	75	80	25	0,2	Rendah
6	S6	75	80	25	0,2	Rendah

7	S7	70	80	30	0,3	Sedang
8	S8	70	80	30	0,3	Sedang
9	S9	65	75	35	0,2	Rendah
10	S10	65	75	35	0,2	Rendah
11	S11	60	70	40	0,2	Rendah
12	S12	50	70	50	0,4	Sedang
4,3						
0,3						Sedang

N-Gain Example Calculating :

$$N\ Gain = \frac{95\ -\ 80}{100\ -\ 80}$$

$$= \frac{15}{20}$$

= 0,7

Based on the table above, it can be seen that the average N-Gain score obtained from the pre-test and post-test is 0.3, which means it falls into the medium category. This indicates a moderate improvement in student learning outcomes between before and after the implementation of the interactive cooperative learning model with XI grade students in the subject of Microprocessor and Microcontroller Programming Techniques at SMK Muhammadiyah Banda Aceh.

Hypothesis Testing

The next step is to conduct a hypothesis test to determine whether the application of the interactive cooperative learning model has an effect on the learning outcomes of XI grade students in the subject of Microprocessor and Microcontroller Programming Techniques at SMK Muhammadiyah Banda Aceh. The hypothesis test in this study uses an Independent Sample T-Test, with the results as follows:

Table 5. Group Statistics Testing

Group Statistics					
	Post-Test	N	Mean	Std. Deviation	Std. Error Mean
Pre-Test	1.00	12	70.0000	8.79049	2.53760
	2.00	12	80.4167	7.52521	2.17234

Based on Table 5 above, it can be observed that there is an increase in the average learning outcomes of students before and after the implementation of the interactive cooperative learning model, where the pre-test score was 70 and increased to 80 in the post-test. This is supported by the output results of the Independent Sample T-Test, as shown in Table 4.4.

Tablel 6. *Independent Sample T-Test Testing*

Independent Samples Test										
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pre Test	Equal variances assumed	.286	.598	-3.118	22	.005	-10.41667	3.34043	-17.34429	-3.48904
	Equal variances not assumed			-3.118	21.489	.005	-10.41667	3.34043	-17.35385	-3.47948

Based on the results of the hypothesis testing conducted using the Independent Sample T-test analysis through the SPSS program, the Sig (2-tailed) value obtained is 0.005. This means

that p = 0.005 < 0.05, indicating that Ha is accepted. This implies that the interactive cooperative learning model has an effect on the learning outcomes of XI grade students in the subject of Microprocessor and Microcontroller Programming Techniques at SMK Muhammadiyah Banda Aceh.

CONLUCION

Based on the results of the research and discussion above, it can be concluded that there is an effect of the interactive cooperative learning model on the learning outcomes of XI grade students in the subject of Microprocessor and Microcontroller Programming Techniques at SMK Muhammadiyah Banda Aceh. This is indicated by an increase in the pre-test score from 70 to 80 in the post-test. The hypothesis test shows that the p-value is 0.005 < 0.05, which means that Ha is accepted. This indicates that the interactive cooperative learning model has an effect on the learning outcomes of XI grade students in the subject of Microprocessor and Microcontroller Programming Techniques at SMK Muhammadiyah Banda Aceh.

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