Using the Swansoft Application to Improve Students' Learning Outcomes in NC/CNC and CAM Machining Engineering

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Article Info	Abstract
Article history: Received : 14 March 2024 Published : 19 March 2024	*Learning outcomes are a set of competencies obtained by students after participating in learning activities. Most of the current students' learning outcomes are still low in setting up and editing CNC programs. Therefore, teachers need to innovate by using applications that are relevant and support improving students' learning outcomes. The aim of this research is to use the Swansoft application to improve the learning outcomes of NC/CNC and CAM Machining Engineering students in Class XI of SMK Negeri 2 Sampang. This research is classroom action research which consists of 2 learning cycles for setting up and editing CNC programs using the Swansoft application. The subjects of this research were 33 TPM XI-1 Class students. Based on the results of the test questions given to students, students' learning outcomes in cycle I were 87.88% or twenty-nine students had met the KKM. There was an increase in students' learning outcomes in cycle II where as many as 100% or 33 students had met the KKM, namely 70. Thus, it can be concluded that the use of the Swansoft application can improve the learning outcomes of NC/CNC and CAM Machining Engineering students in Class XI of SMK Negeri 2 Sampang.*
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Info Artikel	**Abstrak**
Article history: Diterima : 14 Maret 2024 Publis : 19 Maret 2024	Hasil belajar seperangkat kompetensi yang diperoleh siswa setelah mengikuti kegiatan pembelajaran. Hasil belajar siswa saat ini sebagian besar masih rendah dalam mensetting dan menynuting program CNC. Oleh sebab itu, maka guru perlu melakukan inovasi dengan menggunakan aplikasi yang relevan dan mendukung peningkatan hasil belajar siswa. Tujuan penelitian ini adalah penggunakan aplikasi swansoft untuk meningkatkan hasil belajar siswa Teknik Pemesinan NC/CNC dan CAM Kelas XI SMK Negeri 2 Sampang. Penelitian ini merupakan penelitian tindakan kelas yang terdiri atas 2 sklus pembelajaran mensetting dan menyunting program CNC menggunakan aplikasi swansoft pada. Subyek penelitian ini adalah siswa Kelas TPM XI-1 sebanyak 33 siswa. Berdasarkan hasil pengerjaan soal tes diberikan kepada siswa, hasil belajar siswa pada siklus I sebanyak 87,88% atau dua puluh Sembilan siswa sudah memenuhi KKM. Terjadi peningkatan hasil belajar siswa pada siklus II dimana sebanyak 100% atau 33 siswa sudah memenuhi KKM yaitu 70. Dengan demikian maka dapat disimpulkan bahwa penggunaan aplikasi swansoft dapat meningkatkan hasil belajar siswa Teknik Pemesinan NC/CNC dan CAM Kelas XI SMK Negeri 2 Sampang.

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1. INTRODUCTION

Education is a process that is carried out systematically to develop individual competencies in accordance with objectives. Education is provided by credible educational institutions and meets applicable statutory provisions. Educational institutions are responsible for organizing learning to achieve national educational goals. Therefore, the implementation of education follows the applicable regulations which regulate all standards for the implementation of formal education. Education in Indonesia is carried out in stages based on the stages and levels of development of students. Education is carried out starting from early childhood education, primary education, junior secondary education, senior secondary education and higher education. Education is carried out in the form of learning

programs to master the competencies determined by the government through the curriculum at each level of education.

Seeing the problems of graduates of educational institutions in Indonesia, the government is trying to make various changes in the education sector aimed at improving the quality of education[1]. The implementation of education is expected to be able to adapt to future needs and challenges with students' mastery of competencies in the learning process. It is hoped that the student competencies that are developed will be able to provide provisions for students to be able to face the future, namely the era of globalization and digitalization. The need for competence in the world of work is a challenge for education providers, especially vocational education or vocational high schools. Vocational high schools are educational institutions that aim to provide graduates who are ready to work according to the needs of the world of work. Therefore, school partnerships with business actors are held in order to provide opportunities for internship students in the real world of work. Before students carry out practical field work or work for real, students develop competencies at school optimally. Students' success in learning is influenced by the teacher's competence in managing learning. Students will obtain maximum learning outcomes if student competencies develop well through direct student involvement during the learning process. The success of learning at school will be realized from the success of students' learning[2].

Vocational high schools have various study programs that students can choose according to their interests and talents. One of the study programs that is in great demand is the mechanical engineering study program. One of the subjects taught is NC/CNC and CAM machining techniques. One of the competencies developed in this subject is the ability to set up and edit CNC programs. The curriculum for the machining engineering skills program has prepared several subjects that must be taken by training participants, one of which is the Computer Numerical Control (CNC) subject.[3]. CNC practical learning is a process to improve students' skills directly in running and programming a computer-controlled machine tool that has competency in accordance with SKKNI, namely operating NC/CNC machines (basic)[3]. The advantages offered by CNC machines are: high accuracy, high precision, high productivity, suitable for mass production, can work on complex shapes[3]. CNC machines can support production that requires a high level of complexity and can reduce operator intervention while the machine is operating[4].

The problems currently occurring regarding CNC subjects are the development of CNC technology which is developing rapidly and quickly, learning time in schools is still felt to be insufficient with a heavy burden of basic competencies, the limited number of CNC machines in schools, the lack of innovative and interesting CNC learning media.[5]. To overcome the problem of learning machining techniques in vocational high schools, teachers need to innovate by using relevant learning media. One of the learning media that is relevant to learning machining techniques is the Swansoft application. Using the Swansoft application as media. learning is expected to be able to overcome the limited facilities and infrastructure in schools which are not yet appropriate to the number of students taking CNC learning[6]. The tools include using SwanSoft Simulator software on a computer or laptop that has SwanSoft Simulator software installed so that using this device helps students practice their skills in operating CNC machines.[7].

The use of the Swansoft application learning media is expected to improve students' learning outcomes. The more concrete learning experience using learning media will improve learning outcomes because the process involves more senses that play a role in entering the information provided[8]. Swansoft CNC simulation media, whose operating process is exactly the same as a real CNC machine, is enough to provide students with knowledge about how to operate a CNC machine.[9]. Vocational Schools are tasked with providing adequate educational facilities and infrastructure so that apart from facilitating teaching and learning activities between teachers and students, they also strive to ensure students' learning outcomes are as optimal as possible.[9]. Learning outcomes are students' ability to identify and understand the learning that has been carried

out[8]. Learning media makes the material studied easy to explain and easy for students to understand. The presence of learning media will have a positive impact on students' learning outcomes. The learning outcomes in learning NC/CNC and CAM machine programming are students' ability to set up and edit NC/CNC and CAM programs.

2. RESEARCH METHOD

The subjects in this research consisted of students, teachers, subject matter, and the time of conducting the research. The subjects in this research were 33 students in class XI TP 2 SMK Negeri Sampang. Meanwhile, the teacher who was the subject of the research was the teacher of TPM class XI TP 2 SMK Negeri Sampang. The material taught is manual setting and editing of CNC programs in class XI TP 2 SMK Negeri Sampang. The research was carried out from October to December 2022 for the 2022/2023 academic year. The research method used is classroom action research. Teachers act as researchers in taking corrective action on learning problems by carrying out various innovations and relevant learning strategies. Classroom action research was carried out in two cycles with the hope that there would be an increase in students' learning outcomes that initially did not meet the KKM until they finally fully met the KKM.

Classroom Action Research (PTK) is carried out using a cycle strategy which is carried out in stages of problem identification, planning, action, observation and reflection[10]. The purpose of classroom action research[11]among others:
1. Improving the quality of content, input, processes and outcomes of education and learning in schools.
2. Helping teachers and other education personnel in overcoming learning and education problems outside the classroom.
3. Improving the professional attitude of education and education personnel
4. Developing an academic culture in the school environment, so as to create a proactive attitude in improving the quality of education and learning on an ongoing basis.

Data collection techniques are a way for researchers to collect research data needed as material for data analysis. Data collection techniques were carried out using test techniques. Students will be given a test at the end of the lesson to determine students' learning outcomes in setting and editing CNC programs manually. The research procedures in each cycle consist of planning activities, implementing actions, observing and reflecting. The researcher will describe all procedures carried out in stages 1 and 2 in the form of tables, diagrams or descriptions.

3. RESEARCH RESULTS AND DISCUSSION
3.1. Research result

There are 33 students in class XI TP 2 SMK Negeri 2 Sampang, all of whom are male. Based on the results of initial observations carried out by researchers on students in class

Table 1. List of Pre-Cycle Students' learning Results

No	Student	L/P	Learning outcomes
1	A	L	40
2	B	L	30
3	C	L	35
4	D	L	55
5	E	L	75
6	F	L	65
7	G	L	80

No	Student	L/P	Learning outcomes
8	H	L	35
9	I	L	40
10	J	L	40
11	K	L	55
12	L	L	65
13	m	L	75
14	N	L	90
15	O	L	65
16	P	L	55
17	Q	L	75
18	R	L	40
19	S	L	65
20	Q	L	50
21	U	L	60
22	V	L	75
23	W	L	65
24	X	L	80
25	Y	L	35
26	Z	L	40
27	A A	L	40
28	AB	L	55
29	air conditioning	L	65
30	AD	L	75
No	**Student**	**L/P**	**Learning outcomes**
31	A.E	L	90
32	AF	L	55
33	AG	L	65

Table 2. Average value of initial learning outcomes (before cycle)

No	Mark	The number of students	Number of Values	Percentage		Note
				Complete	Not Completed	
1	90-100	2	180	6.06%	-	Average class value 1,930: 33 = 58.48
2	80-89	2	160	6.06%	-	
3	70-79	5	375	15.16%	-	
4	60-69	8	515	-	24.24%	
5	50-59	6	325	-	18.18%	
6	40-49	6	240	-	18.18%	
7	30-39	4	135	-	12.12%	
8	20-29	-	-	-	-	
9	10-19	-	-	-	-	

10	<10	-	-	-	-	
	Amount	33	1930	27.28%	72.72%	

Based on the information obtained above, the researchers then redesigned the learning to set up and edit CNC programs manually to be able to overcome the problems above, where the learning outcomes of students who met the KKM 70 were only 27.28%, while the remaining 72.72% did not meet the KKM. Some of the things the researcher did were: 1) determining the learning outcomes of manually setting up and editing the CNC program, 2) preparing the swansoft application, and 3) for each learning activity, the researcher made preparations for classroom management so that the learning process was conducive.

In cycle I, researchers conducted apperception, conveyed learning objectives, and provided learning motivation to students. Researchers provide information about the stages of learning implementation. and conducting questions and answers about manual CNC programming. After conducting dialogue and questions and answers, the teacher divides the students into 5 groups where each student consists of 6-7 heterogeneous students. Researchers provide students with the opportunity to utilize the Swansoft application to understand the activities of setting up and editing CNC programs manually. The results of each group's work are then presented in front of the class in turn. During the learning process, researchers carry out monitoring to identify problems or obstacles faced by each group, then provide direction and guidance. The lesson ends by providing description questions consisting of 5 description questions regarding the activities of setting up and editing CNC programs manually. Students' learning outcomes in cycle I are described as follows:

Table 3. Average Value of Cycle I Learning Results

No	Mark	The number of students	Number of Values	Percentage		Note
				Complete	Not Completed	
1	90-100	7	655	21.21%	-	Average
2	80-89	10	840	30.30%	-	value
3	70-79	12	885	36.37%	-	for class
4	60-69	1	65	-	3.03%	2,600:
5	50-59	2	110	-	6.06%	33 =
6	40-49	1	45	-	3.03%	78.78
7	30-39	-	-	-	-	
8	20-29	-	-	-	-	
9	10-19	-	-	-	-	
10	<10	-	-	-	-	
	Amount	33	2600	87.88%	12.12%	

Based on students' learning results in cycle I using the Swansoft application media in learning to set up and edit CNC programs manually, information was obtained that there was a significant increase in students' learning outcomes in cycle I. There were 29 students or 87.88% of the total number of students who obtained the learning outcomes meet the minimum completeness criteria and there are still 4 students or 12.12% of the total number of students who still obtain learning results below the minimum completeness criteria. During the learning process, the researcher was assisted by colleagues who were tasked with observing the entire learning process from start to finish. Information collected by colleagues serves to provide

reinforcement for the reflection activities carried out by researchers to find deficiencies experienced during learning cycle I.

Based on the reflection process and the results of peer observations, several deficiencies were obtained that needed to be corrected in cycle II, namely that there were still group members who were less active during the learning process, so researchers needed to ensure that each group member had the same role during the learning process. In addition, when the teacher gave an explanation of the learning stages, some students did not pay close attention so that in the second cycle, the researcher ensured that the students' attention was focused on the teacher's explanation. The next deficiency information is that when using the Swansoft application in a group, some group members are too dominant so that some other group members are less active. Some of this information is used as material in preparing learning to set up and edit CNC programs manually in the second cycle.

In the second cycle, Researchers conduct apperception, convey learning objectives, and provide learning motivation to students. Researchers provide information about the stages of learning implementation. and conducting questions and answers about manual CNC programming. When explaining, the researcher focuses attention on all students and ensures that all students have received clear information about what will be learned. After conducting dialogue and questions and answers, the teacher divides the students into 5 groups where each student consists of 6-7 heterogeneous students. Researchers provide students with the opportunity to utilize the Swansoft application to understand the activities of setting up and editing CNC programs manually. The traveling researcher monitors each student's group work and ensures that all students are active in the group. The results of each group's work are then presented in front of the class in turn. Then, at the end of the lesson, the researcher gave 5 descriptive questions to measure students' learning outcomes. Based on the recapitulation of students' answers, the following students' learning outcomes in the second cycle were obtained:

Table 4. Average Value of Learning Results for Cycle II

No	Mark	The number of students	Number of Values	Percentage		Note
				Complete	Not Completed	
1	90-100	8	750	24.24%	-	Average class score 2,720: 33 = 82.42
2	80-89	12	1,010	36.36%	-	
3	70-79	13	960	39.40%	-	
4	60-69	-	-	-	-	
5	50-59	-	-	-	-	
6	40-49	-	-	-	-	
7	30-39	-	-	-	-	
8	20-29	-	-	-	-	
9	10-19	-	-	-	-	
10	<10	-	-	-	-	
	Amount	33	2,720	100%	-	

Based on students' learning outcomes in cycle II using the Swansoft application media in learning to set up and edit CNC programs manually obtained information that there was a significant increase in students' learning outcomes in cycle II compared to cycle I. There were 33 students or 100% of the total number of students obtained learning outcome scores that meet the KKM. There were 8 students or 24.24% who got a learning result score of 90-100, there were 12 students or 36.36% of the total number of students who got a learning result score of 80-89, and

there were 13 students or 39.40% of the total number of students who obtained a learning outcome score of 70-79.

3.2.Discussion

Before cycle I, students' learning outcomes were low and the majority of students did not meet the score according to the minimum completeness criteria, namely 75, where the students' learning outcomes that met the KKM 70 were only 27.28%, while the remaining 72.72% did not meet the KKM. This problem occurs because students are less actively involved during the learning process and do not use learning media to make it easier for teachers and students to understand the lesson material. Based on these problems, the researcher designed learning to set up and edit the CNC program manually using the Swansoft application in cycle I. The researcher carried out the lesson according to the design and at the end of the lesson, the researcher gave test questions to measure students' learning outcomes after using the Swansoft application media in the setting and editing lesson. manually editing the CNC program in class XI TP 2 SMK Negeri 2 Sampang. Based on the recapitulation of students' learning outcomes in cycle I, information was obtained that the class average score was 78.78 with details that 7 students got a score of 90-100 or 21.21%, students who got a score of 80-89 were 10 students or 30.30%, students who got a score of 70-89 were 12 students or 36.37%, students who got a score of 60-69 were 1 student or 3.03%, students who got a score of 50-59 were 2 students or 6.06%, and students who get a score of 40-49 are 1 student or 3.03%.

In the first cycle there were still 4 students who scored below the KKM so the researcher and colleagues reflected and discussed the results of observations regarding deficiencies during the learning process in stage I. Based on the results of the reflection and observations, the researcher made several improvements as needed and redesigned cycle II learning to set up and edit CNC programs manually for class XI TP 2 students at SMK Negeri 2 Sampang. The researcher carried out the learning according to the design and improvements in the first cycle of learning and at the end of the second cycle of learning the researcher gave 5 descriptive test questions. Based on the recapitulation of students' learning outcomes in cycle II, information was obtained that the class average score was 82.42 with details that 8 students got a score of 90-100 or 24.24%, students who got a score of 80-89 were 12 students or 36.37%, and students who got a score of 70-89 were 13 students or 39.40%. This means that 33 students or 100% of the total number of students have succeeded in obtaining learning outcome scores that meet the KKM. So, it can be stated that using the Swansoft application can improve students' learning outcomes in setting up and editing CNC programs manually for NC/CNC and CAM Machining Engineering students in Class XI TP 2 SMK Negeri 2 Sampang.

4. CONCLUSION

Based on the results and discussion described above, the researcher concludes that using the Swansoft application can improve students' learning outcomes in manually setting up and editing CNC programs for NC/CNC and CAM Machining Engineering students in Class XI TP 2 SMK Negeri 2 Sampang. Researchers recommend and advise vocational high school teachers to use the Swansoft application media in learning machining techniques because it can help teachers explain lesson material and help students understand the lesson material.

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