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Implementation of Autodesk Inventor E-Module in The Study of Manufacturing Engineering Drawings
(Case Study at State Vocational High School 2 Kebumen)

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Abstrak. Penelitian ini merupakan penelitian eksperimen. Penelitian ini dilakukan di SMK Negeri 2 Kebumen pada tahun ajaran 2022/2023. Pemilihan sampel dalam penelitian ini adalah kelas XII TP 3 sebanyak 35 sebagai kelas kontrol dan kelas XII TP 4 sebagai kelas eksperimen dengan total sampel sebanyak 35. Kelas eksperimen perlakuannya dalam proses pembelajaran menggunakan media pembelajaran E-Modul, dan kelas kontrol diberikan perlakuan dalam proses pembelajaran dengan metode konvensional. Desain yang digunakan dalam penelitian ini adalah *PreTest PostTest Control Grup Desain*. Instrumen penelitian berupa hasil belajar. Untuk menguji hipotesis menggunakan uji *paired* sample t-*test*. Analisis dilakukan secara deskriptif. Hasil penelitian ini menunjukkan bahwa pengaruh E-Modul terhadap prestasi belajar peserta didik menunjukkan peningkatan yang signifikan dibanding dengan pembelajaran yang tidak dengan E-Modul, terbukti bahwa data yang diolah pada kelas eksperimen menunjukkan nilai sig < 0,001 baik nilai pengetahuan maupun nilai ketrampilan yang menandakan jika hasil nilai sig kurang dari (α) = 0,05, maka H_0 ditolak dan H_a diterima yang menunjukkan ada pengaruh E-Modul terhadap prestasi belajar peserta didik.

Keywords:
Autodesk Inventor; E-Module; Engineering Drawing; Learning Media; Vocational High School Students

Abstract. *This research is experimental. This research was conducted at SMK Negeri 2 Kebumen in the 2022/2023 academic year. The sample selection in this study was class XII TP 3 as much as 35 as the control class and class XII TP 4 as the experimental class with a total sample of 35. The experimental class was treated in the learning process using E-Module learning media, and the control class was given treatment in the learning process with conventional methods. The design used in this study was the*

Pretest and Post Test Control Group Design. The research instrument is in the form of learning outcomes. To test the hypothesis using the paired sample t-test. The analysis was conducted descriptively. The results of this study indicate that the effect of the E-Module on student learning achievement shows a significant increase compared to learning without the E-Module. the result of the sig value is less than (\alpha) = 0.05, then H_0 *is rejected and* H_a *is accepted which shows that there is an effect of the E-Module on student achievement.*

INTRODUCTION

In the current era of development, education is an absolute necessity that must be fulfilled for human life. The purpose of education is to shape human resources to a higher quality and character (Mahari & Kritian, 2021). Therefore, the Republic of Indonesia provides various levels of education in its educational units, including Kindergarten, Elementary School, Junior High School, Senior High School/Vocational School, and College.

According to Zainal Arifin's statement (2010), learning is a process experienced by individuals for learning activities. Learning is essentially a process where an individual's behavior changes as a result of interaction with the environment and experiences. From this statement, it can be concluded that learning is a communicative activity that is conducted systematically both between teachers and students and other students, which can take place both inside and outside the classroom, and the aim can be concluded to be mastering one of the abilities given.

An educator should have effective and innovative methods to enhance the learning experience of students (Zuriah et al., 2016; Puspita, 2021). Educators who possess a creative and innovative mindset can make the learning process more engaging, preventing students from feeling bored. If these requirements are met by educators, students will become more self-reliant in participating in the learning process, which can ultimately reduce any inconvenience for educators in the future (Oktiani, 2017; Julita, 2022).

However, the process of learning Manufacturing Engineering Drawing activities at SMK Negeri 2 Kebumen (State Vocational High School 2 Kebumen) has gone well. However, several problems exist when observing, including that educators still teach using conventional learning, where conventional learning still depends on a direct learning system between educators and students, making students less independent.

Conventional learning that is still used by educators is learning by giving direct explanations face to face, either with PowerPoint and YouTube for tutorials or with other

applications (Purnasari, 2020; Patandean & Indrajit, 2021). This can cause students to become bored while following lessons, especially since students do not take notes on the material explained by the teacher at that time, so that many students are left behind in understanding the material that has been taught.

When educators explain using Microsoft PowerPoint, educators will tend to passively pay attention to what is in front of them, whereas with YouTube, students will lose a lot of internet quota for viewing tutorials, therefore there is a need for E-Modules in the learning process so that students can be active later. following the ongoing learning process and not being left behind in following the learning material (Laili et al., 2019; Sumanto, 2021).

Based on these problems, an E-Module is needed to expedite the learning process which is useful for helping educators following the Manufacturing Engineering Drawing learning system, where students have a handle containing materials and questions along with answer keys and steps for solving these questions (Darman, 2017). In addition, at vocational high schools (SMK), practical training is required for several subjects. Teachers might face difficulties in effectively delivering these concepts. However, the use of media can be a helpful tool for this purpose. The media can also make abstract concepts more understandable by providing concrete examples. (Sadewo, 2021; Setiawan & Hudha, 2021).

The existence of these problems aroused the curiosity of researchers in conducting research. Then, the idea arose to research the implementation of the Autodesk Inventor E-Module in Learning Manufacturing Engineering Drawing at SMK Negeri 2 Kebumen. E-Module was chosen because nowadays many people use electronic means which have many advantages.

It is hoped that the E-Module in learning will be able to make students more active in participating in the ongoing learning process because the Autodesk Inventor E-Module contains several materials, especially material related to the Autodesk Inventor 2014 software. This E-Module aims to help students, especially those with difficulties in studying lessons, especially lessons about Autodesk Inventor Software. The arrangements in the contents of the E-Module prioritize more modern innovations which will later make it easier for educators and students to use them and make students more independent in ongoing teaching and learning activities.

METHOD

The method that will be used by researchers in this research applies experimental research methods. This experimental research will use two different groups, namely the control group, and the experimental group. According to an essay by Syaodih (2013: 194), what is meant by experimental research is a quantitative research that is full or saturated, in the sense that the research conducted can fulfill all the requirements used to test cause and effect relationships. Experimental research is the only type of research that can test a hypothesis correctly (according to Emzir, 2012: 64). This experimental research will later aim to test how much influence one or more variables have on other variables.

Experimental research involves a method called Randomized Subjects Pretest-Posttest Control Group Design. In this method, two population groups are selected randomly from the research sample and given a pretest to determine the initial conditions and whether there are any differences between the experimental group and the control group.

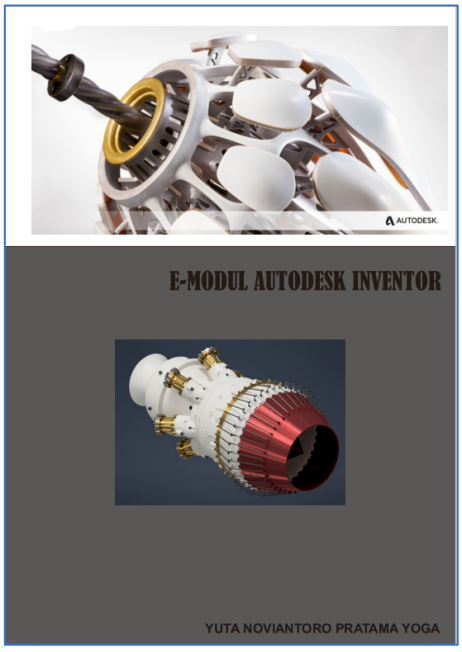

Figure 1. *E-Modul* Autodesk Inventor

1. Place and Time of Research

The research was conducted in the Department of Machining Engineering Class XII TP 3 and Class XII TP 4 SMK Negeri 2 Kebumen (State Vocational High School 2 Kebumen) which is located at Jalan Joko Sangkrip KM 01 Kebumen. The research was conducted from January to February of the 2022/2023 academic year.

2. Research Population and Sample

The population in this study were students in class XII TP 3 and class XII TP 4 in Machining Engineering at SMK Negeri 2 Kebumen. The sample in this study used a sample of class XII TP 3 students, totaling 35 students, as the experimental group, and class XII TP 4 students, totaling 35 students, as the control group.

3. Data Collection Techniques and Instruments

The first step in collecting data in this research is observation. Observation is a data collection technique by observing ongoing learning activities. Activities can relate to the way educators teach, students learn, employees work, and so on. As a tool for collecting observational data, it has several advantages, including it can collect a lot of information, the results are more accurate and cannot be denied and research subjects cannot be lied to. Apart from that, to make it easier and remember all events during the observation, observers also use cameras to document ongoing research activities. Observations in the research were conducted during classroom learning and when the experimental group (XII TP 4) was given action in the form of Implementing the Autodesk Inventor E-Module.

The next step in research is to use a tool known as a research instrument or data collection tool, commonly referred to as a test. This tool is used to collect research data by taking measurements (Setiawan & Purnomo, 2019). Tests are typically used in educational research, psychology, and sociology to measure specific constructs. Constructs in the education field can include skills, motivation, learning outcomes, talents and abilities, attitudes, and relationships, as stated in an essay by Sukardi (2012: 138). According to an essay by Wagiran (2013: 253), a test is a series of questions, exercises, or other tools used to measure students' skills, knowledge, intelligence, abilities, or talents.

4. Data Analysis Techniques

The data analysis technique in this research uses hypothesis testing. According to (Duwi Priatno, 2010: 101), hypothesis testing uses the SPSS 27 Paired sample T-Test program on the Pre-Test and Post-Test scores in the Experimental class and Pre-Test and Post-Test in the control class with a significance level of 5%. This test was conducted to find out the difference between the average score before being given treatment (Pre-Test) and the average score after being given treatment (Post-Test) using the Autodesk Inventor learning E-Module. The hypothesis used is:

- H0: There is no increase in student learning achievement before being given the E-module and after being given the E-module.
- H1: There is an increase in student learning achievement before being given the E-module and after being given the E-module.

Based on probability

- H0 can be accepted if it is significant > 0.5%

H0 is rejected if it is significant < 0.5%

RESULTS AND DISCUSSIONS

The research conducted by researchers is experimental research. This experimental research was conducted by taking saturated samples in class XII TP 3 as a control group and XII TP 4 at SMK Negeri 2 Kebumen (State Vocational High School 2 Kebumen) as the experiment group sample. This research was conducted at 5 meetings, where the first meeting held a Pre-Test which took 2 x 45 minutes. Next, class XII TP 3 students will be given learning materials as usual, and class.

Observations conducted in the experimental class (XII-TP4) had the aim of knowing the E-Module learning process that took place in the class. The learning process consists of: opening the lesson, implementation methods used, teaching principles used, use of E-Module media, evaluation, and closing the lesson.

Observations at the first meeting showed that the results of observations at the first meeting of students were very enthusiastic about participating in the learning process using E-Module media as evidenced by data on Visual Activities, Listening Activities, Writing Activities, Motor Activities and Mental Activities reaching a percentage of 100%, which means that students participated. all these activities, however, in the data on verbal activities and emotional activities, students are still less active, because these activities are related to question and answer sessions, both between students and teachers, as well as students and other friends, only reaching a percentage of 8.57%.

Observations at the second meeting showed that students were very active in participating in the learning process using E-Module media as evidenced by data on Visual Activities, Listening Activities, Writing Activities, Motor Activities, and Mental Activities reaching a percentage of 100%, which means that students participating in all these activities would However, in the data on verbal activities and emotional activities, students are still less active because these activities are related to question and answer sessions, both between students and teachers, as well as students and other friends. In oral activities,

number 4 shows a percentage of 5,71%, and number 5 shows a percentage of 0%. Percentage of emotional activities 2,85%.

Observations at the third meeting showed that students were very active in participating in the learning process using E-Module media as evidenced by data on Visual Activities, Listening Activities, Writing Activities, Motor Activities, and Mental Activities reaching a percentage of 100%, which means that students participating in all these activities would However, in the data on verbal activities and emotional activities, students are still less active because these activities are related to question and answer sessions, both between students and teachers, as well as with other friends. In oral activities, number 4 shows a percentage of 5,71%, and number 5 shows a percentage of 2,85%. Emotional activities show a percentage of 2,85%.

Observations at the fourth meeting showed that students were very active in participating in the learning process using E-Module media as evidenced by data on Visual Activities, Listening Activities, Writing Activities, Motor Activities, and Mental Activities reaching a percentage of 100%, which means that students participating in all these activities would However, in the data on verbal activities and emotional activities, students are still less active because these activities are related to question and answer sessions, both between students and teachers, as well as students and other friends. In oral activities, number 4 and number 5 show a percentage of 0%. Emotional activities also show a percentage of 0%.

Observations at the fifth meeting showed that students were very active in participating in the learning process using E-Module media as evidenced by data on Visual Activities, Listening Activities, Writing Activities, Motor Activities, and Mental Activities reaching a percentage of 100%, which means that students participating in all these activities would However, in the data on verbal activities and emotional activities, students are still less active because these activities are related to question and answer sessions, both between students and teachers, as well as students and other friends. In oral activities, number 4 and number 5 show a percentage of 0%. Emotional activities show a percentage of 5,71%.

Pre-Test and Post-Test are used to measure how far students know. The control class and experimental class were both given a Pre-Test and Post-Test. The difference lies in that the experimental class is given learning with the E-Module before being given the Post-Test, while the Control class is only given learning as usual before being given the post-Test.

The following are the results of the comparison between the Pre-Test and Post-Test scores from the control class and the experimental class.

1. Class XII TP 3 (Control) Results

a. Knowledge Assessment

Referring to the data shown in Table 1, it can be concluded that there has been a change in the Pre-Test and Post-Test scores, for knowledge assessment, the minimum score from 75 has increased by 5 to 80, while the maximum score is still same, that is 100, for the average score. from 86.71, it increased by 7 to 93.71, and the percentage of completeness from 82.80% increased by 17.20% to 100%.

Table 1. Comparison of Pre-test and Post-Test Knowledge for Class XII TP 3

No	Performance	Pre-Test Score	Post-Test Score
1	Minimum Score	75	80
2	Maximum Score	100	100
3	Average	86,71	93,71
4	Completion Percentage	82,80%	100%

b. Skills Assessment

Based on the data shown in Table 2, the skills assessment data shows changes in scores between the scores from the Pre-Test and the scores from the Post-Test. The change in score from 73 increased by 7 to 80, the maximum score from 90 increased by 5 to 95, the average score from the initial score of 80.29 increased by 8.71 to 89, and the percentage of completion from 71% increased by 29% to 100%.

Table 2. Comparison of Pre-test and Post-Test Skills for Class XII TP 3

No	Performance	Pre-Test Score	Post-Test Score
1	Minimum Score	73	80
2	Maximum Score	90	95
3	Average	80,29	89
4	Completion Percentage	71%	100%

2. Class XII TP 4 (Experiment) Results

a. Knowledge Assessment

From the experimental class knowledge assessment data listed in Table 3, it can be concluded that there was an increase in the value of learning outcomes between the Pre-Test and Post-Test. The increase in question is that the minimum score from 80 increased by 15 to 95, the maximum score remained 100, while the average score from 82.80 increased by 9.57 to 99.14 while the percentage of completion from 82.80% increased by 17.20% to 100%.

Table 3. Comparison of Pre-test and Post-Test Knowledge for Class XII TP 4

No	Performance	Pre-Test Score	Post-Test Score
1	Minimum Score	80	95
2	Maximum Score	100	100
3	Average	89,57	99,14
4	Completion Percentage	82,80%	100%

b. Skills Assessment

From the skill assessment data for the Experiment class shown in Table 4, it can be concluded that there was an increase in the value of learning outcomes between the Pre-Test and Post-Test. The increase in question is the minimum value from 70 increased by 20 to 90, the maximum value from 90 increased by 5 to 95, while the average value from 80 increased by 13.57 to 93.57 and the percentage of completeness from 65.71% increased by 34.29% to 100%. This increase in learning outcomes shows that the learning method applied is effective in improving students' understanding and skills. Some factors that are thought to influence the improvement of learning outcomes include: learning materials delivered according to the level of students' thinking ability, interactive and participatory learning methods that motivate students to be actively involved, and evaluation questions that demand higher order thinking skills. Thus, it can be said that the application of appropriate learning methods is very instrumental in improving the quality of learning and student achievement.

Table 4. Comparison of Pre-test and Post-Test Skills for Class XII TP 4

No	Performance	Pre-Test Score	Post-Test Score
1	Minimum Score	70	90
2	Maximum Score	90	95
3	Average	80	93,57
4	Completion Percentage	65,71%	100%

3. Hypothesis Test Results

Testing of the group of students who received treatment with E-Modules (Class XII LO 3). The following are the results of different tests for class XII TP 4 students (Experiment) using the t-test with SPSS shown in Table 5 and Table 6.

Table 5. *Paired t-test* Class XII TP 4 Knowledge

	N	t-count	Sig	Level of Significance
Pre-Test & Post-Test	35	-10,445	< 0,001	0,05

Table 6. *Paired t-test* Class XII TP 4 Skills

Pre-Test & Post-Test	N	t-count	Sig	Level of Significance
	35	-14,225	< 0,001	0,05

Based on the Paired Sample t-test table data above, in the knowledge assessment, a significance value <0.001 was obtained, meaning it was less than the significant value level (α) = 0.05, so the hypothesis H0 was rejected. This means that there is a significant increase in learning achievement between the average value of the value before treatment and the average value after experimental treatment using E-Module. In Table t, the calculated t value is -10.445, meaning that the average before the treatment has a lower value than the average after the experimental treatment using the Autodesk Inventor E-Module. It can be concluded that there was a significant increase in knowledge learning results in the experimental class (XII TP 4) from the Pre-Test to the Post-Test assessment.

In the skills assessment, the significance obtained was <0,001 and less than the 0.05 significance level, so H0 was also rejected. This means that there is a significant difference in learning achievement between before being given learning with the Autodesk Inventor E-Module and after being given learning with the Autodesk Inventor E-Module. So it can also be concluded that there has been a significant increase in the assessment of experimental class skills learning outcomes (XII TP 4) from the Pre-Test assessment and Post-Test assessment.

From the description above, it can be said that learning using learning media tools in the form of E-Modules can improve students' learning achievement. The average score obtained for the Experimental class (XII TP 4) can be concluded that the average score obtained by students was 99.14 for the knowledge aspect, and 93.57 for the skills aspect from initially 89.57 in the Pre-Test for the knowledge aspect. and 80 for the skills aspect. Thus, student learning achievement in the Pre-Test assessment and Post-Test assessment can meet the research indicators, namely having at least a percentage of 85% of the total number of students in the class who have obtained a score above the KKM (minimum limit score) or above 80 and student activity can be further increased by learning using the Autodesk Inventor E-Module media at SMK Negeri 2 Kebumen for the 2022/2023 academic year.

CONCLUSION

The Autodesk Inventor e-Module has a big influence on the learning achievement of students at Vocational High School 2 Kebumen Class initial score and the average score of skills increased 16,96% from the initial average score compared to class XII TP 3 (control) with the average score of knowledge increasing 8.07% from the initial average score e and the average score of skills increased 10.88% from the average initial score. This shows that the average score for class XII TP 4 (experiment) increased more significantly compared to class XII TP 3 (control).

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