Jurnal Pendidikan Teknik Mesin Vol 25, No. 2, December 2025 (1-6)

JPTM
http://journal.unnes.ac.id

Application of PowerPoint-Based Multimedia to Improve Students' Learning outcomes on Milling Machine Parts in Vocation Education

Dwi Prastiyo[1], Muhammad Khumaedi[1], Kriswanto[1]

[1]Department of Mechanical Engineering Education,Faculty of Enginering, Universitas Negeri Semarang, Indonesia
Email: Prasetyo7142@gmail.com

Abstract

This study aims to evaluate the effectiveness of PowerPoints-assisted multimedia in enhancing students learning outcomes related to milling machine parts at SMK IPT Karangpanas. The background of this research is based on poor student learning outcomes, which are below the Graduation Threshold Value (KKM). Before conducting research, the feasibility of media and material was tested by experts with a percentage of 83% so that the material and media were suitable for use. The method used is quantitative experimental research with a two-group pre-test and post-test experimental model. Samples from two XI classes were taken randomly, with one experimental class and the other as a control class. Data were collected through questions in the form of pretest and posttest, and analysed using normality test, paired sample t-test, independent sample t-test, and N-Gain analysis. Results showed a significant improvement in learning outcomes in the experimental class compared to the control class, with a higher mean posttest score. The independent sample t-test showed significance <0.001, and the mean N-Gain of 0.4713 was classified as moderate. Thus, the use of PowerPoint multimedia was proven effective in improving students' learning outcomes.

Key words: multimedia learning, learning outcomes, Milling machine, vocational high school, PowerPoint

INTRODUCTION

Education is the process of acquiring knowledge, skills, and value, which are passed down across generation through formal instruction, training, and educational research(Mulyani & Haliza, 2021).

The rapid development of science and technology brings positive things to the world of education because the teaching and learning process is practical. Many changes that occur from time to time are caused by technology, changes that occur include the teaching process of teachers, student learning and student teaching materials that are always updated. Learning that is usually done face-to-face can now be done online from home. By using a little *software* such as Zoom, Google Meet and many more *software* that can be used (Mulyani & Haliza, 2021).

Learning media is an important aspect for students to gain new knowledge, competencies and concepts. The Fadilah et al., (2023). Learning process is not only fixated on book or blackboard media but also uses other media such as visual media, audio media and audio-visual media

Learning media refers to all equipment used by educators as a means of delivering teaching materials. The goal is that the information can be received properly and effectively by students who are learning (Pagarra et al., 2022).

Multimedia, in a sense, refers to the use of multiple media. However, over time, the term multimedia is now more often interpreted as a combination of various media in the delivery of learning through computers. After the 1980s, the definition of multimedia further evolved, as an interactive and integrated means of conveying information, which includes elements such as text, images, sound, video and animation. In the context of learning, multimedia refers to a computer-based system that combines various types of content-including text, audio, video, graphics, and animation-as well as interactive elements to support a more effective and engaging teaching and learning process (Lestari, 2013).

One of the interactive media is powerpoint. Microsoft powerpoint provides facilities in the form of slides that can help in making a presentation that is effective, professional, and also easy to use. So that it is possible for school teachers to utilize it as a learning media (Purwanti et al., 2020).

A milling machine is defined as a metal cutting machine that uses a cutting tool in the form of a multi-edged blade to cut metal. In its working system, the cutting tool (cutter) rotates on an axis, while the workpiece is attached to the machine table (ragum) which is controlled by vice or other tools, allowing the milling machine table to move up and down and back and forth (Sumbodo et al., 2008).

Learning outcomes are the result of the learning process experienced by individuals, which is reflected in internal changes that include increased knowledge, understanding, attitudes, behaviour, skills and competencies. These changes are relatively stable and have the potential to de-

velop over time. However, changes that occur naturally as a result of biological growth are not categorised as learning outcomes, as they do not involve a conscious and directed learning process (I. Lestari, 2015).

This study is based on several previous studies, such as the study conducted by Torgersen, (2019) entitled Which Tools in Multimedia Are Best for Learning Outcomes? A Study Grounded in Cognitive Load Structures, which concluded that multimedia presentations in sequence provide better learning outcomes (LO) than multi-presentations (synchronous) for all participants.

Research conducted by Diksit & garg,(2015) on Pedagogic Effectiveness of Print, Interactive Multimedia, and Online Resources: A Case Study of IGNOU This study shows that, in general, instructional content presented through interactive multimedia CD-ROMs for self-learning is more effective than printed modules and online learning.

Research conducted by Cadizal & Bamdarlipe ,(2024) on the Effectiveness of Contextualized Interactive Multimedia for Grade 8 Science Students explains that teachers are advised to utilize interactive multimedia in the teaching process to improve students' attitudes and motivation toward learning.

This study is motivated by a *research* gap with previous research based on research conducted by Suyitno (2016) in research on the development of interactive multimedia for technical measurement material in the Automotive Engineering Education program at SMK Negeri 1 Girisubo shows that the learning media design process is carried out through three main stages, namely: needs analysis, product development which includes index design, navigation, and content, and the testing stage which consists of individual testing, small group testing, and comprehensive product implementation. The results of this study concluded that the interactive multimedia products developed can be used effectively as learning media to improve students' understanding of technical measurement materials. In addition, there is a significant difference in learning outcomes between the group of students using interactive media and those using conventional media, with interactive media proving to have a more positive impact on learning achievement.

The update in this study is based on previous research, but there are differences. The research refers to the research of (Worang et al., 2021). entitled The Effect of Multimedia-Based Learning on Learning Outcomes of Interactive Multimedia Design of Vocational Students which uses experimental methods and pseudo-experimental design “Non-Equivalent Group Design” as the research design used Where there are experimental groups and control groups conducted at SMK Negeri 3 Tahuna.

This can be seen from the comparison of the average value between the control class (which uses conventional media) which is 69.78, and the experimental class (which uses interactive media) with an average value of 78.83.

The phenomenon of the gap that exists at SMK in IPT KarangPanas based on observations made, there are still many students who are below the KKM score in conventional milling machine subjects, so the need for interactive multimedia in improving student learning outcomes about milling machine parts.

METHODS

This research uses a type of quantitative research with experimental methods, with a true experimental research design using a two group pretest-posttest design whose purpose is to analyse the presence or absence of a cause-and-effect relationship by giving treatment to several experimental groups and conducting control investigations as a comparison (Zainudin & Ubabuddin, 2023).

Population is the whole subject of research, the whole object being studied, in the form of people, objects, events, and values. Population can also be understood as a general area that includes objects or subjects that are the magnitude and certain characteristics set by researchers to study and then draw conclusions (Danuri & Maisaroh, 2019).

The population of this study was the entire class Xl of Smk IPT Karangpanas and the sample of this research was Class Xl as many as 2 classes. Data collection was carried out with random sampling technique

According to Hasnunidah, (2017)states that in experimental research, researchers manipulate the treatment given to the subject.The realibility test is a tool that when used repeatedly to assess the same object will produce consitenst information (Sugiyono, 2010).

Before carrying out the research, a test was carried out for the feasibility of media and material validity with the formula:

$$CVR = \frac{ne - \frac{1}{2}N}{\frac{1}{2}N}$$

With description

CVR : Content Validity Ratio

Ne : Number of Validators who agree on Validity

N : Total number of validators

After completing the validity test, the reliability test is then carried out with the formula

The percentage agreement was calculated using the formula: (agre + disagree)) X 100%

which determines the reliability between raters.

Data collection in the form of observation before conducting research then interviews to find

out the information needed then tests, which are given twice before giving treatment is done pretest and after the treatment is given posttest conducted in control and experimental classes. and the research instrument consists of 20 multiple choice questions.

Tests carried out using Descriptive Test, normality test, paired sample t-test, independent t-test, homogeneity test and n gain. Research whether it affects student learning outcomes

Descriptive statistics are statistics that organize and analyze data to provide an organized, concise, and clear description of a phenomenon, event, or situation that contains meaning and draws conclusions (Sholikhah, 2016).

In quantitative research to provide an overview of the data that has been collected can use descriptive statistics to analyze (Martias,2021).

According to Widana & Muliana, (2020)in the book test Requirements Analysis. Proving whether the data is normally distributed is done through normality testing.

To clarify the stages of research implementation, the research flow chart is presented in Figure below. This diagram illustrates the steps starting frompreparation, pretest implementation, treatment with multimedia powerpoints learning model, to posttest implementation and data analysis.

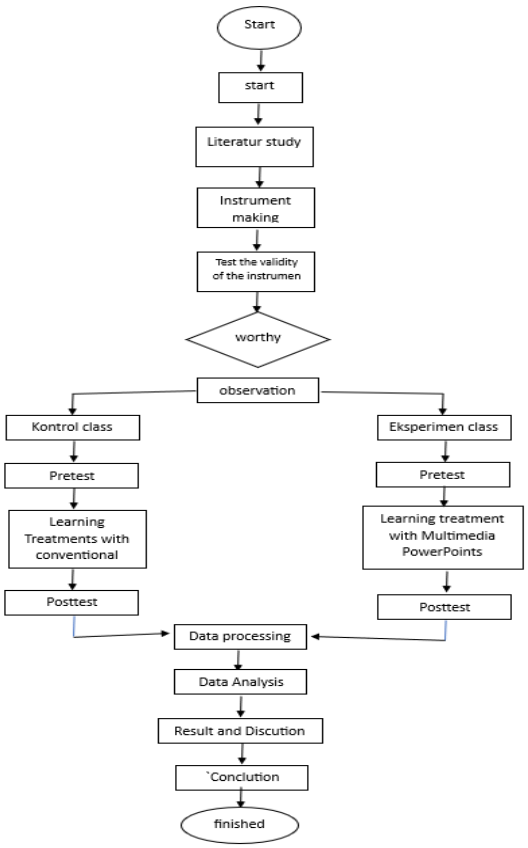

Figure 2.1 flow diagram

RESULTS AND DISCUSSION

This research was conducted to improve the learning outcomes of students of Smk IPT Karangpanas Semarang for class XI by using Powerpoint Multimedia learning media. Before doing this, first conduct research observations at school to find out the information needed Where it is found that there are still many students who are below the KKM value for the material Function of the parts of the Frais Machine.

Before conducting the retest and posttest, the media and material were tested on experts, both from lecturers and smk teachers so that the results were obtained.

CVR = $\frac{5-\frac{1}{2}6}{\frac{1}{2}6}$ = 0.97619 rounded to 0.98

And continued with reliability with the formula:

percent = $\frac{5}{5+1} X100$ =0.8333x100= 83%

This study was conducted by conducting a pretest and posttest of 20 questions.

by giving treatment to the Experiment class using powerpoint media while the control class was not given the treatment of learning as usual with the lecture method and others.

This research scheme by giving pretest questions first to measure student knowledge then students are given knowledge by means of control classes doing learning as usual and experimental classes are given treatment in the form of multimedia powerpoints to find out whether this Multimedia has an effect on improving student learning outcomes after each class has gained knowledge then students are given a posttest to measure the results of learning.

The results obtained were then processed with various tests, the first with a descriptive test with the results of the data There was an increase in the mean score from 71.25 to 84.75 after treatment in the experimental group, which indicated a positive effect of the intervention provided. The minimum and maximum values also showed an increase reflecting a higher distribution of values.

Table 3.1 Pretest class experiment values

Experiment Class	**Pretest**
Maximum Value	80
Minimum value	60
Mean	71,25
Median	70
Standard Deviation	6,463

Table 3.1 Pretest class experiment values

With the results of the post-test scores as follows

Table 3.2 Posttest class experiment values

Experiment Class	**Posttest**
Maximum Value	100
Minimum value	75
Mean	84,75

Median	85
Standard Deviation	6,584

Then continued with normality The normality test was carried out to determine whether the data in this study were normally distributed. The test was carried out using the Kolmogorov-Smirnov and Shapiro-Wilk tests. The test results are as follows

Table 3.3 Normality test

	Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Learning Outcomes function of milling machine parts	experimental pre-test	,169	20	,136	,916	20	,082
	experimental post-test	,185	20	,072	,933	20	,173
	control pretest	,184	20	,074	,912	20	,068
	control posttest	,139	20	,200*	,949	20	,351

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Because the sample used is broughtah 50, it uses the Shapiro-wilk test and the data obtained above the significance value for all data both from ks and sw is greater than 0.5. So it can be concluded that the research data is normally distributed based on the results of the normality test obtained that the research data is normally distributed so that we can use parametric (paired sample t-test and independent sample t-test test to continue the next analysis.

Table 3.4 Paired Samples Test

		Paired Differences					t	df	Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			One-Sided p	Two-Sided p
Pair 1	preexperiment - experiment	-13,50000	6,09141	1,36208	-16,35087	-10,64913	-9,911	19	<,001	<,001
Pair 2	precontrol - postcontrol	--4,00000	6,40723	1,43270	-6,99868	-1,00132	-2,792	19	,006	,012

Hypothesis testing
H0 = there is no average difference between the learning outcomes of the test and the post test, which means that there is no effect of multimedia-assisted learning to improve student learning outcomes on the function of milling machine parts.
Ha = there is an average difference between the prestes learning outcomes and the post test, which means that there is an effect of multimedia-assisted learning to improve student learning outcomes on the function of milling machine parts.

Decision-making guidelines and paired sample t-test

1. If the significance value (sig) is greater than 0.05 then h0 is accepted and ha is rejected.
2. If the significance value (sig) is smaller than 0.05 then H0 is rejected and ha is accepted.

From the sig data where 0.001 <0.05, it is concluded that there is a difference in the average value of results, student learning for the prestest and post test in the experimental class using multimedia powerpoint.

The results showed that there was a significant increase in learning outcomes in both the experimental and control groups. However, the improvement in the experimental group using PowerPoint multimedia was more significan

Table 3.5 Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Learning Outcomes	Based on Mean	1,527	1	38	,224
	Based on Median	1,253	1	38	,270
	Based on Median and with adjusted df	1,253	1	36,606	,270
	Based on trimmed mean	1,439	1	38	,238

The homogeneity test was conducted to ensure that both groups had uniform variance. The significance value of Levene's Test in all methods (mean, median, trimmed mean) is greater than 0.05. Therefore, it can be concluded that the data has a homogeneous variance and qualifies for the independent sample t-test.

From the data above in the section that the mean median and trimmed mean values are more than 0.05, it can be concluded that this data is homogeneous data.

Furthermore, an independent t-test was conducted

Table 3.6 Independent Samples Test

		t-test for Equality of Means							
				Significance				95% Confidence Interval of the Difference	
		t	df	One-Sided p	Two-Sided p	Mean Difference	Std. Error Difference	Lower	Upper
Learning Outcomes	Equal variances assumed	4,698	38	<,001	<,001	11,250	2,394	6,403	16,097
	Equal variances not assumed	4,698	35,868	<,001	<,001	11,250	2,394	6,393	16,107

The independent sample t-test was conducted to determine the difference in learning outcomes between the experimental and control groups after treatment. The test results showed a significance value of <0.001 and an average difference of 11.250. Thus, there is a significant difference between the two groups. The experimental group obtained higher learning outcomes than the control group.

Finally, analyse the NGain-Score to determine the effectiveness of the media.

Table 3.7 Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
NGain_Scor	20	,17	1,00	,4713	,20363
NGain_Percent	20	16,67	100,00	47,1250	20,36274
Valid N (listwise)	20				

Normalised N-Gain	Interpretation
0.70 ≤ g 1.00	High
0.30 ≤ g < 0.70	Medium
0.00 < g < 0.30	Low
g = 0.00	No increase
-1.00 ≤ g < 0.00	There was a decrease

N-Gain analysis was conducted to measure the effectiveness of learning in improving student learning outcomes. The N-gain average score of 0.4713 places the effectiveness of learning in the moderate category (0.30 ≤ g < 0.70). This shows that PowerPoint multimedia-assisted learning provides an increase in learning outcomes that are at a moderate level of effectiveness.

Disscution

Based on the results of quantitative data analysis, multimedia-assisted learning using PowerPoint was proven to significantly improve students' cognitive achievements. Initial descriptive analysis showed that the average score of the experimental class increased from 71.25 ± 6.463 on the pre-test to 84.75 on the post-test, reflecting a substantial improvement in performance after the intervention.

Before inferential testing, parametric assumptions were met. The Shapiro–Wilk test yielded $p > 0.05$ for all groups, confirming the normal distribution of scores; while Levene's Test showed $p = 0.224–0.270$, indicating homogenity of variance across groups.

The paired-samples t-test in the experimental class confirmed a significant increase between the pre- and post-tests ($t = -9.911$; $p < 0.001$), while the increase in the control class was relatively smaller ($t = -2.792$; $p = 0.012$). Furthermore, the independent-samples t-test-showed a post-test mean difference of 11.25 points with $p < 0.001$, indicating

the dominance of multimedia effectiveness over conventional methods.

To evaluate the magnitude of instructional gains, the *normalized gain* index was calculated and yielded a mean value of 0.4713 (moderate category: $0.30 \leq g < 0.70$). These findings confirm that PowerPoint multimedia provides moderate yet consistent improvements in learning.

In summary, the statistical evidence concludes that multimedia integration not only meets the prerequisites for parametric testing but also results in pedagogically and statistically significant improvements in learning outcomes. These results support the use of interactive PowerPoint multimedia as an effective instructional strategy for technical subjects in vocational high schools.

CONCLUSIONS

Based of the findings, the experimental group showed a significantly greater improvement in learning outcomes compared to the control group.

There is a significant difference between the learning outcomes of the experimental and control groups after which shows that the experimental class is more significantly and the use of PowerPoint multimedia significantly improved students' unsderstanding of the topic, with N-Gain scores supporting its moderate effevtiveness.

ACKNOWLEDGMENTS

Many thanks to the principal and all elemen of SMK IPT Karangpanas for accepting and assisting with this research.

REFERENCE

Cadizal, R. G., & Bandarlipe, M. C. (2024). Effectiveness of a Contextualized Interactive Multimedia for Grade 8 Science Students. In *International Research and Innovation Journal on Education, Engineering and Agriculture* (Vol. 1, Issue 1).

Danuri, dan Maisaroh, S. (2019). Metodologi Penelitian Pendidikan. Cetakan Pertama. Yogyakarta: Penerbit Samudra Biru.

Diksit, J., Garg, S., & Panda, S. (2013). Pedagogic Effectiveness of Print, Interactive Multimedia, and Online Resources: A Case Study of IGNOU. *International Journal*, *6*(2). www.e-iji.net

Fadilah, A., Nurzakiyah, K. R., Kanya, N. A., Hidayat, S. P., & Setiawan, U. (2023). Pengertian Media, Tujuan, Fungsi, Manfaat dan Urgensi Media Pembelajaran. *Journal of Student Research (JSR)*, *1*(2), 01–17.

Hasnunidah, N. (2017). Metode Penelitian Pendidikan. Medan: Media Akademi.

Lestari, I. (2015). PENGARUH WAKTU BELAJAR DAN MINAT BELAJAR TERHADAP HASIL BELAJAR MATEMATIKA. *Jurnal Formatif*, *3*, 115–125.

Lestari, S. A. (2013). PEMBELAJARAN MULTIMEDIA. *Jurnal Al-Ta'dib*, *6*(2), 84–98.

Martias, L. D. (2021). Statistika Deskriptif Sebagai Kumpulan Informasi. Fihris: Jurnal Ilmu Perpustakaan Dan Informasi, 16(1), 40.

Mulyani, F., & Haliza, N. (2021). Analisis Perkembangan Ilmu Pengetahuan dan Teknologi (Iptek) Dalam Pendidikan. *JURNAL PENDIDIKAN Dan KONSELING*, *3*.

Pagarra, H., Syawaluddin, A., Krismanto, W., & Sayidiman. (2022). *MEDIA PEMBELAJARAN* (1st ed.). Badan Penerbit UNM.

Purwanti, L., Widyaningrum, R., & Melinda, S. A. (2020). Analisis Penggunaan Media Power Point dalam Pembelajaran Jarak Jauh pada Materi Animalia Kelas VIII. *Journal of Biology Education*, *3*(2), 157. http://journal.iainkudus.ac.id/index.php/jbe

Sholikhah, A. (2016). Statistik Deskriptif Dalam Penelitian Kualitatif. Komunikasi Islam, 10(2) 1–21.

Sugiyono. (2010). Metode penelitian pendidikan (pendekatan kuantitatif, kualitatif dan R & D. Alfabeta.

Sumbodo, W., Pujiono, S., Pambudi, A., Komariyanto, Anis, S., & Widayat, W. (2008). *TEKNIK PRODUKSI MESIN INDUSTRI*.

Suyitno. (2016). PENGEMBANGAN MULTIMEDIA INTERAKTIF PENGUKURAN TEKNIK UNTUK MENINGKATKAN HASIL BELAJAR SISWA SMK. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *23*(1).

Torgersen, G. E., & Boe, O. (2021). Which Tools in Multimedia Are Best for Learning Outcomes? A Study Grounded in Cognitive Load Structures. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.545335

Widana, I. W., & Muliana, P. L. (2020). *UJI PERSYARATAN ANALISIS*. Klik Media.

Worang, N. A., Mintjelungan, M. M., & Takaredase, A. (2021). PENGARUH PEMBELAJARAN BERBASIS MULTIMEDIA TERHADAP HASIL BELAJAR DESAIN MULTIMEDIA INTERAKTIF SISWA SMK. *Jurnal Pendidikan Teknologi Informasi Dan Komunikasi*, *1*(3), 241–250.

Zainudin, & Ubabuddin. (2023). RANAH KOGNITIF, AFEKTIF DAN PSIKOMOTORIK SEBAGAI OBJEK EVALUASI HASIL BELAJAR PESERTA DIDIK. *ILJ: Islamic Learning Journal*, *1*(3), 915–931.