Transforming the Learning of Lathe Machine Part Functions: Improving Learning Outcomes through Interactive Multimedia

Muhammad Aden Ilhami*, Muhammad Khumaedi, Heri Yudiono, Sudiyono

Mechanical Engineering Education Study Program, Faculty of Engineering, Universitas Negeri Semarang, Semarang, Indonesia

*Email: adenilhami2002@gmail.com

Abstract: *This study aims to test the feasibility, effectiveness of learning media and improvement of cognitive learning outcomes knowledge of the function of lathe parts in the learning process with interactive multimedia. Learning related to the function of lathe parts is a challenge for Muhammadiyah Vocational School students because of the complexity of the material and the limitations of teaching methods that apply the use of technology. Based on the results of the interactive multimedia trial, the student response showed an average of 116.52, included in the "Very Appropriate" category. The results of data analysis showed that the use of interactive multimedia was effectively used in the learning process with an effectiveness test score of 84.64%. Based on the calculation results of the posttest t test and the N-Gain t test, interactive multimedia can improve learning outcomes, with the posttest t test value $t_{count} > t_{table}$, namely 3.177 > 1.673 and the N-gain t test value t_{count} 4.328 > t_{table} 1.673. The magnitude of the increase in learning outcomes of experimental class students got an N-Gain value of 0.45 which was included in the medium category, while the increase in learning outcomes of control class students got an N-Gain value of 0.27 which was included in the low category. concluded that interactive multimedia is feasible and effective to be used in the learning process and can improve student learning outcomes. The application of interactive multimedia-assisted learning allows students to gain a deeper understanding of the parts of the bubu machine and experience increased motivation and involvement in the learning process. This implication opens up opportunities for the development of innovative and technology-based curriculum.*

Keywords: *Functions of Lathe Parts; Interactive Multimedia; Learning Outcomes*

Submitted: April 2024 | Reviewed: January 2025 | Accepted: January 2025 | Published: October 2026

1. INTRODUCTION

Advances in science and technology are developing very rapidly, which requires educators to be able to develop innovations in classroom management so that the learning process runs optimally and produces maximum results (Salim and Yunus, 2021: 51). Educators are professionals whose duties are to plan and implement the learning process, assess learning outcomes, provide guidance and training, and conduct research and community service, especially educators in higher education. One of the obligations of educators is to create an educational atmosphere that is meaningful, enjoyable, creative, dynamic, and dialogical (UUSPN No. 20 of 2003).

Vocational schools are part of Indonesia's national education system and play a strategic role in producing a national workforce that is competent, globally competitive, and supportive of sustainable development. Vocational education significantly influences sustainable development. Therefore, the learning content must meet workforce requirements (Yudiono, et al. 2018: 18). As part of vocational education, vocational schools are expected to build innovative, creative, competitive, and sustainable character, which requires socio-cultural and structural support. Vocational education has its own characteristics: the selection of learning content must always keep pace with technological developments, the needs of society, the needs of individuals, and the needs of the workplace (Yudiono, 2017: 259). According to Huda, et al. (2023: 23), vocational education is an educational institution that focuses on educating students to attain a level of expertise recognized in the world of work. Technological developments have changed learning patterns in education, especially in the use of learning media such as multimedia.

Learning is a process that combines two aspects: studying, which focuses on what students must do, and teaching, which is oriented toward what educators must do as providers of material. Humans have an obligation to learn in many things. For some students, learning is difficult because not all students are able to understand the material delivered (Cahyani and Wibawa 2019: 10). Improving the quality of learning is important and must be considered in the learning process in order to improve the quality of education. Improved quality of education will be achieved when the learning process in the classroom is effective and serves to build knowledge, attitudes, and skills. Educators must be creative and innovative in the learning process so that students find it easier to understand the material explained and are enthusiastic in participating in the learning process (Zaki and Yusri 2020: 811).

Nababan, et al. (2019: 169) explain that in implementing learning, educators must use complete media that meet the needs and touch all elements. This is in line with the principle that education must be organized in an interactive, inspiring, enjoyable, and challenging manner, motivating students' active participation and providing room for initiative, creativity, and independence in accordance with students' talents, interests, and physical and psychological development.

Learning media are conveyors of messages or communication tools for students; messages and student responses can be processed through the media, so media are sometimes called interactive media (Norhayatun, et al., 2019: 3). The use of learning media during the learning adaptation stage greatly supports the effectiveness of the learning process and the delivery of information and learning material. In addition to increasing students' motivation and interest, learning media can also help improve students' understanding, present data in an attractive and acceptable way, make data easier to interpret, and condense information (Sapriyah 2019: 473). Multimedia is a combination and collaboration of text, graphics, audio, animation, and video. Multimedia bridges students' mastery of basic skills through drill and practice (Rajendra and Sudana: 2018: 2). According to Wiana (2018: 3), interactive multimedia is multimedia equipped with control devices that can be operated by the user, so that users can choose what they want for the next process. This study offers an innovative approach through the use of interactive multimedia to improve students' understanding of the functions of lathe machine parts, so that the results can provide a solution to the challenges of less effective conventional learning.

Based on observations and interviews conducted by the researcher with the teacher of the lathe machining subject at SMK Muhammadiyah 1 Kota Tegal, it was found that learning in the lathe machining subject, especially the material on the functions of lathe machine parts, was still carried out using lecture and discussion methods. The learning media used by the teacher still consisted of writing the material on the board based on a printed book (handout). Many students

obtained daily test scores below the Minimum Mastery Criterion (KKM). Based on the data obtained, 42.4% of students in class XI Mechanical Engineering 1 met the KKM while 57.6% did not, and 40.7% of students in Mechanical Engineering 2 met the KKM while 59.3% did not.

The study by Cahyani and Wibawa (2019: 9) explains that learning media have developed and are used as teaching tools so that students can more easily understand the content explained by the teacher. Most students find it difficult to understand the material if it is only explained through lectures, especially if the material contains difficult calculations in the form of numbers and formulas. Dolo, et al. (2022: 488) explain that a learning process using interactive multimedia is very effective in improving students' understanding. Suwarti, et al. (2019: 231) also explain that the use of interactive multimedia produced an overall average in the "good" category and is feasible for use as learning media. Interactive multimedia is effective and can improve students' learning outcomes (Septiana, 2022: 262). This shows the importance of using appropriate interactive multimedia so that students can improve their understanding after the learning process. The learning process on the functions of lathe machine parts in class XI Mechanical Engineering at SMK Muhammadiyah 1 Kota Tegal still uses the lecture method, which leads to low learning motivation and low learning outcomes.

Based on the problems above, a study was conducted on the learning media used for the material on the functions of lathe machine parts by applying interactive multimedia in the learning process. The interactive multimedia was developed using Microsoft PowerPoint and converted to PowerPoint Show format. Microsoft PowerPoint was chosen because it is a very common medium that is widely used in learning, is very easy to understand and apply, and can also serve as a medium for independent learning.

2. RESEARCH METHOD

This study used a quantitative approach with an experimental method. Sofiyana, et al. (2022: 37) explain that quantitative research uses numerical data and focuses on objective measurement results using statistical analysis. According to Harahap (2021: 21), experimental research is used to examine cause-and-effect relationships between independent variables and dependent variables, in which the independent variable is controlled to determine its effect on the dependent variable. This study used a True Experimental Design with a two-group pretest-posttest design, as shown in Table 1:

Table 1. Two-group pretest-posttest design

Class	*Pretest*	Treatment	*Posttest*
Experimental	O1	X1	O2
Control	O1	X2	O2

The difference in treatment in this study was that learning in the experimental class was carried out using interactive multimedia, while learning in the control class was carried out using the lecture method without interactive multimedia. The subjects of this study were 4 media experts, 4 material experts, and students of class XI Mechanical Engineering 1 as the control class and XI Mechanical Engineering 2 as the experimental class, each consisting of 28 students. Data were collected through observation of the research site, interviews with the lathe machining teacher, document study of students' daily test scores to determine the condition of learning outcomes, questionnaires to determine the feasibility of the interactive multimedia developed, and tests to determine the improvement in students' learning outcomes after learning assisted by interactive multimedia. Data analysis consisted of a feasibility test of the interactive multimedia using CVR and CVI, an effectiveness test, descriptive analysis, a normality test, a homogeneity test, a pretest-posttest t-test, and an N-Gain test.

3. RESULTS AND DISCUSSION

The interactive multimedia was validated and declared feasible by 8 experts, consisting of two staff members of Balai Industri Kreatif Digital Semarang, one mechanical engineering lecturer at Universitas Negeri Semarang, one mechanical engineering teacher at SMK Dinamika Kota Tegal, and material experts consisting of four mechanical engineering teachers at SMK Muhammadiyah 1 Kota Tegal. The interactive multimedia was then tried out with students using a questionnaire to measure the suitability of the product from the students' perspective. The results of the product trial of the interactive multimedia are shown in the following table.

Table 2. Product Trial Results

Score	Category	Score Range	Frequency	%
5	Very Appropriate	> 113.4	17	70%
4	Appropriate	91.8 – 113.4	8	28%
3	Fairly Appropriate	70.2 – 91.8	3	2%
2	Not Appropriate	48.6 – 70.2	0%	0%
1	Very Inappropriate	< 48.6	0%	0%

The results of the interactive multimedia trial in Table 2 show that 70% of students considered the interactive multimedia "Very Appropriate", 28% considered it "Appropriate", and 2% considered it "Fairly Appropriate". Overall, the students' responses showed an average of 116.52, which is in the "Very Appropriate" category.

Effectiveness Test

The effectiveness test was carried out to determine whether the interactive multimedia is effective for use in the learning process. The effectiveness test was conducted by giving a questionnaire to the students. The results of the effectiveness test are as follows:

Table 3. Effectiveness Test Results of the Interactive Multimedia

Number of students	Total Score	Ideal Total Score	Percentage
28	237	280	84.64%
Effectiveness Criterion			**Effective**

Based on the effectiveness test in Table 3, the effectiveness percentage reached 84.64%, which is in the effective category. It can therefore be concluded that learning using interactive multimedia is effective.

Pretest Data Test

The pretest data test was carried out to determine the initial ability of students in the experimental class and the control class on the material on the functions of lathe machine parts. The pretest results were obtained by administering multiple-choice questions, and the results were then analyzed using the Independent Sample t-Test with the help of SPSS. The

results of the Independent Sample t-Test on the pretest results of the experimental and control classes are as follows:

Table 4. Pretest t-Test Results

		Independent Sample t Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pretest	Equal variances assumed	.603	.441	.275	54	.785	1.143	4.163	-7.203	9.489
	Equal variances not assumed			.275	53.077	.785	1.143	4.163	-7.207	9.492

Based on the pretest results using the Independent Sample t-Test in Table 4, the t-count value was 0.275 with a significance value of 0.785 > 0.05; therefore, Ho was accepted and Ha was rejected. It can be concluded that there was no significant difference in students' initial knowledge of the functions of lathe machine parts between the experimental class and the control class. Thus, the initial abilities of the students in the experimental and control classes were the same.

Normality Test

The normality test was carried out to determine whether the data obtained were normally distributed. The normality test used the Kolmogorov-Smirnov method with the help of SPSS. The results of the normality test of the posttest in the experimental and control classes are as follows:

Table 5. Normality Test Results

	Class	Kolmogorov-Smirnov		
		Statistic	Df	Sig.
Posttest	Experimental	.133	28	.200
	Control	.140	28	.172

Based on the normality test results in Table 5, the experimental class obtained a statistic value of 0.133 with a significance value of 0.200, while the control class obtained a statistic value of 0.140 with a significance value of 0.172. Data are considered normal if the significance value is greater than 0.05. Based on the calculation above, both classes had significance values greater than 0.05, so it can be concluded that the data were normally distributed.

Homogeneity Test

The homogeneity test was carried out to determine whether the two groups of data had similar variances. The homogeneity test used Levene's test with the help of SPSS. The results of the homogeneity test of the posttest in the experimental and control classes are as follows:

Table 6. Homogeneity Test

		Test of Homogeneity of Variance			
		Levene Statistic	df1	df2	Sig.
Posttest	Based on Mean	2.060	1	54	.157
	Based on Median	1.613	1	54	.210
	Based on Median and with adjusted df	1.613	1	49.138	.210
	Based on trimmed mean	1.980	1	54	.165

Based on the homogeneity test in Table 6, the Based on Mean result shows a Levene Statistic of 2.060 with a significance value of 0.157, which is greater than 0.05 (0.157 > 0.05). It can be concluded that the data in the experimental and control classes had similar, or homogeneous, variances.

Descriptive Analysis

Data description is a description or overview of the data that have been collected. The data description was processed with the help of SPSS. The results of the data description for the experimental and control classes are as follows:

Table 7. Descriptive Analysis Results

	N	Minimum Score	Maximum Score	Mean Score
Experimental Pretest	28	32	92	60.57
Experimental Posttest	28	60	96	79.57
Control Pretest	28	36	88	59.43
Control Posttest	28	44	92	70.57

Based on the descriptive analysis in Table 7, the experimental and control classes each consisted of 28 students. The mean pretest and posttest scores of the experimental class were 60.57 and 79.57, a difference of 19. The mean pretest and posttest scores of the control class were 59.43 and 70.57, a difference of 11.14.

Posttest t-Test

The posttest t-test was carried out to determine whether the learning outcomes of students in the experimental and control classes differed significantly after the treatment. The posttest t-test used the Independent Sample t-Test with the help of SPSS. The results of the Independent Sample t-Test on the posttest results of the experimental and control classes are as follows:

Table 8. Posttest t-Test Results

		Independent Sample t Test			
		Levene's Test for	t-test for Equality of Means		

		Equality of Variances								
		F	Sig.	T	Df	Sig. (2tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Posttest	Equal variances assumed	2.060	.157	3.177	54	.002	9.000	2.833	3.321	14.679
	Equal variances not assumed			3.177	50.371	.003	9.000	2.833	3.312	14.688

Based on the posttest t-test in Table 8, the t-count value was 3.177. The t-table value with df = (n1+n2-2) = (28+28-2 = 54) is 1.673. Since t-count 3.177 > t-table 1.673, Ho was rejected and Ha was accepted. It can be concluded that there was a significant improvement in students' learning outcomes after learning with interactive multimedia on the material on the functions of lathe machine parts.

N-Gain Test

The N-Gain test was carried out to determine the magnitude of the improvement in students' learning outcomes after receiving the treatment. The results of the N-Gain test for the experimental and control classes are as follows:

Table 9. N-Gain t-Test Results

		Independent Sample t Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
n-gain	Equal variances assumed	1.989	.164	4.328	54	.000	.17861	.04127	.09588	.26135
	Equal variances not assumed			4.328	44.355	.000	.17861	.04127	.09547	.26176

Based on the N-Gain t-test in Table 9, the t-count value was 4.328. The t-table value with df = (n1+n2-2) = (28+28-2 = 54) is 1.673. Since t-count 4.328 > t-table 1.673, Ho was rejected and Ha was accepted. It can be concluded that there was a significant improvement in students' learning outcomes after learning with interactive multimedia on the material on the functions of lathe machine parts.

Table 10. Mean N-Gain Scores

Class	Mean Pretest Score	Mean Posttest Score	N-Gain Score	Description
Experimental	60.57	79.57	0.45	Medium
Control	59.43	70.57	0.27	Low

Based on the N-Gain test in Table 10, the N-Gain score of the experimental class using interactive multimedia was 0.45, which is in the medium category, while the N-Gain score of the control class was 0.27, which is in the low category. It can be concluded that the learning outcomes of the experimental class using interactive multimedia were better than those of the control class that did not use interactive multimedia.

Interactive multimedia gives educators the opportunity to develop learning techniques and achieve maximum results. To achieve learning objectives, educators must understand learning techniques that are useful in the teaching and learning process. This is in line with Yudiono, et al. (2022: 218), who state that broadening teachers' understanding of learning models can support the development of creativity, strengthen students' reasoning, and improve students' reasoning and analytical abilities in the learning process. Using multimedia in the learning process has become an alternative in line with the times, and it is expected that interactive multimedia can make it easier for students to understand. This study used interactive multimedia for the material on the functions of lathe machine parts. The experimental class was taught the material using the prepared interactive multimedia, while the control class was taught using the conventional media usually used by the teacher without interactive multimedia. This treatment was carried out to determine whether there was a significant difference in the mean learning outcomes of students in the experimental and control classes.

The feasibility of the interactive multimedia was tested by eight experts using a media feasibility questionnaire. Media experts and material experts assessed and determined whether the multimedia was feasible for use in the study. The experts in this study consisted of four media experts and four material experts. Based on the feasibility test by the eight experts, the interactive multimedia obtained a validity value of 0.89 and a reliability value of 94%. Thus, the interactive multimedia met the feasibility criteria and could be used in the study. This is in line with Munir, et al. (2018: 8), who state that according to the assessment of media experts and material experts, interactive multimedia obtained a score of 84.36%, which means that the multimedia is feasible for use in research.

Based on the effectiveness test conducted by giving questionnaires to students in the experimental class as users of the multimedia, the effectiveness of the interactive multimedia was 84.64%, placing it in the very effective category. It can be concluded that interactive multimedia attracts more attention from students, makes them enthusiastic about participating in learning, and makes it easier for them to understand the material. This is in line with Cabaluna (2022: 23), who states that learning using interactive multimedia is more effective than traditional learning and that students also understand learning material more easily using interactive multimedia.

Furthermore, the analysis of the difference in mean posttest scores using the Independent Sample t-Test produced a t-count of 3.177 and a t-table value of 1.673. Since t-count is greater than t-table (3.177 > 1.673), Ha was accepted and Ho was rejected. It can be concluded that the posttest scores of the experimental and control classes differed significantly, with the experimental class obtaining better posttest results than the control class. This is also supported by the descriptive analysis, which shows a higher increase in mean learning outcomes in the experimental class,

with a mean posttest score of 79.57 compared with 70.57 in the control class. The mean posttest results show that the use of interactive multimedia has been proven to improve students' learning outcomes. This is in line with Yudiono, et al. (2019: 153), who state that improving students' learning outcomes requires the application of learning models that match the learning experiences expected by students.

The analysis of the difference in N-Gain using the Independent Sample t-Test produced a t-count of 4.328 and a t-table value of 1.673. Since t-count is greater than t-table (4.328 > 1.673), Ha was accepted and Ho was rejected. It can be concluded that there is a difference in N-Gain between the experimental and control classes, with the experimental class showing an improvement after learning with interactive multimedia. Furthermore, the N-Gain test shows that the improvement in learning

outcomes differed between the experimental and control classes. The N-Gain of the experimental class was 0.45, which is in the medium criterion, while the N-Gain of the control class was 0.27, which is in the low criterion.

This difference in improvement can occur because the experimental and control classes received different treatments. The experimental class was taught using interactive multimedia, while the control class was taught using the usual learning approach of the teacher without interactive multimedia. The improvement in the medium category in the experimental class was due to students' limited understanding of the material on the spindle speed control lever. According to Arnawa (2021: 77), efforts to understand the material on the spindle speed control lever can include giving students examples such as tables of cutting speed and machine rotation, as well as providing more effective and intensive assistance in learning. Using examples of machine rotation speed tables also makes it easier for students to understand the material on the spindle speed control lever.

The results of this study are in line with the study by Cahyani and Wibawa (2019: 9), which explains that learning media have developed and are used as teaching tools so that students can more easily understand the content explained by the teacher. Most students find it difficult to understand the material if it is only explained through lectures, especially if the material contains difficult calculations in the form of numbers and formulas. Dolo, et al. (2022: 488) explain that a learning process using interactive multimedia is very effective in improving students' understanding. Suwarti, et al. (2019: 231) also explain that the use of interactive multimedia produced an overall average in the "good" category and is feasible for use as learning media. Interactive multimedia is effective and can improve students' learning outcomes (Septiana, 2022: 262).

The use of interactive multimedia in learning the functions of lathe machine parts is a new learning innovation in class XII Mechanical Engineering at SMK Muhammadiyah 1 Kota Tegal. It needs to be developed further so that learning can have an even better impact. The use of interactive multimedia in this study was proven to improve students' learning outcomes because of increased learning motivation after its application. However, inadequate facilities and infrastructure meant that the interactive multimedia in this study could not be used routinely in every class.

4. CONCLUSION AND RECOMMENDATION

The feasibility test of the interactive multimedia by eight experts shows that the interactive multimedia is feasible for learning. The interactive multimedia on the functions of lathe machine parts is effective for use in the learning process and has been proven to improve learning outcomes, with an improvement of 0.45 in the experimental class, which is in the medium category, and 0.27 in the control class, which is in the low category.

Educators should increase the intensity of using interactive multimedia so that students are more motivated to participate in learning and the learning process becomes more effective. Students should improve their focus and activeness in the learning process so that learning outcomes using interactive multimedia on the functions of lathe machine parts can increase. The results of this study can serve as a reference for further research related to interactive multimedia as an effort to improve students' learning outcomes.

5. REFERENCES

Arnawa, K. I. (2021). Penerapan Model Pembelajaran Berbasis Masalah Dengan Metode Tutor Sebaya untuk Meningkatkan Hasil Belajar Siswa. *Wahana Matematika dan Sains: Jurnal Matematika, Sains, dan Pembelajarannya, 15*(1), 69-80.

Anggiani, L., Rika, H., Nengsi, N., Dian, D., & Apriana, M. (2023). Penerapan Multimedia Interaktif Untuk Meningkatkan Hasil Belajar Siswa Pada Materi Pemrograman. *Jurnal Penelitian Teknologi Informasi dan Sains* , 1 (2), 69-79.

Cabaluna, JC. (2022). *Effectiveness Of Interactive Multimedia Courseware In Teaching Care Management*. *European Journal of Social Sciences Studies*, *7*(3), 9-27.

Cahyani, D. D. (2019). Media Pembelajaran Interaktif Untuk Meningkatkan Hasil Belajar Peserta didik Pada Mata Pelajaran Sistem Komputer Kelas X Multimedia Di Smkn 1 Driyorejo. *IT-Edu*, *04*.

Dolo, F. X., Kua, M. ., & Djawaria, P. Y. (2022). Meningkatkan Pemahaman Konsep Peserta didik dengan Multimedia Interaktif pada Materi Pemantulan Cahaya. *Jurnal Pendidikan Tambusai*, *6*(1), 484–489.

Harahap, K. T., P, I. M. I., Issabella, M. C., Hasibuan, S., Yusriani, Hasan, M., Musyaffa, A. ., Surur, M., & Ariawan, S. (2021). Metodologi penelitian pendidikan. *Tahta Media Group*.

Huda, Y., Tasrif, E., Sari, R. E., dan Costa, R. R. K. (2023). *Literature Review*: Penggunaan Media *Augmented Reality* dalam Pendidikan Kejuruan. *JTEV (Jurnal Teknik Elektro dan Vokasional), 9(*1), 27-33.

Made Rajendra, I., & Made Sudana, I. (2018). *The Influence of Interactive Multimedia Technology to Enhance Achievement Students on Practice Skills in Mechanical Technology*. *Journal of Physics: Conference Series, 953*(1).

Manurung, P. (2020). Multimedia Interaktif Sebagai Media Pembelajaran Pada Masa Pandemi *Covid* 19. 1(14), 1-12.

Munir, Sutarno, H., & Aisyah, N. S. (2018). *The Development of Interactive Multimedia Based On Auditory Intellectually, Repetition Algorithm Learning To Increase Learning Outcome. Journal of Physics, 1013*(1), 012102.

Norhayatun, Qahfi, M., & Mutho Alimah, T. (2019). *Level of Information Technology Power of Ability to Make Learning Media PowerPoint Teacher*. *Journal of Physics*, 1-8.

Rahmat, S. T. (2015). Pemanfaatan multimedia interaktif berbasis komputer dalam pembelajaran. Jurnal Pendidikan dan Kebudayaan Missio, *7*(2), 196-208.

Salim, N. (2021). Pengembangan Media Pembelajaran Interaktif Berbasis Android Pada Mata Pelajaran Teknik Pemesinan Bubut di SMK Negeri 2 Surabaya. *Jptm*, *11*(1), 51–56.

Sapriyah. (2019). Media Pembelajaran Dalam Proses Belajar Mengajar. *2*(1), 470–477.

Septiana, K. D., Yulinati, D., & Herpratiwi, H. (2022). Peran Multimedia Interaktif Dalam Pembelajaran Matematika Terhadap Hasil Belajar Peserta Didik Kelas VIII di SMP Negeri 3 Mesuji. *JEMS: Jurnal EDUKASI Matematika Dan Sains, 10*(2), 254-264.

Sofiyana, S.M., Sukhori, Novita, A., Munthe, B., Lumastri, Ajeng W Roadhatul, Jannah Sutresna, J., Tedy, S., Eunike, A. L., Juli, A. B. S., Achmad, R. S., Imarotus, S., Nikma, F., & Herman. (2022). Metodologi Penelitian Pendidikan. Sumatera Barat. GET Press.

Suwarti, S., Restu, R., & Hidayat, H. (2019). *Interactive Multimedia Development in Social Sciences Subject of Disaster Material at Grade IV SDN. (Public Elementary School)*. *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal, 2*(1), 216-232.

Wiana, W. (2018). Interactive Multimedia-Based Animation: A Study of Effectiveness on Fashion Design Technology Learning. *Journal of Physics: Conference Series, 953*(1).

Yudiono, H. (2017). *The Alignment of Productive Competence on Machinery Between Vocational Education Institutions and Industry. World Transactions on Engineering and Technology Education*, *15*(3), 256–259.

Yudiono, H., Soesanto, S., & Haryono, H. (2018). *An Industrial Competency-Based Curriculum Alignment Model. World Transactions on Engineering and Technology Education*, *16*(1), 18–22.

Yudiono, H., Sumbodo, W., Salim, S., & Setiadi, R. (2019*). Improving the Milling Machine Competency Learning Outcomes Through Industrial Project-Based Learning for Vocational School Students. Jurnal Pendidikan Vokasi*, *9*(2), 151-160.

Yudiono, H., Asri, S., Widodo, A. P., Firdus, F. F., & Lailasari, A. N. (2022). *Improving The 21st Century Learning Skills of A Vocational Teacher Candidate Through An Industrial Project Approach. World Transactions on Engineering and Technology Education*, *20*(3), 214–219.

Zaki, A., & Yusri, D. (2020). Penggunaan Media Pembelajaran Untuk Meningkatkan Prestasi Belajar Peserta didik Pada Mata Pelajaran PKN di SMA Swasta Darussa'adah Kec. Pangkalan Susu. *Al-Ikhtibar: Jurnal Ilmu Pendidikan,* 7(2), 809-820.

How to cite: Ilhami, M. A., Khumaedi, M., Yudiono, H., & Sudiyono. (2026). Transforming the learning of lathe machine part functions: Improving learning outcomes through interactive multimedia. *Teknodika, 24*(2), 138-148. https://doi.org/10.20961/teknodika.v24i2.85973