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

DEVELOPMENT OF MOTORCYCLE TUNE UP TUTORIAL VIDEO MEDIA FOR STUDENTS OF MOTORCYCLE TECHNIQUE AND BUSINESS EXPERTISE COMPETENCY AT VOCATIONAL HIGH SCHOOL

Budiyanto[1], Bayu Ariwibowo[2], Sena Mahendra[2], Nurul Burhan[1].

[1]Distance Education Vocational Education in Mechanical Engineering, Faculty of Science and Technology, Ivet University, Semarang, Central Java, Indonesia.
[2]Vocational Education in Mechanical Engineering, Faculty of Science and Technology, Ivet University, Semarang, Central Java, Indonesia.
Email: budiyanto189108@mail.com

Abstract

This study aims to develop learning media in the form of a video tutorial on motorcycle tune-up practices for students of Motorcycle Engineering and Business Expertise at SMK. The method used is research and development (R&D) by adapting the Borg & Gall model. Data collection was carried out through observation, interviews, expert validation questionnaires, and student response questionnaires. The results of the study showed that the video tutorial media developed obtained the category of "feasible" to "very feasible". As many as 90% of students stated that video visualization helped their understanding, 80% stated that the video explanation was easy to understand, 85% stated that it was comfortable to access and operate the video, and 75% of students stated that the video was effective in improving understanding and skills. Video Tutorial Media Proven to be Very Effective in Improving Student Learning Outcomes, an average increase of 25.70 to 26.35 points.

Key words: *video tutorial, motorcycle tune up, learning media, practical skills, vocational school*.

INTRODUCTION

High-quality human resources (HR) are an important element in supporting the advancement of modern science and technology. Achieving national development goals is highly dependent on improving the quality of HR, one of which can be achieved through education. Both formal education in schools and non-formal education are part of the government's strategy in creating a competent workforce that is ready to compete in the world of work (Direktorat Jenderal Pendidikan Vokasi, 2021). In this case, formal education, especially in schools, plays a crucial role in shaping and developing individual knowledge, intelligence, and skills (Suyanto, 2017). One of the formal educational institutions that has a strategic role is Vocational High Schools.

Vocational schools make a significant contribution to supporting the national development agenda with the main objective of producing productive, skilled, and independent graduates to meet the needs of the workforce (Kementerian Pendidikan dan Kebudayaan, 2020). Data from the Central Statistics Agency (BPS, 2023) shows that around 60% of vocational school graduates are directly absorbed in the workforce, but there are still challenges in the readiness of technical skills according to industry needs. One approach to achieving this goal is through improving student skills, which are an indicator of a person's ability to carry out work tasks effectively (Paryati & Ma'ruf, 2022).

To produce graduates with high skills, learning is needed that is not only oriented towards theory, but also emphasizes mastery of practices according to the needs of the industrial world. These skills must be developed through a contextual learning process and based on real experiences, so that students are able to apply the knowledge they have in real work situations. In this context, skills training such as Motorcycle Tune Up practices is an important aspect that needs serious attention in the learning process in vocational schools (Purnomo et al., 2023).

The results of observations conducted on class X students of the Motorcycle Engineering and Business expertise program at SMK Muhammadiyah Bawang, Batang Regency, on November 16, 2024, showed problems related to low skills in Motorcycle Tune Up practices. Skill assessment data showed that most students were not able to complete practical tasks optimally. This condition indicates the need for further analysis of the factors that influence the quality of Motorcycle Tune Up practices (Slameto, 2010).

Various factors that influence these skills can be categorized into two, namely internal and external factors (Hamalik, 2008). Internal factors include physical conditions (eg health and physical condition) and psychological aspects such as intelligence level, attitude, talent, interest, discipline, independence in learning, and motivation. Meanwhile, external factors include the influence of teachers, peers, parents, community

environment, physical condition of the school (building and location), residence, learning methods, curriculum, and learning facilities.

In the learning process at SMK Muhammadiyah Bawang, it was found that there were construction activities of new facilities adjacent to the Motorcycle Engineering and Business laboratory which also affected students' concentration when doing practice (Dimyati & Mudjiono, 2013). The noise caused caused focus disturbances, which resulted in decreased effectiveness of practical skills (Wibowo & Prabowo, 2021). In addition, the condition of the workshop space which was not neatly arranged and the limited facilities for practice, such as the number of motorbikes which was only six units, caused students to have to work in groups, which in turn reduced the intensity of individual practice.

Student discipline issues are also a concern, marked by late entry after breaks and a tendency to leave the practice for other activities such as being in the canteen. On the other hand, the role of teachers in assisting practical activities is considered lacking, because teachers tend to leave the practice room after giving initial directions. Based on these various problems, the use of video tutorial media is proposed as a solution to improve the quality of learning and student skills in the practice of Motorcycle Tune Up (Nugroho & Subekti, 2020).

The aims of this study were to find out: (1) Identify the needs of students and teachers in the learning process of motorcycle tune up practices in class X of the Motorcycle Engineering and Business Expertise Competency at Muhammadiyah Bawang Vocational School, (2) Find out the students' responses to the use of video tutorial media in the learning process of motorcycle tune up practices, and (3) Assess the effectiveness of video tutorial media in improving the understanding of concepts and motorcycle tune up practice skills of class X students at Muhammadiyah Bawang Vocational School, (4) Find out the suitability of video tutorial media with instructional design and learning theory, (5) find out the relevance of video tutorial media to independent learning.

The benefits of this study are expected to provide input as an alternative solution and consideration in improving the practical skills of Motorcycle Tune Up, especially in the Motorcycle Engineering and Business expertise program at SMK Muhammadiyah Bawang. The use of video tutorials is expected to be an effective learning medium in supporting the achievement of student competencies, as well as providing direct experience in overcoming real problems in the educational environment (Arsyad, 2019). In addition, the results of this study are expected to contribute to the development of science, especially related to the development of video media for students' technical skills, and become a reference for further research.

METHODS

This research is a research and development (Research and Development/R&D) which aims to develop learning media in the form of a motorcycle tune-up video tutorial. The development model used in this study refers to the model proposed by Borg & Gall (1983), which consists of ten stages of development: Research and information collecting, Planning, Develop preliminary product, Preliminary field testing, Main product revision, Main field testing, Operational product revision, Operational field testing, Final product revision, Dissemination and implementation. However, in this study only 7 stages were used due to limitations of time, cost and research scope.

The Borg & Gall model used in this study, which was adopted from (Sugiyono, 2022), consists of several simplified stages as follows:

1. Research and Initial Information Gathering. This stage is carried out with needs analysis and literature studies. The collection of these data is carried out through observation, interviews, and document reviews related to learning needs and problems faced by students in motorcycle tune-up practices.
2. Planning. At this stage, planning is carried out related to the research being conducted, for example research objectives, testing stages, and so on.
3. Develop Preliminary Form of Product. At this stage, video making (recording & editing), video recording process, editing, and compilation of video tutorial media that are in accordance with student needs and learning objectives are carried out. At this stage, media experts and material experts are involved.
4. Preliminary field testing. Expert test (material and media experts). This expert evaluation method uses eligibility criteria with a minimum score of 71% for all aspects. The goal is to determine the feasibility of video tutorial media. Aspects assessed by material experts: Suitability of video to material, Breadth and depth of material, suitability of content to material, Accuracy of material in presenting scientific and factual information, Integration of material with learning methods and media, Language used in video, Activeness of learners and responsiveness of learning media, Diversity of learner characteristics and openness, Measurement and evaluation of media. Aspects assessed by media experts: Content aspects, presentation aspects, Technical/visual aspects, Creativity and aesthetic aspects, Ethics and copyright aspects. Sug-

gestions and input from material and media experts are used as a reference for improvement. The formula used in this stage is as follows:

a. Calculating the average percentage of material expert and media expert test scores using the formula:

$$P = \left(\frac{\sum Skor\ per\ ahli}{n\ x\ Skor\ maksimum\ per\ ahli} \right) x\ 100\%.$$

Information: P = Average percentage
$\sum$ = The average obtained
n = Number of experts

(Riduwan, 2015).

b. Determine the product eligibility criteria. In this study, the criteria used:

Table 1. Establish Product Eligibility Criteria

Percentage (%)	Product Eligibility Category	Information
86% – 100%	Very Worth It	The product meets the criteria perfectly
71% – 85%	Worthy	Product meets the criteria
56% – 70%	Quite Decent	The product can still be repaired
< 56%	Not feasible	Product does not meet criteria

(Sumber: Arikunto, S., 2019).

5. Initial field test. At this stage, the researcher involved trial subjects with the participation of ten students to provide an assessment of the video tutorial media. The data collection techniques used were observation and questionnaires. Based on the initial field test, revisions were made to improve the video tutorial media.

6. Main field test. At this stage, the researcher conducted a test of the effectiveness of the video tutorial media. The researcher applied a repetition model experiment to a group of 35 students. So that the results of this activity obtained effective video tutorial media.

7. Field test is wider. At this stage it is done in the same way as the previous stage, but involves the participation of a wider range of students, namely 70 students.

The collected data was processed and analyzed using descriptive statistics (percentages) to determine the level of validity, practicality, and effectiveness of the video tutorial media (Nurzaman, 2014).

RESULTS AND DISCUSSION

The development of learning media in the form of video tutorial media is carried out through several stages. The discussion is as follows.

Early Product Development Video Tutorial Media

This stage involves media experts and material experts. The test results from both experts are as follows.

a. Material Validation Test

The validation test of the material was conducted twice to ensure the quality and suitability of the material in the developed video tutorial media. In the first stage, the assessment results showed that the three main aspects were the depth and breadth of the material, suitability with the learning method used, and the level of involvement and interactivity generated obtained an average percentage with a sufficient category. Based on these findings, material experts provided a number of inputs aimed at improving the quality of the media, including suggesting that the level of difficulty of the material be adjusted to make it easier for students to understand, encouraging cooperation between students through group activities, and adding more detailed instructions regarding the use of materials in accordance with the learning approach applied. The complete results of the first and second stages of the material expert test can be seen in the following description:

Table 2. Results of the First Stage of Material Testing.

No.	Assessment Aspects	Average percentage	Category
1	Video conformity to material	72%	Worthy
2	Breadth and depth of material	60,41%	Quite Decent
3	Suitability of material content	68,16%	Quite Decent
4	Accuracy of material in presenting scientific and factual information	73%	Worthy
5	Integration of materials with learning methods and media	85%	Worthy
6	Language used in the video	70,27%	Quite Decent
7	Student activity and responsiveness of learning media	60%	Quite Decent
8	Diversity of student characteristics and openness	80,66%	Worthy

9	Media measurement and evaluation	65%	Quite Decent

Table 3. Results of the Second Stage of Material Testing.

No.	Assessment Aspects	Average percentage	Category
1	Video conformity to material	87%	Very Worth It
2	Breadth and depth of material	76%	Worthy
3	Suitability of material content	80%	Worthy
4	Accuracy of material in presenting scientific and factual information	88,64%	Very Worth It
5	Integration of materials with learning methods and media	90,72%	Very Worth It
6	Language used in the video	76,84%	Worthy
7	Student activity and responsiveness of learning media	75,58%	Worthy
8	Diversity of student characteristics and openness	88%	Very Worth It
9	Media measurement and evaluation	77%	Worthy

Based on the results of the material test that has been conducted, the researcher continued by revising and retesting the video tutorial material and media. In the second stage of the trial, an average percentage of assessments was obtained that were in the category of feasible to very feasible in all aspects assessed. These data indicate a significant increase in the aspects of the suitability of the video with the material, the suitability of the integration of the material with the learning method, as well as the activeness of students and the responsiveness of the learning media. In detail, the average increase in the aspects of the breadth and depth of the material reached 15.59%, in the aspect of the integration of the material with the learning method and media by 5.72%, and in the aspect of the activeness of students and the responsiveness of the learning media by 15.58%. Based on these achievements, it can be concluded that the material in the video tutorial was declared feasible by the material expert and did not require further revision.

b. Media Validation Test

After conducting the material validation test, the researcher conducted a media validation test. The feasibility test process by media experts was carried out in three stages. In the first stage, the video tutorial media was assessed as being in the less feasible category in several aspects, including content, presentation, technical/visual, creativity and aesthetics, and ethics and copyright. Input from media experts in this stage included several recommendations for improvement, including: (1) rearranging text and image elements to be more balanced and neat, (2) using headings and subheadings to make it easier to understand, (3) selecting high-resolution images, (4) applying harmonious colors, (5) consistency in the use of fonts, (6) providing clear instructions for use, and (7) avoiding excessive visual design. Based on this input, revisions were made to the media and continued with the second stage of testing.

In the second stage of testing, the media still received a category below adequate, especially in the aspects of creativity and aesthetics. Media experts provided two main suggestions, namely (1) selecting images that are more relevant to the content of the material, and (2) improving the appearance of the media to make it look more professional. After improvements were made according to the instructions, the media test continued to the third stage.

In the third test, the same aspects were re-evaluated. The results showed a significant increase, where the video tutorial media received an assessment in the category of decent to very decent. The complete results of the media expert test are presented below.

Table 4. Results of the First Test by Video Media Experts.

No.	Assessment Aspects	Average percentage	Category
1	Content aspects	55,6%	Not feasible
2	Presentation aspects	44,36%	Not feasible
3	Technical/visual aspects	70%	Quite Decent
4	Creativity and aesthetic aspects	53,55%	Not feasible
5	Ethical and copyright aspects	60,66%	Quite Decent

Table 5. Results of the Second Test by Video Media Experts.

No.	Assessment Aspects	Average percentage	Category

1	Content aspects	64,35%	Quite Decent
2	Presentation aspects	60,12%	Quite Decent
3	Technical/visual aspects	76%	Worthy
4	Creativity and aesthetic aspects	62,83%	Quite Decent
5	Ethical and copyright aspects	74%	Worthy

Table 6. Results of the Third Test by Video Media Experts.

No.	Assessment Aspects	Average percentage	Category
1	Content aspects	78,36%	Worthy
2	Presentation aspects	75%	Worthy
3	Technical/visual aspects	87,91%	Very Worth It
4	Creativity and aesthetic aspects	76%	Worthy
5	Ethical and copyright aspects	86,53%	Very Worth It

Based on the data presented, there is an increase in the average percentage from the first test to the second test, namely 8.75% in the content aspect, 15.76% in the presentation aspect, 6% in the technical/visual aspect, the creativity and aesthetic aspect of 9.28%, and the ethics and copyright aspect of 13.34%. Furthermore, in the comparison between the second and third tests, the average percentage increase was recorded at 14.01% in the content aspect, 14.88% in the presentation aspect, 11.91% in the technical/visual aspect, the creativity and aesthetic aspect of 13.17%, and the ethics and copyright aspect of 12.53%. Referring to the results of the third stage evaluation, the video tutorial media has met the eligibility criteria so that it does not require further improvement.

Initial Field Test Implementation

At this stage, the study focused on evaluating the use of video tutorial media as a learning tool. Data were collected through direct observation during the learning process and questionnaires distributed to ten students after the use of video tutorials. The results of the observations showed a significant positive response from students. Most students looked enthusiastic and focused on following the material presented through the video, indicating a high level of attention. Video tutorials also seemed to trigger active student participation, encouraging them to try to practice the steps demonstrated directly. Initial indications also showed that this media helped students understand complex concepts that required visualization or gradual demonstrations, making it easier for them to follow the flow of the material. However, observations also noted that some students might have difficulty following the speed of the video, indicating the need for additional repetition or guidance features.

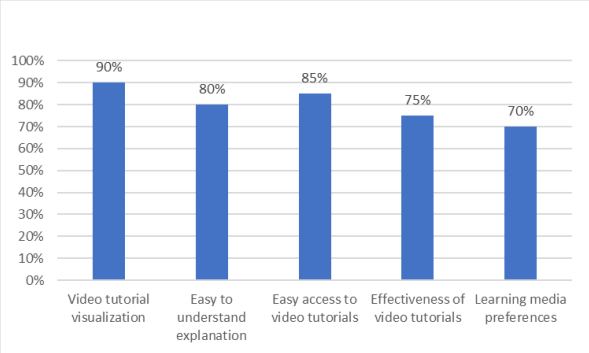

Figure 1. Initial Field Test Implementation.

The findings from the questionnaire strengthened and complemented the observation results. The majority of students (90%) consistently stated that the visualization in the video tutorial greatly helped their understanding, considering the video more interesting than traditional learning methods. As many as 80% of students agreed that the explanations in the video were easy to understand, with a clear sequence of steps being a positive point. In addition, 85% of students felt comfortable and easy to access and operate the video tutorial. Overall, 75% of students felt that the use of video tutorials was very effective in improving their understanding and skills. When asked about their preference for learning media, the majority of students (70%) chose video tutorials over conventional methods. Some input from students included suggestions for a shorter duration and the potential for adding interactive quizzes, indicating room for further development. In general, the results of the observations and questionnaires consistently showed that video tutorial media were well received by students and had great potential to improve their learning experience.

Main Field Test Implementation

At this stage, the research focuses on testing the effectiveness of the developed video tutorial media. The effectiveness test was conducted through an experimental approach by applying a repetition model to a group of 35 students. The main objective of this experiment was to determine whether the video tutorial media that had been

created was able to achieve learning objectives effectively.

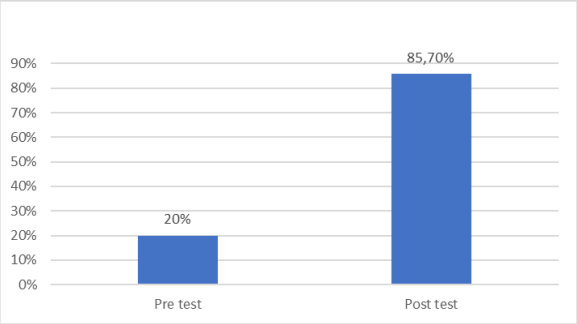

Figure 2. Main Field Test Implementation.

The results of the experiment consistently showed that the implemented video tutorial media was effective in improving students' understanding and skills. This was evident from the significant increase in students' average scores from pre-test to post-test. At the beginning of the experiment (pre-test), the students' average score was 62.50. After participating in learning using video tutorial media with a repetition model, the students' average score increased sharply to 88.20 in the post-test. This average increase of 25.70 points shows a substantial positive impact. In addition, the proportion of students who achieved the Minimum Completion Criteria of 75 also increased drastically, from only 20% (7 out of 35 students) in the pre-test to 85.7% (30 out of 35 students) in the post-test. Based on this quantitative data, it can be concluded that the video tutorial media developed and implemented in this experiment is effective as a learning aid.

Wider Field Testing

At this stage, the effectiveness test of video tutorial media was expanded to involve wider student participation. Similar to the previous stage, this study used an experimental approach by applying a repetition model to groups of students, but now involving 70 students. This expansion aims to validate initial findings and obtain a more comprehensive picture of the effectiveness of video tutorial media on a larger scale.

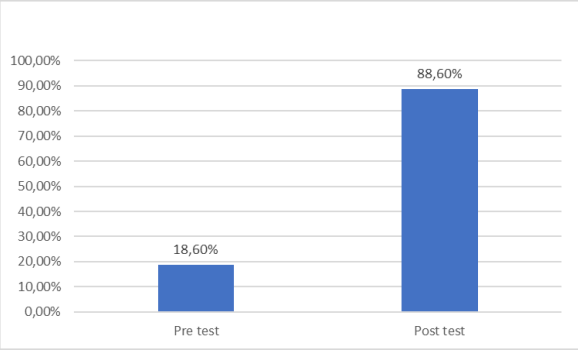

Figure 3. Wider Field Testing.

The results of the experiment from 70 students consistently confirmed that the implemented video tutorial media was very effective in improving understanding and learning skills. This increase was clearly seen from the significant increase in the average score of students from the pre-test to the post-test. In the pre-test, the overall average score of students was 63.15. After using video tutorial media with a repetition model, the average score of students in the post-test jumped to 89.50. This average increase of 26.35 points is strong evidence of the positive impact of the media.

In addition, 88.6% (62 out of 70 students) managed to achieve the Minimum Completion Criteria of 75, a drastic increase compared to only 18.6% (13 out of 70 students) who achieved KKM in the pre-test. These data collectively indicate that video tutorial media with a repetition model is not only effective on a small scale, but also maintains and even shows strong effectiveness in larger groups of students.

The development of this video tutorial media is fundamentally rooted in proven principles of instructional design and learning theory, ensuring that this innovation is not only responsive to practical needs but also has a strong scientific basis. The process of developing this media takes into account Sweller's (1988) Cognitive Load Theory, which emphasizes the importance of presenting information efficiently so that irrelevant cognitive loads can be minimized, so that students can focus on the essence of the material. Therefore, the video tutorial is designed by breaking down complex materials into smaller, more digestible segments, in line with the advice of Paas, Renkl, & Sweller (2003) to minimize extrinsic cognitive load and maximize extrinsic cognitive load. Furthermore, the development of this media also implements Mayer's (2009) Multi-media Learning Principle, which states that "People learn better from words and pictures than from words alone" (p. 47). By harmoniously integrating visuals and audio narration, video tutorials distribute cognitive load across two sensory channels, and minimize redundancy by avoiding excessive text that is identical to the narrative.

In addition, the developed video tutorial media inherently supports the concept of self-regulated learning. The flexible feature to pause and repeat video sections allows students to control their own learning pace, a crucial aspect in forming independence. Suparman (2014) emphasized the superiority of video in presenting material dynamically and can be repeated according to students' needs which directly empowers students to review difficult parts until they really understand. This concept is also relevant to the popular

flipped classroom model, where instructional materials are accessed by students outside of class hours (Bergmann & Sams, 2012), allowing face-to-face time to be used for more in-depth discussions or practices. Not only that, the visual and auditory aspects of video tutorials also play an important role in increasing student engagement and motivation, in line with Dale's (1969) view on the effectiveness of visual and demonstrative learning experiences in making abstract concepts more concrete. Thus, the development of this video tutorial media has not only been proven to be empirically effective, but also has a comprehensive theoretical justification, making it an innovation that is in line with the modern learning paradigm.

CONCLUSIONS

The following is the conclusion of the research that has been conducted:

1. There is a clear need for more interactive, visual, and accessible motorcycle tune-up learning media. Students need learning resources that allow them to independently understand tune-up concepts and procedures, review difficult material, and practice the steps step by step. On the other hand, teachers need media that can facilitate practical demonstrations effectively, overcome limitations of tools or time, and assist students who have varying learning speeds. Overall, there is an urgent need for learning media that can bridge the gap between theory and practice, and increase students' motivation and independence in learning in motorcycle tune-up material.
2. The video tutorial media showed excellent potential and was positively received as a learning tool. Students showed enthusiasm, focus, and active participation when using the videos, and showed an initial understanding of complex concepts thanks to the visualizations and demonstrations provided. The findings from the questionnaire supported this, with the majority of students (90%) stating that the video visualizations helped their understanding, and the majority (80%) found the video explanations easy to understand. In addition, the majority of students (85%) felt comfortable accessing and operating the videos, and 75% of students generally felt that the videos were effective in improving their understanding and skills. However, there were suggestions for shorter durations and the addition of interactive features such as quizzes, indicating room for further development. Overall, these initial results confirm that the video tutorial media has great potential to enhance students' learning experiences.
3. Video Tutorial Media Proven to be Very Effective in Improving Student Learning Outcomes. Field tests conducted in stages, starting from a small scale (10 students) to a large scale (70 students), consistently showed a significant positive impact. This media succeeded in drastically increasing students' conceptual understanding, active participation, and average scores from pre-test to post-test (an average increase of 25.70 to 26.35 points), and substantially increasing the proportion of students who achieved the Minimum Completion Criteria to above 85%.
4. Video Tutorial Media Development Based on Instructional Design Principles and Modern Learning Theories. The effectiveness of this media is not a coincidence, but rather the result of the application of scientific principles. The design takes into account Cognitive Load Theory to present information efficiently, and implements Multimedia Learning Principles that optimize the combination of visuals and audio. This ensures that the material is presented in a way that best suits the way students' brains process information.
5. Video Tutorial Media Encourages Independent Learning and is Relevant to Contemporary Educational Paradigms. Flexible features such as the ability to pause and replay videos empower students to control their own pace and depth of learning, in line with the concept of independent learning. In addition, this media is also highly relevant to innovative learning models such as the flipped classroom, making it a tool that is not only pedagogically effective but also adaptive to the needs and challenges of education in today's digital era.

IMPLICATIONS

The impact of research results based on objectives is as follows:

1. The media development process becomes more focused, contextual, and in accordance with real conditions in the field, thereby increasing the relevance and acceptance of the media by end users.
2. This media can be used as a design reference for the development of similar media in other vocational fields, and contribute to the diversification of learning resources in vocational schools.
3. The development of interactive video tutorial media based on learning theory has an impact on improving the quality of content and presentation of information. This helps create media that is not only visually appealing, but also pedagogically effective, thus supporting

the achievement of more optimal learning objectives.

4. This media can be used as a teaching tool in vocational school environments, widely used by teachers in teaching and learning activities, and has the potential to be recommended in the development of other digital-based learning tools.
5. Positive responses from students indicate that this media is able to increase learning motivation, understanding of work procedures, and self-confidence during practice. As a result, the media contributes to improving the quality of practice-based learning, and indirectly supports the achievement of student competencies, both cognitively and psychomotorically.

REFERENCE

Andrade, H. L., & Brookhart, S. M. (2020). Classroom assessment as the co-regulation of learning. Assessment in Education: Principles, Policy & Practice, 27(4), 350–372. https://doi.org/10.1080/0969594X.2020.1730768.

Arikunto, S. (2019). Prosedur Penelitian: Suatu Pendekatan Praktik. Jakarta: Rineka Cipta.

Arsyad, A. (2019). Media pembelajaran. PT Raja Grafindo Persada.

Badan Pusat Statistik (BPS). (2023). Penyerapan Tenaga Kerja Lulusan SMK di Indonesia.

Bergmann, J., & Sams, A. (2012). Flip Your Classroom: Reach Every Student in Every Class Eve-ry Day. International Society for Technology in Education.

Black, P., & Wiliam, D. (2018). Classroom assessment and pedagogy. Assessment in Education: Principles, Policy & Practice, 25(6), 551–575. https://doi.org/10.1080/0969594X.2018.1441807.

Borg, W.R, & Gall, M.D. (1983). Education Research: An Introduction, Fifth Edition. New York: Longman.

Dale, E. (1969). *Audio-visual methods in teaching*. Holt, Rinehart and Winston.

Darling-Hammond, L., Flook, L., Cook-Harvey, C. M., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. Applied Developmental Science, 24(2), 97–140. https://doi.org/10.1080/10888691.2018.1537791.

Dick, W., Carey, L., & Carey, J. O. (2022). The systematic design of instruction (9th ed.). Pearson.

Dimyati, & Mudjiono. (2013). Belajar dan pembelajaran. Rineka Cipta.

Direktorat Jenderal Pendidikan Dasar dan Menengah. (2016). Petunjuk teknis penyelenggaraan pendidikan menengah kejuruan berbasis kompetensi. Kementerian Pendidikan dan Kebudayaan Republik Indonesia.

Direktorat Jenderal Pendidikan Vokasi. (2021). Strategi Penguatan Pendidikan Vokasi di Era Industri 4.0.

Efitra, R., Nur Safitri, & Susanti, T. (2024). Pengembangan media video tutorial dalam pembelajaran interaktif. Universitas Negeri Padang Press.

Hamalik, O. (2008). Proses belajar mengajar. Bumi Aksara.

Kementerian Pendidikan dan Kebudayaan. (2020). Peta Jalan Pengembangan SMK 2020-2024.

Mayer, R. E. (2009). *Multimedia Learning* (2nd ed.). Cambridge University Press.

Mayer, R. E. (2020). Multimedia learning (3rd ed.). Cambridge University Press. https://doi.org/10.1017/9781139094755.

Nugroho, H., & Subekti, A. R. (2020). Pengembangan media video tutorial untuk meningkatkan keterampilan praktik siswa SMK. Jurnal Pendidikan Teknologi dan Kejuruan, 27(1), 15–22. https://doi.org/10.21831/jptk.v27i1.29910.

Nurhadi. (2020). Peran pendidikan kejuruan dalam menyiapkan tenaga kerja terampil di era industri 4.0. Jurnal Pendidikan Vokasi, 10(2), 102–111. https://doi.org/10.21831/jpv.v10i2.31900.

Nurzaman, M. (2014). Pengembangan Media Pembelajaran. Bandung: Alfabeta.

Paas, F., Renkl, A., & Sweller, J. (2003). Cognitive Load Theory and Instructional Design: Recent Developments. Educational Psychologist, 38(1), 1–4. https://doi.org/10.1207/S15326985EP3801_1.

Paryati, T., & Ma'ruf, A. (2022). Pengaruh Pembelajaran Berbasis Praktik terhadap Kesiapan Kerja Siswa SMK. Jurnal Pendidikan Vokasi, 12(1), 45-56.

Purnomo, A., et al. (2023). Efektivitas Media Video Tutorial dalam Meningkatkan Keterampilan Siswa SMK. Jurnal Teknologi Pendidikan, 15(2), 112-125.

Schunk, D. H., & Zimmerman, B. J. (1998). *Self-Regulated Learning: From Teaching to Self-Reflective Practice*. Guilford Press.

Slameto. (2010). Belajar dan faktor-faktor yang mempengaruhinya. Rineka Cipta.

Sugiyono. (2022). Metode Penelitian dan Pengembangan (Research and Development). Bandung: Alfabeta.

Suparman. (2014). *Desain Instruksional Modern: Panduan Para Pengajar dan Inovator Pendidikan*. Penerbit Andi.

Suyanto, M. (2017). Manajemen pendidikan vokasional: Teori dan praktik di Indonesia. Andi.

Sweller, J. (1988). Cognitive Load During Problem Solving: Effects on Learning. Cognitive Science, 12(2), 257–285. https://doi.org/10.1207/s15516709cog1202_4.

Syaodih, Nana. 2006. *Metode Penelitian Pendidikan.*Bandung: Remaja Rosdakary.

Wibowo, A., & Prabowo, Y. (2021). Efektivitas penggunaan media video dalam meningkatkan hasil belajar praktik siswa SMK. Jurnal Pendidikan Teknologi dan Kejuruan, 28(2), 87–94. https://doi.org/10.21831/jptk.v28i2.36742.