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DEVELOPMENT OF WEBSITE-BASED LEARNING MEDIA FOR ENGINEERING DRAWING SUBJECTS AT NATIONAL VOCATIONAL SCHOOL MALANG

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Abstract

The rapid development of information technology has encouraged the need for innovative learning media to improve the quality of Technical Drawing instruction in vocational high schools. Learning activities that are still dominated by conventional teaching methods often result in students being less actively engaged and experiencing difficulties in understanding the learning materials. This study aimed to develop a website-based learning medium for the Technical Drawing subject at SMK Nasional Malang and to determine its validity, practicality, and feasibility. The study employed the Research and Development (R&D) method using Arief S. Sadiman's development model, which consists of needs identification, objective formulation, material development, assessment instrument development, media script writing, media production, validation, revision, and product testing. The product was validated by a media expert and a subject-matter expert. The field testing involved two Technical Drawing teachers, 10 students in a small-group trial, and 35 eleventh-grade students from the Mechanical Engineering program at SMK Nasional Malang. Data were collected using questionnaires and analyzed descriptively using percentage analysis. The results showed that both the media expert and subject-matter expert validation achieved a score of 95%, while the teacher trial obtained 96.25% and student responses reached 84.31%, all of which were categorized as highly valid. Therefore, the developed website-based learning medium is considered highly valid, practical, and feasible for use in Technical Drawing instruction at SMK Nasional Malang .

Keywords: Website-based learning media; Technical Drawing; Research and Development (R&D); Validity; Vocational High School (SMK)

INTRODUCTION

Education is one aspect that reflects the level of development and progress of a nation . Indonesia, as a developing country, continues to strive to strengthen the quality of its human resources . The low quality of public intelligence can be an obstacle to realizing professional, adaptive, and competitive human resources to drive national progress (Yudhistira et al., 2022) . In the era of globalization, the education sector is not only expected to be able to carry out its functions and mandates but is also required to adapt to the dynamics and complexity of ever-evolving challenges. Therefore, readiness is needed to reorient the vision of education towards the formation of capable individuals, oriented towards excellence, and able to optimize the capacity for self-empowerment and their environment .

Learning is a series of activities that play a role in creating change in a person , which is reflected through new behavioral changes reflected in abilities, dispositions, traditions of action, insights, and skills (Reimer, 2021) . Therefore, the learning process needs to be designed to contribute to creating authentic, contextual, and valuable learning experiences for students, thereby encouraging these changes. Along with the rapid development of technology, society is also required to have the capability to anticipate and face the various dynamics and complex challenges of the digital era. Technological advancements require society to have the ability to adapt to the various challenges that arise today. Therefore, education is expected to play an active role and contribute significantly to maintaining its existence in the world of education. Educational institutions must have adaptive resilience to address various obstacles, complexities, and disruptions that develop at the local, national, regional, and global levels (Pihar, 2022) .

In formal educational institutions, such as schools, the success of educational delivery can be identified through students' achievement of competencies in learning activities. The success and quality of student learning

outcomes depend on the level of competency possessed by each individual and the alignment of educators in determining and implementing effective teaching techniques (Putri, 2022) . The quality of the learning process is largely determined by the educator's capability in developing and implementing learning methods that align with students' learning needs. In line with this description, teachers not only play the role of facilitators in delivering material but also as catalysts who optimize students' creativity, potential, and capacity to achieve successful educational delivery. (Magdalena et al., 2023) .

Secondary education in Indonesia is divided into Senior High Schools (SMA) and Vocational High Schools (SMK), with the government prioritizing the development of SMKs to improve the quality of the workforce through technical skills training. Since the implementation of the 12-Year Compulsory Education program as stipulated in the 2015–2019 National Medium-Term Development Plan (RPJMN), the government has strived to increase participation in secondary education and increase investment in the vocational sector. This commitment is evident in the 2018 budget allocation, which reflects a larger allocation of funds for SMKs than for SMAs (Amalia & Sugiharti, 2023) . Within the National Education System, Vocational High Schools (SMK) serve as a component of education providers, serving as vocational education units at the secondary level that are oriented towards strengthening competencies and professional skills in line with the concentration of student expertise. This provision is based on Government Regulation Number 19 of 2005 concerning National Education Standards, which emphasizes that vocational education is organized to prepare students to be able to master competencies appropriate to their field of expertise and the demands of the workplace. (Santika et al., 2023) .

At the Vocational High School (SMK) level, various concentrations of expertise are available which are designed to develop students' abilities, capabilities, and vocational insights that are in line with the needs and dynamics of the development of the business world and the industrial world . These majors are divided into several areas of expertise, including Machining Engineering. The Machining Engineering Expertise Program at SMK is one of the areas of competency in Engineering and Engineering that focuses on the process of manufacturing and maintaining machine components using various machining techniques. This major equips students with skills in operating machine tools such as lathes, milling, grinding, CNC (Computer Numerical Control), and welding, as well as understanding the basic principles of manufacturing engineering (Febrian et al., 2024) , according to Fatkhurohman, (2020) In addition to mastering technical skills in operating machine tools, students majoring in Machining Engineering are also equipped with the ability to read technical drawings, apply work safety standards, and understand modern computer-based manufacturing technology. These competencies are expected to enhance the competitiveness of vocational high school graduates, preparing them to enter the manufacturing industry or continue their studies at the next level. The curriculum, as outlined, focuses not only on improving practical skills but also on mastering theoretical foundations in engineering and optimizing digital technology .

Technological advancements drive innovation in education by providing digital-based learning tools designed to optimize interactivity and active student involvement in dynamic and effective learning, thereby improving the quality of student learning outcomes in the modern era (Sulistyorini & Listiadi, 2022) . Learning media act as educational tools designed to facilitate efficient delivery of material while constructing more meaningful learning experiences by strengthening visual aspects , rather than relying solely on verbal communication (Telaumbanua, 2022) . The implementation of learning media contributes to improving student learning outcomes because it builds a more interactive, communicative, and student-focused learning process , clarifies material, adds variety to teaching methods, and increases active student participation through direct involvement in various learning activities (Atmaja et al., 2023) .

Although various studies have reported that the use of website-based learning media has been proven to optimize the implementation of the learning process, motivation, and learning outcomes of students, its implementation in Technical Drawing learning materials in Vocational High Schools (SMK) is still relatively limited. Educational tools adopted in Technical Drawing learning activities generally still take the form of textbooks, printed modules, or PowerPoint presentations that do not integrate learning materials, technical drawing illustrations, learning videos, practice questions, and evaluations into a single digital medium. This situation causes learning to not fully accommodate students' needs for interactive, flexible learning media that supports independent learning. Thus, there is a gap between the demands of technology-based learning transformation and the availability of digital learning media with the main objectives planned in Technical Drawing learning in Vocational High Schools (SMK).

Based on these problems, this study presents a novelty that differentiates it from previous studies through the design of instructional learning media using a website developed to support Technical Drawing learning at SMK Nasional Malang. The developed media integrates material substance, visual representation of technical drawings,

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learning videos, exercises, and evaluation instruments into a digital platform that can be used flexibly through various devices. The product developed in this study has its own uniqueness when compared to the learning media that have been studied in previous studies, the media is designed comprehensively by accommodating the needs of students, the characteristics of the Technical Drawing subject, and the demands of digital technology-based learning. In addition to producing outputs in the form of learning media, this study also carries out a series of tests on the validity, practicality, and feasibility of the product through assessments by media experts, material experts, educators, and student responses. Thus, the results of this study are expected to enrich theoretical studies and provide empirical evidence related to the development of digital learning media in the field of vocational education, especially as an alternative innovation in Technical Drawing learning that is effective, adaptive, and relevant to the dynamics of educational transformation in the digital era. In line with the description above, this study was conducted with the aim of designing a website-based learning platform to support the learning process of Technical Drawing at Malang National Vocational School to identify the level of validity, practicality and feasibility of the media developed as an alternative technology-based learning innovation.

LITERATURE REVIEW

1. Learning

   The learning and teaching process is the core of educational activities that emphasize student participation and the strategic role of educators in creating a conducive learning environment (Andini et al., 2024) . Based on this context, all learning elements including objectives, material substance, learning approaches, educational media, and assessment instruments must be constructed in an integrated manner . The success of learning cannot be separated from internal factors of students, such as intrinsic motivation, attention to learning, and student readiness to learn, and external determinants that include the quality of learning practices, the learning ecosystem, and support provided by other parties. By understanding all these aspects, it is hoped that the implementation of learning can be realized well (Windi Anisa et al., 2023).

2. Learning Media

   Based on the definition of KBBI, learning media is defined as various tools and materials used in the teaching and learning process to convey messages and information to students through their senses. These learning media can be in the form of various sources, such as books, illustrations, films, or videos that function to help teachers elaborate on teaching materials through more systematic, attractive, and meaningful presentations . Their use not only makes it easier for students to understand, but also contributes to increasing learning motivation and student activity, resulting in a more optimal and communicative learning process (JASMINE, 2014) . According to Haptanti et al., (2024) classifying learning tools based on their presentation characteristics, learning media can be classified into four main groups, namely: (1) visual media, (2) auditory media, (3) media that combine audio and visual elements, and (4) multimedia media. in the form of a series of illustrations that clarify the presentation of learning materials.

3. Website as a learning medium

   This media not only supports independent learning but also plays an effective role in facilitating the process of conveying information between teachers and students (Dini & Ekohariadi, 2024) . Technological developments are driving the transformation of education from conventional systems to modern ICT-based learning. The use of computers and the internet enables students to learn independently, enhance creativity, and give birth to a more effective and flexible e-learning concept (Riza Azizi et al., 2023) . Website-based learning platforms play a role in providing a dynamic, flexible, and easily accessible learning ecosystem for students . By combining various presentation formats, such as text, images, and videos, this media contributes to the realization of a more engaging, effective, and interactive learning process. In addition, the interactive features in the form of forums and discussion rooms can facilitate two-way interaction between educators and students, so that the website is not only used as a medium for conveying information, but also a collaborative tool that encourages technology-based independent learning in the digital era (Maksum et al., 2020) .

METHOD

This study is guided by the Research and Development (R&D) method developed by Arief S. Sadiman, specifically designed for the development of learning tools with systematic procedures. This concept facilitates a planned and continuous development process, enabling optimal realization of learning objectives (Syofian.Is, 2020) . The learning media development procedure is systematically structured to achieve a product that aligns with the research development objectives. The design stages are shown in Figure:

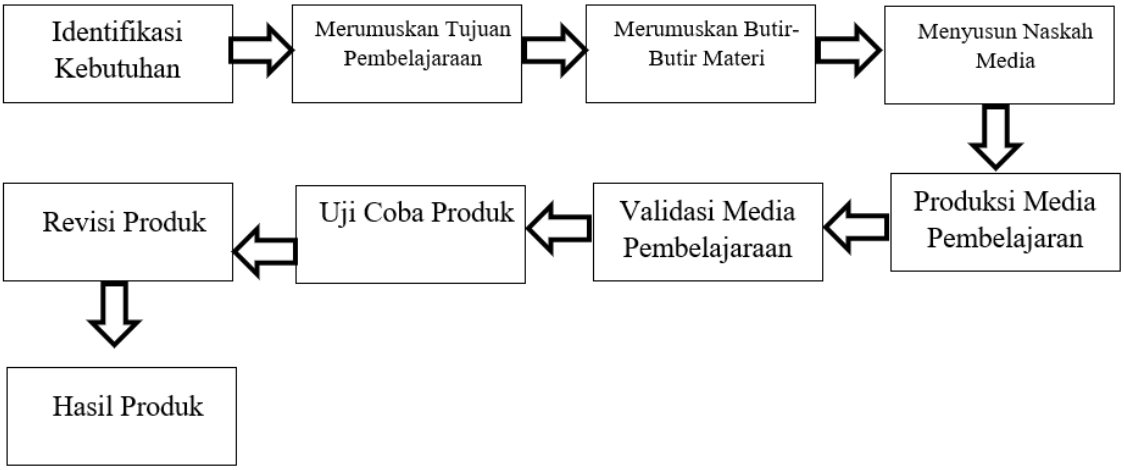


Figure 1. Development Stages

The trial design in this study includes product validation and direct field testing. The research trial includes a validation process by experts and product testing in the field. The media validation process was carried out by a media expert, namely Ir. Marsono, S.Pd.T., M.Pd., Ph.D., who serves as an Associate Lecturer in the Department of Mechanical Engineering, Faculty of Engineering, State University of Malang, and involved one of the lecturers from the Department of Mechanical Engineering, State University of Malang as a material expert to evaluate the feasibility of the learning media. Furthermore, the subjects involved in this development research included two stages of testing, namely expert reviews and field implementation tests. The expert review involved material experts who assessed the harmony and suitability of the material and media experts who evaluated the quality of the media's appearance and function. Product testing in the field was carried out through several stages, such as teacher trials involving two Engineering Drawing teachers, limited group testing consisting of 10 students, and field testing attended by 35 grade XI students of Mechanical Engineering at SMK Nasional Malang. All students were selected based on the criteria of having or currently taking Engineering Drawing subjects.

Data analysis was applied qualitatively and quantitatively (Ghafara et al., 2022) . Qualitative data were collected through observation, interviews, and responses in the form of criticism and suggestions from media validators, material validators, educators, and students, which were used as a reference in making product improvements. On the other hand, quantitative data were sourced from the results of learning media evaluations which were then processed using percentage analysis as a basis for determining product feasibility (Risnita et al., 2024) . The process of calculating the percentage value was carried out based on the percentage analysis formula that is generally applied in educational research to measure the level of achievement or feasibility of a product:

$$P = \frac{\sum x}{\sum x} \times 100\%$$

Conclusions of data results using criteria. These assessment criteria are explained in Table 1.

Table 1 Product Eligibility Criteria

Kategori	Interval	Klasifikasi	Keterangan
A	80%-100%	Sangat layak	Produk baru siap dimanfaatkan di lapangan untuk kegiatan pembelajaran (*)
B	60%-79%	Layak	Produk dapat dilanjutkan dengan menambahkan sesuatu yang kurang dengan pertimbangan-pertimbangan tertentu
C	50%-59%	Kurang layak	Merevisi dengan meneliti kembali secara seksama dan mencari kelemahan-kelemahan produk untuk disempurnaka
D	0%-49%	Tidak layak	Merevisi secara besar-besaran dan mendasar tentang isi produk

Source: Qaira et al., (2025)

RESULTS AND DISCUSSION

1. Identify Needs

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Referring to the results of observations of Technical Drawing teachers, several problems were found, including: (1) limited learning facilities in the form of interactive media; (2) there is still a need for instructional media that is able to optimize the presentation of Technical Drawing substance in a more systematic manner; (3) the need to provide learning media that is able to adapt to the characteristics and learning needs of today's students; and (4) the still limited attention and contribution of students to the learning activity approaches that have been implemented so far. This situation indicates the urgency of designing learning media that is more flexible and has elements of renewal and participation to strengthen conceptual understanding and optimize active student involvement during the Technical Drawing learning process .

2. Formulate learning objectives

The formulation of learning targets is used as a guideline in the process of designing learning facilities for Technical Drawing so that they are in line with the expected competencies. Learning objectives are formulated based on the competency achievements set out in the curriculum and adapted to the conditions and learning needs of students . Through the formulation of targeted objectives, the stages of media development can be directed in a structured manner so that the packaged material is well-organized and can improve students' understanding of the material . The objectives of learning practices in the field of Technical Drawing studies are focused on students' abilities to understand the basic concepts of technical drawing, recognize and use drawing equipment, and apply drawing procedures according to applicable standards. Furthermore, learning objectives are also applied to improve students' visualization skills, accuracy, and ability to read and create technical drawings correctly. Thus, the designed learning media is expected to support the achievement of students' knowledge and skills competencies optimally.

3. Formulating Material Points

Based on the formulation of specific learning objectives, the next step is to compile and develop the material details to be explained in the designed learning media. This material selection is tailored to the learning needs outlined in the Independent Curriculum, thus providing relevant material details for development.

Table 2 Basic Competencies and Indicators of Achievement of Technical Drawing Competencies for Creating Learning Multimedia

No	Elemen	Ruang Lingkup Materi	Indikator Pencapaian
1	Gambar Teknik	1. Pengenalan peralatan dan kelengkapan gambar teknik . 2. Standar garis dan jenis garis gambar Teknik 3. Teknik penggunaan alat gambar manual 4. Prosedur dasar pembuatan gambar teknik	Pada akhir fase F, peserta didik mampu memahami dan menggunakan peralatan gambar teknik serta menerapkan prosedur dasar penggambaran sesuai standar yang berlaku.

4. Compiling Media Scripts

After determining the material, the next step is to develop a media script as a guideline for developing learning products. The script is systematically designed in line with the objectives and planned material, encompassing the presentation sequence, content, and display design, including text, images, and interactive elements. In Technical Drawing, the media script is designed to help students understand the concepts and procedures of drawing in a visual and structured manner, thus supporting the effectiveness of the learning process.

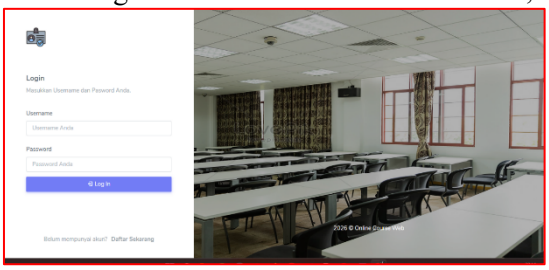


Figure 2 Media Cover Storyboard Layout

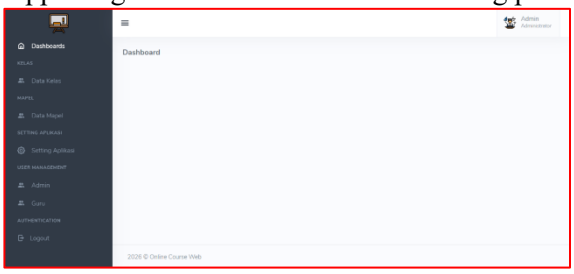


Figure 3 Website Menu Layout

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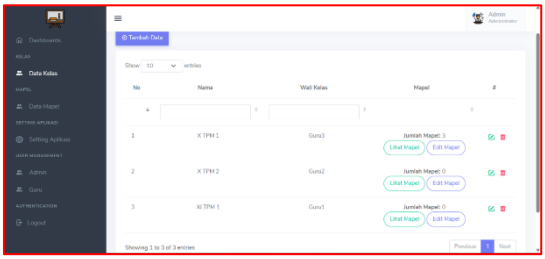


Figure 4 Class Sub Data Website Layout

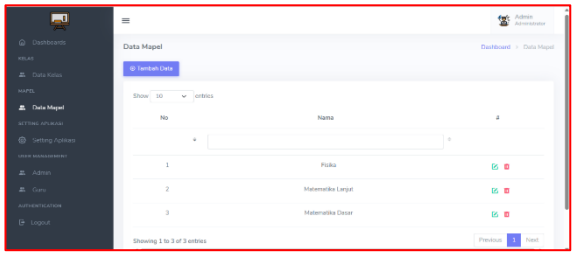


Figure 5: Subject Data Website Layout

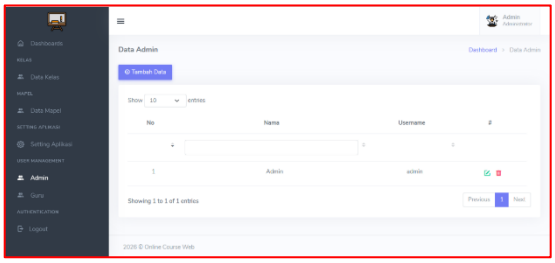


Figure 6 Admin Data Website Layout

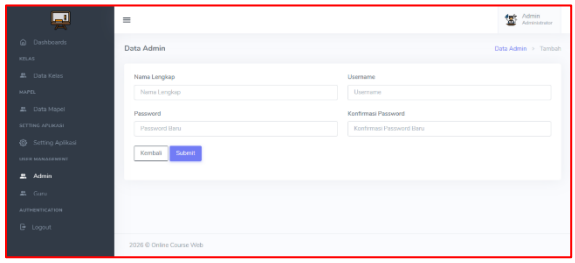


Figure 7 Admin Data Website Layout

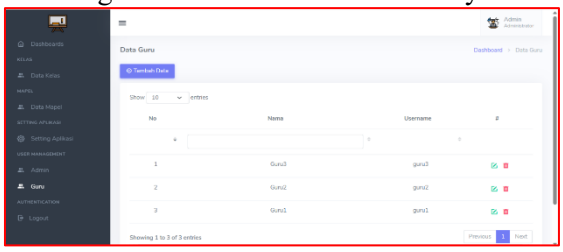


Figure 8 Teacher Data Website Layout

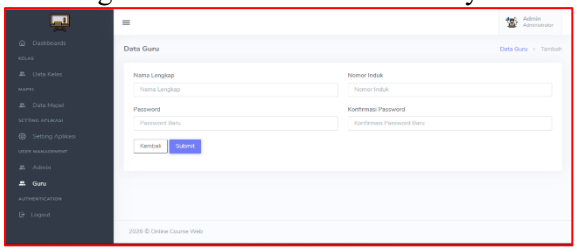


Figure 9 Teacher Data Website Layout

After the material is determined, the next stage is to compile a media script as a guideline in product development. The script is compiled systematically including the presentation of the material, display design, use of text, illustrations, icons, navigation menus, and interactive components tailored to the learning objectives of Technical Drawing. The storyboard and layout in Figures 2–9 illustrate the design of the cover page , main menu, class data, subject data, admin data, and teacher data, which are designed with attention to ease of use, interface consistency, and navigation flow to support the learning process of students.

The design that has been prepared is in line with the theory that explains that the delivery of information through the integration of structured text and visual elements can strengthen student understanding (Mayer, 2009) . Website-based learning media with a systematic interface design and clear navigation can increase learning effectiveness (Rizani et al., 2026) . The integration of visual elements and interactive features in web-based media increases the efficiency of the use of instructional media and student participation in implementing learning activities (Ramdani et al., 2026) . Furthermore, the media developed through the review stage by learning media experts and material experts, continues to the trial implementation stage for educators to ensure product readiness so that it can be applied appropriately in learning activities.

5. Learning Media Production

The production stage is the process of implementing the media script that has been prepared into a website-based digital learning tool product that is applied in Technical Drawing learning at Malang National Vocational High School. In this step, media is created by integrating various supporting elements such as text, technical drawing visualization , animation, and interactive features that are tailored to learning needs. The production process includes creating a display design (interface), developing material content, and coding the system so that the media can be used optimally by users. The developed media is aligned to facilitate students in mastering technical drawing concepts visually and systematically. In addition, the media is also equipped with training instruments and assessments to identify the level of student mastery of the learning substance. Research findings reflect that Technical Drawing learning media developed through systematic procedures is able to optimize concept mastery and increase student learning attention based on a more participatory and communicative presentation of material. Therefore, the

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production stage is an essential phase in creating instructional media that meets the aspects of validity, feasibility, and practicality so that it is suitable for implementation in Vocational High Schools (SMK). (Fadillah, 2020)

6. Media Validation by Experts

A review by media experts was conducted to verify that the designed learning media met the eligibility criteria in terms of visual appearance, presentation structure, and practicality. The validation findings were then used as a basis for determining the product's validity and feasibility before implementation in the learning process. The results of the media expert validation are presented in Table 2.

Table 3. Media Expert Validation Results

Aspek Penilaian	Skor	Skor Maksimal	Persentase	Kategori
Desain Media	24	24	100%	Sangat Layak
Aspek Pembelajaran	19	20	95%	Sangat Layak
Aspek Penggunaan	33	36	92%	Sangat Layak
Jumlah	76	80	95%	Sangat Layak

Source: Data from media expert validation tests, (2026)

Referring to the results of Table 3 above, the media design aspect yielded a feasibility level of 100% with a very feasible classification. This finding reflects that the website's appearance is in line with the principles of learning design, including a systematic layout, harmonious color selection, easy-to-read fonts, clear image quality, and user-friendly navigation. Appropriate design helps students gain access to learning materials without experiencing technical obstacles. This is in line with Multimedia Learning Theory , which states that learning can be more qualitative if the material is delivered through a combination of various elements, such as text, illustrations, animations, and other visual components that are systematically constructed. Attractive visual presentations can reduce cognitive load , making it easier for students to master the material presented (Mayer, 2009) . In learning Technical Drawing, visual displays play an important role because most of the material is related to image shapes, symbols, sizes, and projections, which are easier to understand through visual presentations than through verbal explanations alone.

In the learning aspect, the media obtained a percentage of 95%, including the qualification of very appropriate. This result reflects that if the media has supported the learning process through the presentation of structured materials, in line with learning outcomes, it can facilitate students in mastering Technical Drawing material. The website does not only act as a means of disseminating information, but also provides facilities for students to develop independent learning skills by utilizing the available material menu, learning videos, practice questions, and available evaluations. These findings are in line with the theory of Constructivism which explains that if students' understanding is formed through active involvement through the process of learning experiences and involvement with the scope of learning (Piaget, 2002) and (Vygotsky, 1978) . Through website-based media, students can explore the material according to their individual needs and learning abilities, thus facilitating the formation of a deeper learning experience (meaningful learning). Not only that, these results also support the notion that effective learning must be structured systematically starting from the presentation of information, providing examples, exercises, to evaluation so as to optimize student learning outcomes.

In terms of application, the media achieved a score of 92% and is considered very suitable. These results reflect that the website is easy to operate, has clear navigation, can be used on various devices, and facilitates learning for both teachers and students. Ease of use is a strategic component that contributes to the success of technology integration in the implementation of learning . This finding is in line with the Technology Acceptance Model (TAM), which states that a person's acceptance of the use of technology is influenced by two core aspects: perceived ease of use and perceived usefulness . A website that is easy to use will increase user interest in utilizing it continuously in teaching and learning activities. Overall, validation of the media aspect obtained a percentage score of 95%, reflecting that the website-based learning media has met the media quality criteria set by digital learning from the aspects of design, learning, and use (Davis, 1989) . Quality learning media needs to have an attractive design, be practical in use, and be able to convey learning information effectively, as well as support the achievement of learning objectives (Arsyad, 2017) . Based on the results of the development, website-based learning media has shown suitability with the characteristics of effective media and can be used as a means to support the effectiveness of Technical Drawing learning at Malang National Vocational School.

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In the Technical Drawing course, visual presentation of material through a website platform makes it easier for students to learn and understand the concepts of drawings, symbols, projections, and technical drawing steps more concretely than conventional learning. The results of the expert validation assessment are presented in Table 3.

Table 4. Results of Material Expert Validation

Aspek Penilaian	Skor	Skor Maksimal	Persentase	Kategori
Kesesuaian Materi	16	16	100%	Sangat Layak
Kualitas Materi	22	24	92%	Sangat Layak
Kemudahan Materi	19	20	95%	Sangat Layak
Kemanfaat Materi	19	20	95%	Sangat Layak
Jumlah	76	80	95%	Sangat Layak

Source: Data from material expert validation tests, (2026)

The results of the material expert validation reflect that the website-based learning media obtained a percentage of 95% and is included in the predicate of very suitable. These results reflect that the material presented has met the aspects of suitability, quality, ease, and usefulness so that it is suitable for application in learning Technical Drawing at SMK Nasional Malang. In the aspect of material suitability, a percentage of 100% was obtained, which reflects that the content of the material is in line with the achievement standards, learning objectives, and characteristics of the material in the Technical Drawing subject. The learning content is arranged based on the objectives to be achieved and the needs of students play a role in optimizing the achievement of competencies to the maximum (Dick et al., 2015) .

The material quality aspect obtained a percentage of 92%, while the ease and usefulness of the material each obtained 95%. These results reflect that the material is presented systematically, is easy to understand, and is able to support independent learning. This is in accordance with the Cognitive Theory of Multimedia Learning which explains that presenting learning information through a combination of verbal and visual aspects can support the process of understanding students to understand information more effectively, especially in visual subjects such as Technical Drawing (Mayer, 2009) . Website-based learning media obtained high expert validity of the material because the material is in accordance with the learning objectives and is well received by students (Suryaningrat et al., 2023) . Furthermore, website-based electronic learning facilities obtained good material quality and are suitable for use as independent learning media (Murat, 2020) .

The results of the content expert validation indicate that the website-based digital learning tool meets the content quality standards for learning media development. High scores for each aspect indicate that the tool presents technical drawing material accurately, is easy to understand, and is relevant to learning needs, making it suitable for implementation in vocational high schools.

7. Product Trial

Next, in the validation and revision stage, the learning media was implemented with users to evaluate its practicality and effectiveness. Product testing was conducted on students and Technical Drawing teachers at SMK Nasional Malang, the primary users of the media. The following test results per aspect are outlined in Table 4.

Table 5. Results of Product Trial by Teachers

Aspek Penilaian	Skor	Persentase	Kategori
Tampilan Media	15	93,75%	Sangat Layak
Kejelasan Materi	11	91,67%	Sangat Layak
Kesesuaian Materi	11	91,67%	Sangat Layak
Kepraktisan	11	91,67%	Sangat Layak
Manfaat	12	100%	Sangat Layak
Kelayakan	4	100%	Sangat Layak
Efektivitas	4	100%	Sangat Layak
Kepuasan	8	100%	Sangat Layak
Jumlah	77	96,25%	Sangat Layak

Source: Data from teacher product trials, (2026)

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The results of the product usage test by teachers indicate that the website-based learning media showed an evaluation result of 96.25%, which is categorized as very feasible. This result indicates that the developed media product meets the aspects of practicality of use and excellent suitability for implementation in Technical Drawing learning at SMK Nasional Malang. The assessment of teachers as the primary users of the learning process is an indicator that the media has met learning needs, both in terms of presentation and ease of implementation in the classroom. Referring to the assessment results, the media display aspect obtained a percentage of 93.75%, while the aspects of material clarity, material suitability, and practicality each obtained 91.67%. These results reflect that the media has an attractive visual design, the delivery of material is easy to understand and aligned with learning objectives, and is easy for teachers to implement in supporting learning activities. Meanwhile, the aspects of benefits, feasibility, effectiveness, and satisfaction obtained a percentage of 100%, which indicates that the developed media is able to support teachers in delivering material, improve the quality of learning, and create a more optimal teaching experience.

High ratings for practicality and effectiveness indicate that website-based media has the potential to be a learning alternative that aligns with the demands of vocational education. Quality learning media is not only assessed from an attractive appearance but also needs to consider aspects of ease of use, the ability to clarify material delivery, and increase the efficiency of the learning process (Arsyad, 2017) . Therefore, the results of teacher assessments prove that the resulting media has demonstrated characteristics as an effective learning medium. The characteristics of website-based media that are easy to access, have simple navigation, and are able to integrate learning materials and media in one platform are the main factors influencing the high level of media feasibility (Salsabila & Aslam, 2022) . The web-based quiz management system applies the Rapid Application Development (RAD) method. The study reflects that a systematically designed web-based digital system can improve ease of use, the effectiveness of learning management, and user satisfaction (Wibowo & Narulita, 2025) . The similarity of these results indicates that the development of media and web-based learning systems that are oriented towards user needs can produce products that are practical, suitable for use, and support learning activities to take place more optimally.

Overall, the results of the teacher trials indicate that the developed website-based learning media has been declared practical for implementation in learning activities, with benefits, effectiveness, and feasibility categorized as very feasible. This indicates that the media is not only suitable for use as a learning resource but also capable of supporting teachers in implementing technical drawing optimally, is easy to implement, and is relevant to the demands of developing learning technology. Field testing was conducted on 35 11th-grade students of the National Vocational School of Malang's Mechanical Engineering program to determine the level of attractiveness and feasibility of the media from the perspective of direct users. Details of the trial results per aspect are presented in Table 6.

Table 6. Results of Product Trials by Students

Aspek Penilaian	Skor	Persentase	Kategori
Tampilan Media	533	83,28%	Sangat Layak
Kejelasan Materi	406	84,58%	Sangat Layak
Kemudahan Penggunaan	401	83,54%	Sangat Layak
Manfaat	539	84,22%	Sangat Layak
Motivasi	411	85,63%	Sangat Layak
Kepuasan	408	85%	Sangat Layak
Rata-rata	-	84,31%	Sangat Layak

Source: Data from student product trials, (2026)

The average score for student responses was 84.31%, with a very good score. The motivation aspect received the highest score (85.63%), followed by satisfaction (85%), clarity of material (84.58%), usefulness (84.22%), ease of use (83.54%), and media display (83.28%). These results reflect that the learning media was very well received and was considered to have good appeal, was easy to apply by users, and was able to provide benefits in improving the quality of learning. The high motivation score reflects that the use of the website can strengthen student motivation in the learning process. These results are in line with Keller's ARCS Motivation Model (2010) which explains that interesting learning materials can increase student attention, relevance, self-confidence, and satisfaction during the learning process. Student learning motivation in the Technical Drawing subject is increased through attractive visual design, easy-to-use navigation, and material presentation that encourages active user involvement. The use of a website-based learning platform can be an effective way to increase student interest in participating in learning (Meduri et al., 2025) . The study reflects that presenting material through web-based media that has

interactive features, practical access, and is in accordance with student learning characteristics is able to create a more meaningful learning experience, thereby encouraging students to play an active role during the learning process. The use of web-based multimedia can optimize student motivation and learning outcomes through the delivery of material that is packaged in an interesting, interactive, and simple to understand way (Danaswari & Gafur, 2018) . The alignment of these findings indicates that the characteristics of website-based learning media that combine text, images, videos, and interactive learning activities can encourage increased student participation in the learning process.

8. Revise the Product

The product revision stage was conducted based on validation and trial results to ensure the learning media met quality standards before implementation. Based on the assessment results, no significant revisions were necessary because the media had received an average score of 95% from media experts and material experts, categorizing it as very suitable. Therefore, the product was declared ready for implementation in the learning process. The trial results also reflected a very positive response, with 96.25% from teachers and 84.31% from students, categorizing it as very suitable. Therefore, the revisions were limited to technical improvements, such as improvements to the appearance and editorial content, without changing the substance of the media.

Learning materials are considered suitable for use in the learning process if they meet quality standards in terms of content, design, and ease of use (Arsyad, 2017) . Revisions after evaluation aim to improve product quality, while media that have achieved a very high level of suitability generally only require minor revisions (Smaldino et al., 2019) . These results reflect that the developed Engineering Drawing learning media product has met the validity and practicality criteria so that it is suitable for implementation in the learning process at SMK Nasional Malang.

9. Product Results

The website-based learning media for the Technical Drawing subject is the result of this research and development that has gone through validation, testing, and refinement stages. The developed media is systematically designed by integrating interactive elements that support the learning process, technical drawing materials, and learning content. The media has an attractive and easy-to-use display so that it can be utilized by students independently or in classroom learning activities. The final product is equipped with a material menu, sample images, practice questions, and evaluations that aim to facilitate students in understanding the concepts and stages of technical drawing work more optimally. In accordance with the results of the validation and product testing that has been carried out , the website-based learning media has been proven to have good quality in terms of content, design, and use. These findings have implications if the use of website-based media is able to support a more optimal and participatory learning process that focuses on students. A creative and effective learning process can be realized through the use of learning media that has the potential to create active, interesting, and student-focused learning conditions (Uno, 2016) . In this study, the high response from teachers and students reflects that website-based media can optimize the quality of learning interactions through the integrated delivery of materials, images, videos, exercises, and evaluations within a single platform. This allows for more optimal learning activities compared to learning processes that focus solely on lectures.

Web-based e- learning media at the vocational high school level can optimize the flexibility of learning activities because students can implement the material without being limited by space and time. In addition to making it easier for teachers to manage learning, web-based media encourages students to study the material independently, thereby increasing learning effectiveness and aligning with the characteristics of vocational education that is oriented towards mastery of competencies (Sutama & Fajriani, 2022) . Interactively designed website-based learning media can encourage active student participation in learning because the material is delivered in an interesting way through a combination of text, images, videos, and interactive activities (Firdaus & Mahardika, 2022) . The use of web-based learning media developed with an interactive approach contributes to increasing student activeness during the learning process (Wulandari & Rayungsari, 2024) . Although this research focuses on Android-based media, the characteristics of interactive digital media have the same principles as website-based media, namely providing easy access, increasing interactivity, and supporting a student-focused learning process. Thus, the results of this study further strengthen the use of website-based digital learning media as an effective approach to optimizing the quality of learning in the digital era.

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CONCLUSION

The research results reflect that the digital learning platform designed to support the Technical Drawing subject obtained a review result by media experts and material experts of 95% each, thus obtaining a very appropriate predicate. The trial with teachers also obtained a percentage of 96.25%, while the student response reached 84.31%, which reflects that the media provides easy access, has an attractive design, provides benefits in learning, and supports increasing student learning motivation. These results prove that the media has met the aspects of design, material quality, ease of use, and its application in learning. The study results indicate that the website-based learning media that has been developed meets the standards of feasibility and practicality, so it is worthy of being used as an alternative media in learning Technical Drawing at SMK Nasional Malang.

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