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A Development of Multimedia Video Tutorials on German Embroidery in the Embroidery Art Course

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Abstrak

Multimedia video tutorial merupakan media pembelajaran yang dirancang untuk menyampaikan pesan pembelajaran secara efektif serta memberikan panduan langkah demi langkah bagi pengguna. Sulaman Jerman merupakan salah satu jenis sulaman berwarna yang membutuhkan ketekunan, kesabaran, dan ketelitian tinggi dalam proses pembuatannya. Hasil studi pendahuluan yang dilakukan dengan dosen pengampu mata kuliah Seni Sulam menunjukkan bahwa media pembelajaran yang digunakan pada materi Sulaman Jerman masih terbatas pada presentasi PowerPoint dan contoh fragmen sulaman. Selain itu, media pembelajaran berbasis mobile belum tersedia untuk mendukung mahasiswa dalam mempelajari proses pembuatan Sulaman Jerman. Penelitian ini bertujuan untuk melakukan analisis awal terhadap penggunaan media pembelajaran pada materi Sulaman Jerman; merancang dan mengembangkan multimedia video tutorial; melakukan validasi dan uji coba pengguna; merevisi produk; serta menganalisis hasil validasi multimedia video tutorial Sulaman Jerman yang telah dikembangkan. Metode penelitian yang digunakan adalah *Research and Development* (R&D) dengan tahapan analisis, desain, pengembangan, implementasi, dan evaluasi. Hasil validasi menunjukkan bahwa multimedia video tutorial Sulaman Jerman memperoleh skor persentase rata-rata sebesar 93% dari ahli materi dan 92% dari ahli multimedia. Berdasarkan temuan tersebut, multimedia video tutorial yang dikembangkan dikategorikan "Sangat Layak". Dengan demikian, media ini sangat sesuai untuk digunakan sebagai media pembelajaran dalam mata kuliah Seni Sulam. Peneliti merekomendasikan agar multimedia video tutorial Sulaman Jerman yang telah dikembangkan digunakan untuk mendukung proses pembelajaran, khususnya dalam membantu mahasiswa memahami teknik dan tahapan pembuatan Sulaman Jerman.
Kata Kunci: Sulaman Jerman, sulaman berwarna, multimedia, video tutorial

Abstract

Multimedia video tutorials are learning media designed to deliver instructional messages effectively and provide step-by-step guidance for users. German embroidery is a type of colored embroidery that requires perseverance, patience, and high precision in its production process. The results of a preliminary study conducted with the lecturer of the Embroidery Arts course showed that the learning media used for German embroidery material were limited to PowerPoint presentations and embroidery samples. In addition, mobile-based learning media had not yet been provided to support students in learning the process of making German embroidery. This study aimed to conduct a preliminary analysis of the use of learning media for German embroidery material; design and develop multimedia video tutorials; conduct validation and user testing; revise the product; and analyze the validation results of the developed German embroidery multimedia video tutorials. The research employed a Research and Development (R&D) design based on the ADDIE model (analysis, design, development, implementation, and evaluation). The validation results showed that the German embroidery multimedia video tutorial obtained an average percentage score of 93% from material experts and 92% from multimedia experts. Based on these findings, the developed multimedia video tutorial was categorized as "Very Appropriate". Therefore, it is highly suitable for use as a learning medium in the Embroidery Arts course. The researchers recommend that the developed German embroidery multimedia video tutorial be used to support the learning process, particularly in helping students understand the techniques and stages involved in making German embroidery.
Keywords: *German embroidery, colored embroidery, multimedia, video tutorial*

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INTRODUCTION

The learning process is essentially an educational activity characterised by reciprocal interactions between educators and students in an academic setting, with the aim of achieving

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predetermined learning objectives. To ensure effectiveness, the process of learning involves several interrelated components, namely learning objectives, materials, methods, media, and evaluation (Harahap et al., 2022). Among these, learning media plays a particularly crucial role, as it functions as a conduit for messages from the educator to the learner, stimulating thoughts, feelings, attention, and curiosity, which in turn fosters active engagement in learning.

Previous studies have emphasised that appropriate learning media significantly enhance the effectiveness of teaching and learning (Diah & Astuti, 2021; Kurniawan & Widiastuti, 2022). However, most learning media employed in practice, particularly in embroidery education, remain limited to static forms such as PowerPoint slides or handouts, which have constraints in demonstrating detailed practical processes. With the increasing demand for dynamic and interactive learning, multimedia has emerged as a powerful tool. Multimedia integrates text, images, audio, video, and animation, thereby offering a more comprehensive and engaging learning experience compared to traditional media (Puspitasari et al., 2024; Puspitasari & Pratama, 2024).

Several researchers have examined the application of multimedia in vocational and art education. For example, Diah and Astuti (2021) developed video tutorial media for bridal make-up practice, which provided significant benefits in terms of independent learning. Similarly, Irmayanti et al. (2020) found that video tutorials improved students' competencies in garment design practice. However, despite the demonstrated advantages, very few studies have explored the integration of multimedia tutorials in embroidery, particularly in German embroidery, which is one of the most complex and precise techniques. This gap is significant, as German embroidery requires high levels of patience, accuracy, and diagonal stitch orientation, making it difficult for students to grasp the technique solely from static teaching aids.

German embroidery, also known as flat embroidery, is a form of coloured embroidery applied to household linens and garments (Marlianti & Handayani, 2017). Unlike other techniques, it does not employ filler stitches, but rather requires meticulous use of single-thread flat stitches aligned diagonally, especially on curved motifs (Sofronova & Angelova, 2025). These specific demands present challenges in teaching, as lecturers often have to repeat explanations and demonstrations. Preliminary observations in the Embroidery Arts course indicated that both lecturers and students face difficulties due to the absence of multimedia tutorials; currently, only PowerPoint and sample fragments are used. Students reported that mastering the flat stitch in German embroidery requires repeated practice and clearer demonstrations than those provided by static media.

To address this gap, the present study proposes the development of multimedia video tutorials as an alternative learning medium. Unlike conventional slides or fragments, multimedia tutorials allow students to repeatedly access step-by-step processes both inside and outside the classroom, thus fostering independent learning, improving precision, and enhancing motivation.

The objectives of this study are: (1) to design and develop multimedia video tutorials for German embroidery in the Embroidery Art course, (2) to validate the appropriateness of the developed media through expert assessment, and (3) to evaluate user responses to the tutorial. The novelty of this research lies in introducing multimedia video tutorials into German embroidery practice, an area with limited prior investigation. By filling this gap, the study contributes to enhancing the quality of vocational education in embroidery by providing an accessible, effective, and engaging learning medium.

RESEARCH METHOD

Method

This study employed a Research and Development (R&D) approach using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) as the main research framework. The R&D approach was considered appropriate because the purpose of the study was to produce a valid, practical, and effective multimedia tutorial as an instructional product (Risal et al., 2022).

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Within this framework, the ADDIE model was chosen due to its systematic structure, flexibility, and widespread application in the development of instructional media (Adeoye et al., 2024; Branch & Varank, 2009). The five stages of ADDIE provide clear guidance for researchers and educators in designing, testing, and refining learning resources in a structured and iterative manner.

Research Design and Subjects

The research focused on the development of multimedia video tutorials for German embroidery in the Embroidery Arts course. The subjects of this study included: (1) lecturers of the Embroidery Arts course, who provided input during the needs analysis and validation stages, (2) experts in learning materials and multimedia, who validated the product, and (3) 36 students of the 2022 cohort from the Fashion Education Study Programme, who participated as users during the trial stage.

Research Procedure

The procedure followed the five stages of the ADDIE model:

1. **Analysis**
   A needs assessment was conducted through field studies with course lecturers and literature reviews on German embroidery and multimedia-based learning. This stage identified the gap between existing learning media (PowerPoint and fragments) and the need for interactive video tutorials.
2. **Design**
   The conceptual framework and content were planned, including the formulation of learning objectives, selection of participants, creation of a storyboard and storyline, and compilation of embroidery materials.
3. **Development**
   The product was created based on the design. This stage involved material collection (tools, embroidery materials, software, and hardware) and production, consisting of filming embroidery steps, dubbing narration, video editing (adding text, images, audio, animation, and effects), multimedia integration, testing, and publishing.
4. **Implementation**
   The developed multimedia tutorial underwent validation by material experts and multimedia experts, followed by limited user testing with students to obtain feedback on clarity, usability, and relevance.
5. **Evaluation**
   Data from validation and user trials were collected and analysed quantitatively using percentage scores to determine feasibility. The Likert scale criteria were applied to classify feasibility into categories ranging from “Very Inappropriate” to “Very Appropriate.”

Table 1. Expert Validation Feasibility Categories

No	Expert	Average Score Percentage
1	<21%	Very Inappropriate
2	21%–40%	Inappropriate
3	41%–60%	Fairly Appropriate
4	61%–80%	Appropriate
5	81%–100%	Very Appropriate

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Instruments and Data Analysis

The research instruments included validation sheets for material experts, multimedia experts, and student questionnaires for user trials. The validation sheets assessed aspects such as content accuracy, clarity of explanations, visual and audio quality, and instructional design. The student questionnaires measured practicality, attractiveness, and ease of use. Data were analysed descriptively by calculating average percentage scores for each aspect, which were then categorised according to feasibility levels.

The systematic application of the ADDIE model ensured that the developed multimedia tutorial was rigorously designed, validated, and tested, thus providing a reliable medium for supporting embroidery practice learning.

RESULTS AND DISCUSSION

Results

The aim of this study was to design, develop, and validate multimedia video tutorials for German embroidery in the Embroidery Arts course. The findings obtained from the preliminary study, the design and development stage, validation testing, and user trials are discussed in relation to the research objectives and previous literature.

The preliminary study highlighted a gap in the learning media currently used for German embroidery, which relied mainly on PowerPoint presentations and embroidery fragments. These static media were insufficient for demonstrating the detailed and precise steps required in German embroidery, particularly the diagonal flat stitch that demands accuracy and patience. This finding aligns with previous research (Diah & Astuti, 2021; Irmayanti et al., 2020), which noted that static or text-based media often limit the teaching of practical skills. However, unlike their work on bridal make-up and CAD tutorials, this study specifically identified the absence of dynamic learning media in embroidery practice. This highlights a distinct gap in vocational education, particularly in embroidery arts.

Design and Development of Multimedia Video Tutorials

The developed multimedia tutorials were designed as an integrated learning platform that combined multiple elements such as text, images, animations, audio narration, and video demonstrations into a cohesive instructional package. Each tutorial systematically presented the learning materials, beginning with the definitions and characteristics of German embroidery, followed by detailed explanations of decorative motifs, common stitches, and their practical applications. The development process involved several production stages, including shooting the embroidery demonstrations, dubbing with voice-over explanations, editing the visual and audio materials, and assembling them into a multimedia package. The final product was uploaded and made accessible through Google Drive, ensuring that students could easily access the tutorials across different devices. The use of cloud storage as the delivery medium added significant pedagogical value by enabling asynchronous access anytime and anywhere, aligning with Trilaksono (2020), who emphasizes that cloud-based platforms support flexibility and continuity in learning (Anitha, 2025; Bramhe & Pimple, 2025).

This approach represents an advancement compared to earlier studies that relied primarily on desktop-based applications or classroom-only multimedia presentations. By optimizing the tutorials for mobile-friendly use, the study addressed the growing demand for learning resources that accommodate students' diverse learning contexts and schedules, as suggested by Park (2011), who highlights the importance of mobile learning in expanding educational access. Moreover, integrating multimedia components in embroidery education was found to support different learning styles and increase learner engagement, consistent with Mayer's cognitive theory of multimedia learning, which

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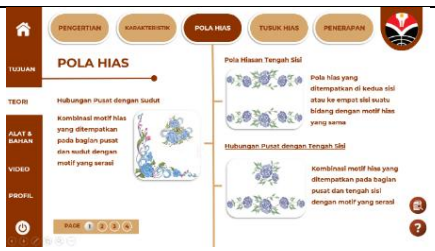
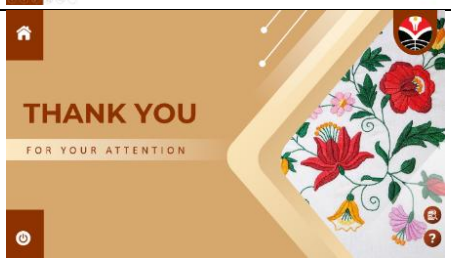
underscores that meaningful learning occurs when verbal and visual information are presented in a complementary way (Mayer, 2002; Puspitasari & Pratiwi, 2021).

The innovation of this study lies not only in the combination of rich multimedia features but also in the delivery method, which leverages cloud storage for wider dissemination. This ensures that learners are not constrained by time or place, supporting the principle of ubiquitous learning (Bomsdorf, 2005). The outcome of the development is illustrated in Figure 1, which presents the multimedia video tutorial interface, showing how the learning materials were effectively structured to provide both theoretical explanations and practical demonstrations.

Table 2. Design of Multimedia Video Tutorials

No.	Visualization	Description
1		Opening interface Using images, text, and animation
2		User Guide Using text, animation, and image
3		Home menu The front page of the multimedia display.
4		Learning objectives Using text, image, and animation
5		Definition of German art embroidery Using text, animation, and image

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No.	Visualization	Description
6		Pattern of art embroidery Using text, animation, and image
7		Embroidery stitch Using text, animation, and image
8		Application of German Embroidery Using text, image, and animation
9		Equipment for German Embroidery Using text, image, and animation
10		Tutorial video Using video and animation
11		References Using text
12		Closing interface Using text, image, and animation

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Validation by Experts

The validation process showed that the multimedia video tutorials achieved high levels of feasibility, with 93% from material experts and 92% from multimedia experts. These results categorised the tutorials as "Very Appropriate" for use in embroidery learning. These findings confirm previous research by Pujawan (2018), which stated that interactive tutorials can improve student satisfaction and mastery (Nawai et al., 2025; Sripan & Lertpongrujikorn, 2025; Tambak et al., 2025). However, this study advances the field by providing evidence that multimedia tutorials are effective in highly specialised and meticulous practices such as German embroidery, which require not only theoretical knowledge but also fine motor precision.

Table 3. Expert Validation Results

No	Expert	Average Score Percentage
1	Material Expert	93%
2	Multimedia Expert	92%

User Trials

User testing conducted with 36 students revealed an average feasibility score of 89%, which falls into the "Very Appropriate" category. This high score demonstrates that the developed tutorial media not only meets usability standards but also provides effective support for the learning process. Students consistently reported that the step-by-step embroidery tutorials facilitated their comprehension of each stage in the embroidery process, while also fostering the ability to engage in independent practice without constant teacher supervision. This aligns with findings from Irmayanti et al. (2020), who highlight the critical role of video-based tutorials in strengthening independent learning, particularly in vocational and skill-based education.

Furthermore, the results resonate with the broader perspective of multimedia learning theory proposed by Mayer (2002), which emphasises that well-structured multimedia resources, (combining visual and verbal explanations) enhance learners' cognitive processing and retention of procedural knowledge. In the context of practical skills like embroidery, such resources reduce cognitive load by providing clear demonstrations, thereby improving both accuracy and self-efficacy

The novelty of this research lies in extending the established benefits of video tutorial media into the domain of embroidery, a field where the integration of multimedia innovation remains limited. While prior studies have predominantly focused on areas such as culinary skills (Ozkan et al., 2025; Sanaan et al., 2025) or mechanical training (Navarrete et al., 2025), few have systematically examined embroidery education. Therefore, this study not only validates the feasibility of tutorial-based media but also expands its application into new territory, contributing to the diversification of multimedia-assisted learning within vocational education.

Discussion

This study aimed to design and develop multimedia video tutorials for German embroidery in the Embroidery Art course, validate the appropriateness of the developed media through expert assessment, and evaluate user responses to the tutorial. The findings indicate that the developed

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multimedia video tutorial is highly feasible for instructional use. This is shown by the validation score of 93% from material experts, 92% from multimedia experts, and 89% from user trials involving 36 students. These findings suggest that the developed media is pedagogically appropriate, technically acceptable, and positively received by students as a learning medium for German embroidery.

The preliminary study revealed that the learning media previously used for German embroidery were still limited to PowerPoint presentations and embroidery fragments. Although these media can support the delivery of basic concepts, they are less sufficient for demonstrating detailed and sequential embroidery procedures. German embroidery is a type of colored embroidery that requires persistence, patience, hand precision, stitch accuracy, and repeated practice. Therefore, static media are limited in helping students observe the process of making stitches, controlling thread tension, following stitch direction, and understanding the gradual formation of motifs. The developed multimedia tutorial responds to this pedagogical gap by transforming German embroidery learning from static visual explanation into dynamic, procedural, and repeatable demonstration.

The design of the multimedia video tutorial is consistent with the nature of German embroidery as a practice-based and skill-oriented subject. The media integrates several elements, including text, images, animation, audio narration, and video demonstration. The learning structure begins with the opening interface, user guide, home menu, learning objectives, definition of German embroidery, embroidery patterns, embroidery stitches, application of German embroidery, equipment, tutorial video, references, and closing interface. This structure is important because vocational learning requires not only conceptual understanding but also procedural clarity. In practical subjects such as embroidery, students need to know what should be done, how it should be done, and in what sequence each step should be carried out.

The findings of this study can be strongly explained through the Cognitive Theory of Multimedia Learning. Mayer and Moreno (2003) explain that meaningful learning occurs when learners process information through verbal and visual channels, while also considering the limited capacity of working memory. In the context of this study, the combination of narration, text, images, animation, and video demonstration allows students to connect what they read, hear, see, and practice. This is particularly important in German embroidery learning because students need to understand the conceptual aspects of the technique while simultaneously observing the practical movement of the needle, direction of stitches, formation of motifs, and finishing process. Therefore, the multimedia tutorial does not merely function as a digital supplement, but as an instructional bridge between theoretical explanation and procedural skill acquisition.

The findings are also supported by Cognitive Load Theory. Sweller (1988) argues that instructional materials should be designed to reduce unnecessary cognitive load so that learners can focus their mental resources on essential learning processes. German embroidery involves complex psychomotor activities that require students to coordinate visual attention, hand movement, stitch direction, and neatness. When students learn only through static images or one-time classroom demonstrations, they may experience difficulty reconstructing the full sequence of the embroidery process. The video tutorial helps reduce extraneous cognitive load by presenting the technique in a concrete, sequential, and observable format. Through this format, students can focus on understanding and practicing the procedure rather than spending excessive effort imagining the movement from static materials.

The use of video tutorial media is also relevant to Social Cognitive Theory, particularly the concept of observational learning. Bandura (1986) emphasizes that individuals can learn new behaviors and skills by observing models, retaining the observed actions, reproducing them, and developing motivation to perform them. In this study, the tutorial video acts as a visual model that demonstrates how German embroidery should be performed. Students can observe the stitch-making process, remember the sequence of actions, imitate the demonstrated procedure, and repeat the practice independently. This theoretical perspective explains why video demonstration is more

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suitable than static media for teaching embroidery skills. Since embroidery involves fine motor skills and visual accuracy, students benefit from being able to watch a model perform the technique repeatedly.

The design of the tutorial also reflects principles of effective instructional video. Fiorella and Mayer (2018) emphasize that instructional videos are useful for procedural learning, especially when learners are given control over the pace of instruction. Features such as pausing, replaying, and reviewing specific parts of the video allow students to regulate their own learning process. This is highly relevant to German embroidery because students may need to repeat difficult stages several times before they can perform the technique accurately. Compared with one-time lecturer demonstrations, multimedia video tutorials provide more flexible access to the learning process. Students are no longer fully dependent on the lecturer's repeated explanation because they can revisit the tutorial when practicing independently.

The validation results further strengthen the appropriateness of the developed media. The material expert validation score reached 93%, while the multimedia expert validation score reached 92%, both categorized as "Very Appropriate." These results indicate that the tutorial is appropriate in terms of content accuracy, instructional relevance, visual presentation, technical quality, and media design. The high score from material experts suggests that the content is aligned with the learning objectives and technical characteristics of German embroidery. Meanwhile, the high score from multimedia experts indicates that the media presentation is clear, attractive, systematic, and technically suitable for use in learning. Thus, the developed tutorial can be considered a valid instructional product for supporting embroidery learning.

The development process also aligns with the ADDIE instructional design model. The stages of analysis, design, development, implementation, and evaluation provide a systematic framework for creating learning media that responds to students' needs, course objectives, expert validation, and user feedback. Spatioti et al. (2022) explain that the ADDIE model is relevant for the development of technology-supported and distance learning because it provides a structured process for designing learning materials, implementing them, and evaluating their quality. In this study, the ADDIE framework ensured that the multimedia tutorial was not developed merely as a digital product, but as an instructional medium based on identified learning problems, systematic design, expert judgment, and student responses.

The user trial involving 36 students produced an average score of 89%, which also falls into the "Very Appropriate" category. This result indicates that students responded positively to the developed tutorial and perceived it as useful for supporting the learning process. The positive response may be explained by the fact that video tutorials provide students with greater learner control. Students can access the material repeatedly, review difficult steps, and practice independently without depending entirely on lecturer supervision. This finding is consistent with Kay's (2012) review of 53 peer-reviewed studies on video podcasts in education, which found that video-based learning can support positive attitudes, learner control, study habits, and learning performance.

The user response can also be interpreted through the Technology Acceptance Model. Davis (1989) explains that user acceptance of technology is influenced by perceived usefulness and perceived ease of use. In this study, the high user response score suggests that students perceived the multimedia tutorial as useful for understanding the stages of German embroidery and easy to use as a learning medium. The fact that the tutorial was accessible through Google Drive also supports this acceptance because students could access the material through various devices and learning contexts. Thus, the tutorial is not only pedagogically appropriate but also practically accessible for students.

The mobile-friendly and cloud-based accessibility of the tutorial adds further value to the learning process. By uploading the tutorial to Google Drive, students can access the media anytime and anywhere using different devices. This supports flexible, asynchronous, and self-paced learning. Crompton and Burke (2018) state that mobile learning in higher education expands learning

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opportunities beyond the classroom and supports learning across multiple contexts. In German embroidery learning, this accessibility is particularly meaningful because practice often takes place outside scheduled class time. Students may need to watch the tutorial while practicing at home, repeating certain parts of the video until they understand the correct technique. Therefore, the media supports learning continuity between classroom instruction and independent practice.

The findings also support the argument that dynamic media are more suitable than static media for procedural and motor-based learning. H'mida et al. (2020) found that video produced better learning performance than static picture formats in the acquisition of complex motor skills. Although their study was conducted in a physical education context, the principle is relevant to embroidery learning because both involve observation, imitation, motor coordination, and procedural accuracy. German embroidery requires students to observe hand movement and reproduce it with precision. Therefore, video tutorial media is pedagogically justified because it allows learners to observe sequential movement and practice it repeatedly.

These findings are consistent with previous studies in embroidery and fashion education. Marlina et al. (2019) developed multimedia video tutorials for white embroidery and found that the developed media was appropriate for learning because it provided clear knowledge, attractive presentation, and understandable content. Similarly, Yuliarma et al. (2024) developed a video tutorial-based training model for embroidery learning in fashion vocational education and found that the model was valid, practical, and effective in supporting learning. Compared with these previous studies, the present study contributes specifically to German embroidery, which remains relatively underexplored in multimedia-based embroidery learning research. Therefore, this study expands the application of video tutorial media into a more specific embroidery technique that requires high precision and procedural guidance.

Overall, the findings indicate that the German embroidery multimedia video tutorial is theoretically and empirically feasible for learning use. The media supports dual-channel information processing, reduces cognitive load, enables observational learning, provides learner control, supports mobile access, and facilitates independent practice. These aspects are essential in vocational education because students are expected not only to understand concepts but also to develop practical competence. In this sense, the developed media contributes to the modernization of embroidery learning by integrating digital technology into a craft-based learning process.

Contribution and Findings

This study makes several significant contributions to vocational education, particularly in the field of embroidery learning. First, it introduces multimedia video tutorials into German embroidery practice, an area that has received limited attention in previous studies. While earlier research has examined video tutorials in white embroidery, Terawang embroidery, and Minangkabau embroidery, this study focuses specifically on German embroidery as a colored embroidery technique that requires patience, precision, and careful procedural guidance.

Second, this study contributes to the development of digital learning media for craft-based vocational education. The findings show that German embroidery can be taught not only through direct lecturer demonstration and physical samples, but also through structured multimedia tutorials that combine text, images, animation, narration, and video demonstration. This is important because craft learning often depends heavily on face-to-face instruction, whereas digital media can provide repeated access, flexible learning time, and support for independent practice.

Third, this study provides empirical evidence that the developed German embroidery multimedia tutorial is highly appropriate for learning use. The media obtained 93% from material experts, 92% from multimedia experts, and 89% from student users. These three validation points are significant because they indicate that the media is not only technically presentable but also pedagogically relevant and acceptable to learners.

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Fourth, this study strengthens the application of multimedia learning theory in textile and embroidery education. The integration of video demonstration, narration, text, images, and animation supports procedural knowledge by helping students connect what they see, hear, and practice. Thus, this study extends the relevance of multimedia learning theory from general academic learning into a more specific vocational craft context.

Fifth, this study offers practical implications for lecturers and institutions. The developed tutorial can reduce students' dependence on repeated lecturer demonstrations, support independent learning, and provide an accessible learning resource that can be used before, during, and after class. For vocational education, this finding is important because high-quality digital media can help preserve craft techniques while also modernizing how practical skills are taught in higher education.

Limitations and Future Research

Although the findings show that the developed multimedia video tutorial is highly feasible and positively received by users, this study has several limitations. First, the data mainly consist of expert validation and user responses. Therefore, the findings should be interpreted as evidence of feasibility, appropriateness, and user acceptance rather than definitive evidence of learning effectiveness. Second, the user trial involved 36 students, which is sufficient for initial product evaluation but still limited for broader generalization. Third, this study did not compare student performance between those who used the multimedia tutorial and those who learned through conventional media.

Future studies are recommended to conduct experimental or quasi-experimental testing to examine the effect of multimedia video tutorials on students' embroidery performance. Learning outcomes can be measured through practical performance rubrics, stitch accuracy, neatness, motif completion, time efficiency, learning motivation, and self-efficacy. Further research may also develop interactive features, such as embedded quizzes, reflective prompts, slow-motion demonstrations, or feedback mechanisms, to strengthen the instructional quality of the tutorial.

CONCLUSION

This study successfully designed, developed, validated, and evaluated multimedia video tutorials for German embroidery in the Embroidery Art course. The development of this media was based on the identified need for more dynamic and accessible learning resources, as the previous instructional media were limited to PowerPoint presentations and embroidery fragments. Since German embroidery requires precision, patience, stitch accuracy, and repeated practice, the use of multimedia video tutorials provides a more suitable instructional approach for demonstrating procedural and psychomotor skills.

The developed multimedia tutorial integrates text, images, animation, narration, and video demonstrations into a structured learning package. This integration allows students to understand both the conceptual and practical aspects of German embroidery. The media also supports flexible and independent learning because students can access the tutorial repeatedly through digital devices and review difficult stages according to their own learning pace.

The validation results showed that the developed media was categorized as "Very Suitable," with a score of 93% from material experts and 92% from multimedia experts. In addition, the user trial involving 36 students obtained an average score of 89%, indicating positive student responses toward the tutorial. These findings show that the multimedia video tutorial is appropriate in terms of content, media design, usability, and learning support. Therefore, the developed media can be recommended as a learning medium for German embroidery in the Embroidery Art course.

The novelty of this study lies in the introduction of multimedia video tutorials into German embroidery learning, a specific embroidery technique that has received limited attention in previous multimedia-based vocational education studies. This study contributes to the development of digital learning media in craft-based vocational education by providing an accessible, engaging, and practice-oriented instructional resource. However, this study is limited to expert validation and user

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response evaluation. Future research is recommended to examine the effectiveness of the tutorial through experimental or quasi-experimental methods by measuring students' practical performance, stitch accuracy, learning motivation, and independent learning ability.

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