



# Effectiveness of Vidio-Based Learning in Flat Pattern Design to Improve Learning Outcomes

Puspaneli<sup>1\*</sup>, Puji Hujria Suci<sup>1</sup>, Mimi Yupelmi<sup>2</sup>, Sri Zulfia Nofrita<sup>1</sup>, Ilham Zamil<sup>1</sup>, Vina Oktaviani<sup>1</sup>, Rafikah Husni<sup>1</sup>, Reni Fitria<sup>1</sup>, Hadiastuti<sup>1</sup>, Hazevi Atila Yazel Aze<sup>1</sup>, Yulia Aryati<sup>1</sup>, Rima Agustia Utami<sup>1</sup>

<sup>1</sup> Department of Family Welfare Studies, Universitas Negeri Padang, Padang, Indonesia.

<sup>2</sup> Department of Cosmetology and Beauty, Universitas Negeri Padang, Padang, Indonesia.

Received: March 27, 2026

Revised: April 21, 2026

Accepted: May 25, 2026

Published: May 31, 2026

Corresponding Author:

Puspaneli

[puspaneli@fpp.unp.ac.id](mailto:puspaneli@fpp.unp.ac.id)

DOI: [10.29303/jppipa.v12i5.15101](https://doi.org/10.29303/jppipa.v12i5.15101)

 Open Access

© 2026 The Authors. This article is distributed under a (CC-BY License)



**Abstract:** This study examined the effectiveness of video tutorials in enhancing students' cognitive understanding and psychomotor skills in Flat Pattern Design learning. A quasi-experimental pretest-posttest design was employed involving 30 fashion design students selected through purposive sampling. The instructional intervention utilized video tutorials that demonstrated each stage of the flat pattern design process, enabling students to review learning materials repeatedly and practice independently. Data were collected through cognitive achievement tests and psychomotor performance assessments and analyzed using descriptive and inferential statistics. The findings revealed statistically significant improvements in students' learning outcomes following the intervention ( $p < 0.05$ ). Cognitive achievement scores increased from pretest to posttest, accompanied by substantial gains in psychomotor performance. Classroom observations also indicated high levels of participation and engagement throughout the learning activities. These results suggest that video tutorials provide effective support for procedural learning by facilitating visual demonstration, self-paced practice, and skill mastery. The study contributes to the growing body of research on digital learning in vocational education by demonstrating the potential of video-based instruction to strengthen both conceptual understanding and practical competencies in fashion design courses

**Keywords:** Effectiveness; Flat pattern design; Slash method; Video tutorial

## Introduction

The rapid expansion of digital learning has transformed teaching practices across educational sectors, including vocational education (T. Wang et al., 2023). While online learning offers greater flexibility, it presents substantial challenges for courses that rely heavily on practical skill development (Gong, 2021). In fashion design education, flat pattern making is a fundamental competency that requires procedural knowledge, visual accuracy, and manual dexterity (Gui-Wei & Guo-Bao, 2024). Traditionally, these skills are taught through face-to-face demonstrations, allowing students to observe each stage of the drafting process directly (Zhuge & Li, 2024). However, the transition to digital learning environments has reduced

opportunities for real-time observation and interaction, making it more difficult for students to understand detailed technical procedures (Peng & Sirisuk, 2024).

To address these challenges, video-based instruction has increasingly been adopted as a learning medium in vocational education (Raza et al., 2024). Previous studies have reported that video tutorials support independent learning, improve procedural understanding, and enhance practical performance. For example, (Xu, 2024) found that vocational students who learned through video tutorials achieved higher practical learning outcomes than those who relied solely on text-based materials. Likewise, Wang (2024) reported positive effects of video tutorials on skill acquisition in fashion-related courses. These findings suggest that video-based learning can facilitate the delivery of

## How to Cite:

Puspaneli, Suci, P. H., Yupelmi, M., Nofrita, S. Z., Zamil, I., Oktaviani, V., ... Utami, R. A. (2026). Effectiveness of Vidio-Based Learning in Flat Pattern Design to Improve Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, 12(5), 896-905. <https://doi.org/10.29303/jppipa.v12i5.15101>

practical content in online environments (Zheng & An, 2023).

Despite this evidence, limited attention has been given to the specific context of flat pattern design learning (Zhao, 2025). Pattern drafting involves a sequence of interconnected procedures, including body measurement, pattern construction, marking, and pattern manipulation (Ye & Kuang, 2024). Errors occurring in the early stages often affect subsequent processes and ultimately influence garment fit and quality (Tian & Li, 2024). Consequently, students require clear visual demonstrations and repeated exposure to each procedural step (Qian, 2022). Conventional online lectures and discussion-based learning environments often fail to provide this level of instructional support (Dohan et al., 2024).

A review of the existing literature reveals an important research gap (Chowdary et al., 2019). Previous studies have generally examined the effectiveness of video tutorials in broad vocational learning contexts or focused primarily on cognitive learning outcomes (Liu et al., 2022). Few studies have investigated their application in flat pattern design courses, and even fewer have simultaneously examined cognitive understanding and psychomotor skill development (Favi et al., 2021). Furthermore, limited empirical evidence is available regarding how students utilize video features such as replaying, pausing, and reviewing critical procedures to support skill acquisition in vocational learning (Cong et al., 2021).

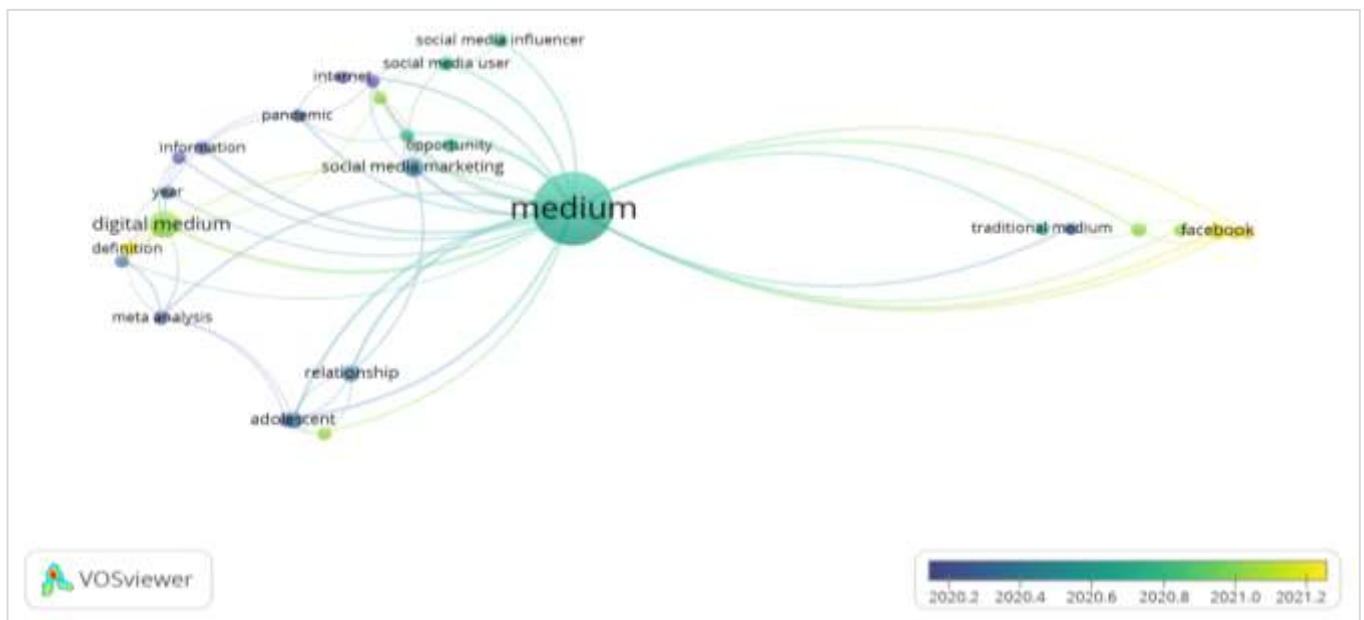


Figure 1. Digital media keywords network visualization

In Asia and Africa, many vocational institutions have adopted flat pattern techniques due to their design flexibility and cost efficiency (Chen et al., 2021). However, empirical research on video tutorial effectiveness specifically for flat pattern design courses remains very limited in Indonesia. Gómez (2021) examined synchronous versus asynchronous learning across multiple vocational subjects but did not specifically analyze flat pattern making (Wu et al., 2025). Liu (2022) identified challenges in practical learning during the pandemic but did not test video tutorial interventions (Yanqiong, 2024). Therefore, a clear research gap exists: no study has systematically evaluated the effectiveness of asynchronous video tutorials for teaching flat pattern design in Indonesian vocational higher education (Gao et al., 2026).

The nature of flat pattern skills demands detailed process visualization something that cannot be adequately conveyed through standard online lectures or text-based forum discussions alone (Zhang & Wu, 2024). Students need to observe how a lecturer positions the ruler, where to apply pressure when cutting paper, and how to interpret grainlines and notches on a pattern (Tang, 2026). Video tutorials offer unique affordances: the ability to pause, rewind, replay, and focus attention on specific steps (Wan et al., 2020). These affordances may be particularly valuable for students with varying learning paces or those who need repeated exposure to complex procedures (W. Fang et al., 2022).

This study, therefore, evaluates the effectiveness of video tutorials in online learning for the Flat Pattern Design course within a Fashion Design Vocational Education Study Programme in Indonesia. Unlike

previous studies that focused on general e-learning platforms or cognitive outcomes alone, this research examines both cognitive understanding and psychomotor skill improvement. Additionally, this study investigates how students interact with video media during learning specifically their use of repetition, pausing, and focused attention on critical pattern-making steps. By addressing these questions, this research aims to provide empirical evidence that can guide vocational educators in designing effective blended learning strategies for practice-based courses.

## Method

### *Research Design and Setting*

This study employed a quasi-experimental pretest-posttest design to investigate the effectiveness of video tutorial media in enhancing students' cognitive understanding and psychomotor skills in Flat Pattern Design learning. The study was conducted in the Fashion Design Vocational Education Study Programme, Department of Family Welfare Education, Padang State University. The design enabled the researchers to compare students' learning outcomes before and after exposure to the instructional intervention, thereby providing evidence of changes associated with the use of video tutorials (Liu et al., 2022).

### *Participants*

The participants were 30 undergraduate students enrolled in the Flat Pattern Design course. Purposive sampling was used to ensure that all participants possessed the prerequisite knowledge and skills required for the learning activities. To be included in the study, students had to be actively registered in the course, have successfully completed Basic Sewing and Textile Science courses, and voluntarily agree to participate. All students who met these criteria provided informed consent and completed the research procedures. All 30 students agreed to participate and signed consent forms prior to data collection.

### *Development of Video Tutorial Media*

The instructional videos used in this study were developed by a nationally certified instructor with expertise in fashion design and garment construction. The development process was guided by multimedia learning principles proposed, particularly the principles of segmentation, signaling, and the integration of visual and verbal information. The content was organized into short learning modules, each focusing on a specific stage of women's flat pattern construction. High-resolution demonstrations, narrated explanations, and visual annotations were incorporated to facilitate students'

understanding of key procedures. Special attention was given to the slash technique because it is widely recognized as one of the most complex stages in pattern development.

Before implementation, the videos were reviewed by two experts in vocational education with extensive teaching experience. The review focused on content accuracy, instructional suitability, and technical quality. The resulting Cohen's kappa coefficient of 0.85 indicated a high level of agreement between reviewers, suggesting that the instructional materials were appropriate for classroom use.

### *Cognitive Ability Measurement*

Students' cognitive achievement was assessed using a 25-item multiple-choice test administered before and after the intervention. The instrument was designed to measure conceptual understanding of flat pattern design principles, drafting procedures, and pattern construction techniques. Reliability testing demonstrated satisfactory internal consistency, with a Cronbach's alpha coefficient of 0.82.

### *Psychomotor Performance Assessment*

Students' practical skills were evaluated using an observation rubric consisting of 15 performance indicators covering preparation, drafting procedures, measurement accuracy, application of techniques, and the quality of the final pattern. The rubric enabled systematic assessment of students' performance throughout the practical learning activities.

### *Student Learning Engagement*

Student engagement was documented through an observation sheet designed to capture participation during learning activities. The indicators included attention to instructional materials, involvement in problem-solving tasks, participation in discussions, and interaction with peers and instructors throughout the learning process.

### *Intervention Procedure*

The intervention was implemented over six instructional sessions during one semester. At the beginning of the study, students completed a pretest to determine their initial level of understanding. They were then provided with access to the video tutorial modules, which served as the primary learning resource throughout the course activities.

During each session, students studied the instructional videos while simultaneously completing practical pattern-making tasks. The videos could be paused, replayed, and reviewed as often as needed, allowing students to revisit difficult procedures and learn according to their individual pace. Lecturers

facilitated the sessions by providing clarification, monitoring students' progress, and offering feedback when necessary. At the end of the intervention period, students completed the posttest and participated in the psychomotor performance assessment.

*Statistical Analysis for Cognitive Data*

To measure students' cognitive abilities, a written test instrument consisting of 25 multiple-choice questions was used and validated (reliability  $\alpha = 0.82$ ). The test was given twice, namely before (pre-test) and after (post-test) video tutorial intervention. The test data were analysed using paired sample t-test for normally distributed data, with the formula:

$$t = \frac{d}{S_d/\sqrt{n}} \tag{1}$$

where  $d$  is the mean difference between pre-test and post-test scores,  $S_d$  is the standard deviation of the score difference, and  $nn$  is the number of participants. If the data is not normally distributed, the non-parametric Wilcoxon Signed-Rank Test is used, with the formula:

$$W = \sum R_i^+ \tag{2}$$

which is the sum of the positive ranks of the difference between pre- and post-test scores. In addition, the effectiveness of the intervention on improving learning outcomes was also analysed using Cohen's  $d$  effect size calculation, as follows:

$$d = \frac{X_{post} - X_{pre}}{s_p} \tag{3}$$

Retrieved from

$$x = \sqrt{\frac{s_{pre}^2 + s_{post}^2}{2}} \tag{4}$$

To measure students' psychomotor skills, a standardised observation sheet was used that included 15 assessment indicators, ranging from work planning, the manufacturing process, to the quality of the product. Each indicator was scored using a 1-5 Likert scale, and the total score was evaluated based on the effectiveness criteria developed by Sugiyono (2009), namely: Highly Ineffective (1-10); Ineffective (11-20); Moderately Effective (21-30); Effective (31-40); Highly Effective (41-50)

The psychomotor data were then analysed descriptively to see the distribution of effectiveness, and inferentially using the Wilcoxon test if the data were not normal. All analyses were conducted using SPSS Statistics version 23 software (IBM Corp., Armonk, NY). The Kolmogorov-Smirnov normality test was used to determine the appropriate type of inferential test. The validity of the results was maintained through a

triangulation process between lecturer assessment, peer assessment, and student self-review. The assessment was conducted in a blinded manner to avoid bias.

**Result and Discussion**

The video tutorial media developed in this study presents a step-by-step demonstration of making women's flat patterns. Each step is evaluated using a performance scoring system, i.e. score 0 if not done, score 1 if done partially, and score 2 if done correctly. This assessment was used to measure students' psychomotor achievement based on practical performance. Table 1 presents a summary of the scoring of the skill observation process.

This study involved 30 students who were divided into 3 classes, each consisting of 10 participants. Cognitive testing was conducted through multiple choice questions to measure conceptual understanding before and after the use of video tutorials. The average value of pretest and posttest results in each class is shown in Table 1.

**Table 1.** Average Student Pretest and Posttest Score

Class	Number of participants	Pretest average	Posttest Average
Class 1	10	5.5	9.7
Class 2	10	5.5	9.8
Class 3	10	5.35	9.8

Based on Table 1, there is an increase in scores in all classes after learning using video tutorials. The average score increase was 4.2 to 4.45 points, indicating that the video tutorial intervention had a positive effect on improving student learning outcomes. To ensure that the data fulfils the normality assumption, the Kolmogorov-Smirnov test was conducted. The results are presented in Table 2.

**Table 2.** Kolmogorov-Smirnov Normality Test

Variable	N	Mean	Std. Dev.	Sig. (2-tailed)
Pretest Class 1	20	5.5	1.57	0.265
Posttest Class 1	20	9.7	0.57	0.16
Pretest Class 2	20	5.5	1.6	0.301
Posttest Class 2	20	9.75	0.44	0.301
Pretest Class 3	20	5.35	2.05	0.674
Posttest Class 3	20	9.8	0.41	0.15

The significance value of all variables  $> 0.05$ , which means that the data is normally distributed. So, the next inferential test uses paired sample t-test.

All significance values are  $< 0.05$ , so  $H_0$  is rejected. That is, there is a significant difference between the pretest and posttest scores in each class. In addition, the overall posttest mean score (76.25) was much higher than the pretest mean score (64.5), indicating the

effectiveness of using video tutorials in improving students' cognitive abilities.

In addition to cognitive measurements, observations were also made of student learning

activities during the learning process. The instructor conducted the assessment using the student activity and participation observation sheet, the results of which are shown in Table 4.

**Table 3.** Paired Sample t-Test Results

Mate	Mean Difference	Std. Dev.	T	df	Sig. (2-tailed)
Pre-Post Clas 1	-4.2	1.67	-11,225	19	0
Pre-Post Clas 2	-4.25	1.59	-11,989	19	0
Pre-Post Clas 3	-4.45	2.21	-8,998	19	0

**Table 4.** Recapitulation of Student Activity Score

Activity Indicator	Max Score	Total Score	Percentage	Category
Watch the tutorial video carefully	15	11	73.33%	Effective
Understand and solve problems in one's own way	15	14	93.33%	Very Effective
Comparing and discussing answers with group mates	15	13	86.67%	Very Effective
Listen and pay attention to the explanation of the instructor or friends	15	11	73.33%	Effective
Ask the instructor or friends related to the material	15	11	73.33%	Effective
Provide responses criticisms or suggestions to the material or discussion	15	14	93.33%	Very Effective
Average	15	12.33	82.22%	Very Effective

Based on Table 4, the average score of student activity during learning is 82.22%. Referring to the effectiveness criteria according to Sugiyono (2009), this figure is included in the 'Highly Effective' category. This confirms that the video tutorial media developed successfully encouraged students' active participation and interest in learning.

*Discussion*

*Interpretation of Cognitive Learning Outcomes*

The findings of this study demonstrate that video tutorial media significantly improved students' cognitive understanding in the Flat Pattern Design course. The significant increase in post-test scores across all three classes ( $p < 0.001$ ) indicates that video-based instruction effectively transmits conceptual knowledge related to flat pattern drafting techniques. This result aligns with the multimedia learning theory proposed by Alzarok (2020), which argues that combining visual and auditory information reduces cognitive load and enhances information retention. When students watch a video tutorial that simultaneously presents visual demonstrations and verbal explanations, they process information through two separate channels visual and auditory thereby creating more robust mental representations of the procedural steps.

The cognitive improvement observed in this study is consistent with previous research in Indonesian vocational education contexts. Yang (2020) reported that vocational students who learned through video tutorials achieved significantly higher practical skill scores compared to those who received only text-based online materials. Similarly, Wang (2023), found that video tutorials were more effective than live demonstration methods in online practical courses. The current study

extends these findings by specifically focusing on flat pattern design, a skill that requires both sequential understanding and visual precision. Unlike previous studies that examined general vocational subjects, this research provides empirical evidence for a specialized, procedure-intensive domain where the affordances of video tutorials such as pausing, rewinding, and replaying are particularly valuable.

However, the cognitive improvements observed in this study should be interpreted with some caution. The pre-test scores across all classes were relatively low (ranging from 5.35 to 5.50 out of a maximum possible score). This low baseline may have created a "floor effect," where any educational intervention would likely produce significant improvements simply because students had substantial room for growth. Without a control group that received alternative instruction (such as synchronous online lectures or text-based modules), it is difficult to attribute the entire improvement solely to the video tutorial media. Nevertheless, the consistency of the improvement across three independent classes strengthens the internal validity of the findings.

*Student Activity and Engagement*

The high level of student activity (82.22%, categorized as "Very Effective") suggests that video tutorials not only improve learning outcomes but also promote active engagement. The highest-scoring indicators were "understand and solve problems in their own way" (93.33%) and "provide responses, criticisms, or suggestions" (93.33%). These findings indicate that video tutorials encourage deeper cognitive processing, as students must actively construct their own understanding rather than passively receiving

information. This finding supports the constructivist perspective, which emphasizes that meaningful learning occurs when learners actively build knowledge through experience and reflection (Adekunle et al., 2025).

The relatively lower scores for passive indicators such as "watch the tutorial video carefully" (73.33%), "listen and pay attention" (73.33%), and "ask questions" (73.33%) are also informative. While these scores remain within the "Effective" category, they suggest that some students may struggle with sustained attention during extended video viewing. This finding is consistent with research by Cai (2021), who noted that asynchronous learning requires strong self-regulation skills, and not all vocational students possess these skills equally. To address this limitation, educators should consider breaking longer videos into shorter segments (e.g., 5–7 minutes) and embedding interactive elements such as quizzes or pause-and-practice prompts.

Interestingly, the "ask questions" indicator scored only 73.33%, despite the high overall engagement. This finding may reflect the asynchronous nature of the video tutorial intervention. In a traditional classroom, students can immediately ask questions when confusion arises. With video tutorials, however, questions must be directed to discussion forums or during scheduled consultation sessions, which may reduce the spontaneity of questioning. Future studies should explore integrating real-time chat or AI-powered question-answering systems to facilitate immediate clarification.

#### *Comparison with Traditional Demonstration Methods*

One of the key contributions of this study is its comparison implicit through literature between video tutorials and traditional live demonstration methods. Previous research in health education has consistently shown that video tutorials can match or even exceed the effectiveness of live demonstrations. For example, Wang (2023) found that video-based instruction for hand disinfection techniques was more effective and more widely accepted by learners compared to conventional methods. The current study extends this finding to fashion design education, a domain with different skill demands (Yan et al., 2021).

However, it is important to acknowledge that live demonstrations offer certain advantages that video tutorials cannot fully replicate. During a live demonstration, students can ask spontaneous questions, receive immediate feedback, and observe the instructor's non-verbal cues in real time. These interactions support what Vygotsky (1978) termed the "zone of proximal development," where learning occurs through social interaction with a more knowledgeable other. Video tutorials, by contrast, are inherently one-way communication media (Wan et al., 2020). The reduced opportunities for direct feedback and lecturer

supervision identified as limitations in the preliminary observations of this study may partially explain why the "ask questions" indicator scored relatively low. To address this, educators should combine video tutorials with structured discussion forums, scheduled Q&A sessions, and formative assessments that provide personalized feedback (Wu et al., 2025).

#### *Practical Implications for Vocational Education*

The findings of this study have several practical implications for vocational education in Indonesia, particularly in the post-pandemic era where blended learning models are likely to persist. First, video tutorials should be integrated as a core component of blended learning strategies, rather than used as a supplementary resource (C. Fang, 2025). The significant cognitive improvements observed in this study suggest that video tutorials can effectively replace some portions of face-to-face instruction, especially for procedural knowledge transmission. This allows valuable class time to be reallocated to hands-on practice, troubleshooting, and personalized coaching.

Second, the development of video tutorial media should follow established multimedia design principles. This study followed Dohan (2024) principles, including segmentation (videos  $\leq 10$  minutes), signaling (visual cues highlighting important steps), and contiguity (synchronized narration and visuals). These principles likely contributed to the positive outcomes observed. Educators who wish to develop their own video tutorials should receive training in these design principles to ensure pedagogical effectiveness (P. Wang & Xu, 2024).

Third, the relatively low scores for passive engagement indicators highlight the need for complementary strategies to sustain student attention. Embedded quizzes, interactive annotations, and guided worksheets that students complete while watching can transform passive viewing into active learning. Fang (2025) successfully implemented such strategies in their video tutorial intervention for fashion design students, reporting even higher engagement levels than those observed in the current study.

Fourth, vocational institutions should invest in technical infrastructure to support high-quality video production. The videos used in this study were recorded at 1920×1080 resolution with close-up visuals, which allowed students to see fine details such as ruler positioning and paper cutting techniques. Low-resolution videos or poorly framed shots would likely reduce the effectiveness of the intervention.

#### *Limitations of the Study*

Several limitations of this study must be acknowledged when interpreting the findings. First, the absence of a control group limits causal inference.

Although the pre-test-post-test design demonstrated significant improvements, it is possible that factors other than the video tutorial intervention—such as maturation, test familiarity, or concurrent learning activities contributed to the observed gains. Future studies should employ a randomized controlled trial design comparing video tutorial instruction with alternative methods such as synchronous online lectures or text-based modules.

Second, the sample size was relatively small ( $N = 30$ ) and drawn from a single study programme at one university. This limits the generalizability of the findings to other vocational education contexts in Indonesia. Replication studies with larger, more diverse samples from multiple institutions are needed to confirm the external validity of these results.

Third, the study did not measure long-term retention of cognitive and psychomotor skills. The post-test was administered immediately after the intervention, so it remains unknown whether the observed improvements persist over time. Future research should include delayed post-tests (e.g., after 4–8 weeks) to assess knowledge retention.

Fourth, the psychomotor assessment relied on a scoring system developed specifically for this study. Although content validation was conducted, the instrument has not been cross-validated with other populations. Additionally, the absence of inter-rater reliability reporting for the psychomotor scores represents a methodological limitation.

Fifth, the study did not systematically collect qualitative data on students' experiences with the video tutorials. While the student activity observation sheet provided some insight, semi-structured interviews or open-ended surveys would offer richer understanding of why certain indicators scored higher or lower.

## Conclusion

Based on the findings and limitations of this study, several directions for future research are proposed. First, researchers should explore the development of artificial intelligence-based adaptive video systems capable of providing personalized feedback. Such systems could analyze students' viewing patterns (e.g., repeated viewing of specific segments, pauses, skips) and automatically generate targeted questions or remedial content. This would address the limitation of reduced direct feedback in asynchronous learning environments. Second, comparative studies should be conducted to evaluate video tutorials against other online learning modalities, including synchronous video conferencing, interactive simulations, and virtual reality-based training. Understanding the relative effectiveness of each modality would help educators make evidence-

based decisions about resource allocation. Third, researchers should investigate the optimal video length for vocational skills instruction. While this study limited videos to 10 minutes based on Mayer's (2009) principles, some researchers have advocated for even shorter "microlearning" videos of 3–5 minutes. Experimental studies manipulating video length while measuring cognitive load, engagement, and learning outcomes would provide practical guidance for video producers. Fourth, longitudinal studies are needed to assess the long-term impact of video tutorial interventions on workforce readiness and job performance. The ultimate goal of vocational education is to prepare students for successful careers, so measuring transfer of skills to real-world work settings is essential. In conclusion, this study provides empirical evidence that video tutorial media significantly improves cognitive learning outcomes and promotes active student engagement in flat pattern design courses. The findings support the integration of video tutorials as a core component of blended learning strategies in Indonesian vocational education. However, the limitations of this study—particularly the absence of a control group and small sample size—suggest that these findings should be interpreted as preliminary. Future research addressing these limitations will further strengthen the evidence base for video-based instruction in vocational skills training. This study examined the use of video tutorial media in Flat Pattern Design learning within a Fashion Design Vocational Education programme. The findings indicate that the integration of video tutorials was associated with improvements in students' learning outcomes and learning engagement. Students demonstrated better conceptual understanding of flat pattern design after participating in the learning activities, while active involvement throughout the learning process suggested positive engagement with the instructional approach. The study also highlights the potential of video tutorials to support the development of procedural skills in vocational education. By allowing students to repeatedly observe, review, and practice each stage of the pattern-making process, video-based learning appears to facilitate the integration of cognitive understanding and practical skill development. Overall, the findings suggest that video tutorial media can support both knowledge acquisition and engagement in practice-oriented learning environments. Despite these positive outcomes, several limitations should be acknowledged. The study was conducted with a relatively small sample and did not include a control group, limiting the ability to establish causal relationships between the intervention and learning outcomes. In addition, the research focused on short-term learning performance and did not examine the long-term retention of knowledge and skills. Future

studies are therefore encouraged to employ more rigorous experimental designs, involve larger and more diverse samples, and investigate the sustainability of learning outcomes over time. From a practical perspective, video tutorials can serve as a valuable component of vocational instruction, particularly for courses that involve sequential and procedure-intensive tasks. However, they should be implemented as part of a blended learning approach that combines digital resources with direct instructor guidance and face-to-face interaction to maximize student learning and skill development.

#### Acknowledgments

The authors thank the Dean of the Faculty of Family Welfare Education and the Head of the Fashion Design Education Study Programme, Padang State University, for their administrative support and research permits. Sincere appreciation is extended to the two expert validators and the nationally certified sewing instructor for their contributions to the video tutorial development. The authors are especially grateful to the 30 students who voluntarily participated in this study. Special thanks also go to the lecturers, laboratory assistants, and research colleagues who facilitated the implementation and data analysis. This research received no specific grant from any funding agency.

#### Author Contributions

A1 conceptualized the study, developed the methodology, analyzed the data, wrote the original draft, and managed project administration. A2 contributed to conceptualization, methodology, validation, supervision, and manuscript review. A3 conducted investigation, curated data, performed formal analysis, created visualizations, and handled software. A4 assisted with methodology, validation, investigation, and manuscript review. A5 provided resources, software, and contributed to formal analysis, visualization, and writing. A6 conducted investigation, curated data, reviewed the manuscript, and assisted with project administration. A7 performed validation, formal analysis, and software management. A8 conducted investigation, curated data, wrote portions of the draft, and created visualizations. A9 provided resources, supervised the research, and reviewed the manuscript. A10 contributed to methodology, investigation, data curation, and manuscript review. A11 participated in investigation, data curation, formal analysis, and visualization. All authors reviewed and approved the final manuscript.

#### Funding

We would like to thank the Research and Community Service Institute of Padang State University for funding this research. The cost of publishing this article was also funded by Padang State University through the Research and Community Service Institute.

#### Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article. No financial, professional, or personal relationships influenced the research

design, data collection, analysis, interpretation of findings, or the decision to submit this manuscript for publication.

#### References

- Adekunle, A. A., Fofana, I., Picher, P., Rodriguez-Celis, E. M., Arroyo-Fernandez, O. H., & Zemouri, R. (2025). Optimizing deep learning predictive models: a comprehensive review of RNN and its variant architectures. *Applied Soft Computing*, *185*, 114015. <https://doi.org/10.1016/j.asoc.2025.114015>
- Alzarok, H., Fletcher, S., & Longstaff, A.-P. (2020). Survey of the current practices and challenges for vision systems in industrial robotic grasping and assembly applications. *Advances in Industrial Engineering and Management*, *9*(1), 19-30. <https://doi.org/10.7508/aiem.01.2020.19.30>
- Cai, J., & Lei, T. (2021). An autonomous positioning method of tube-to-tubesheet welding robot based on coordinate transformation and template matching. *IEEE Robotics and Automation Letters*, *6*(2), 787-794. <https://doi.org/10.1109/LRA.2021.3050741>
- Chen, R., Chen, F., Xu, G., Li, X., Shen, H., & Yuan, J. (2021). Precision analysis model and experimentation of vision reconstruction with two cameras and 3D orientation reference. *Scientific Reports*, *11*(1), 3875. <https://doi.org/10.1038/s41598-021-83390-y>
- Chowdary, B.-V., Richards, M.-A., & Gokool, T. (2019). An integrated approach for sustainable product design: concurrent application of DFMA, DFE and CAD/CAE principles and tools. *Latin American Journal of Management for Sustainable Development*, *4*(4), 259. <https://doi.org/10.1504/LAJMSD.2019.100836>
- Cong, Y., Chen, R., Ma, B., Liu, H., Hou, D., & Yang, C. (2021). A comprehensive study of 3-D vision-based robot manipulation. *IEEE Transactions on Cybernetics*, *53*(3), 1682-1698. <https://doi.org/10.1109/TCYB.2021.3108165>
- Dohan, M., Mu, M., Ajit, S., & Hill, G. (2024). Real-walk modelling: a deep learning model for user mobility in virtual reality. *Multimedia Systems*, *30*(1), 44. <https://doi.org/10.1007/s00530-023-01200-z>
- Fang, C. (2025). AI-driven digital sculpture design: optimising fusion algorithms with deep learning and virtual reality. *International Journal of Information and Communication Technology*, *26*(22), 55-71. <https://doi.org/10.1504/IJICT.2025.146908>
- Fang, R. (2025). Exploring the role of virtual reality in transforming the environmental art experience. *International Journal of E-Collaboration (IJeC)*, *21*(1), 1-15. <https://doi.org/10.4018/IJeC.370951>

- Fang, W., Xu, X., & Tian, X. (2022). A vision-based method for narrow weld trajectory recognition of arc welding robots. *The International Journal of Advanced Manufacturing Technology*, 121(11-12), 8039-8050. <https://doi.org/10.1007/s00170-022-09804-x>
- Favi, C., Mandolini, M., Campi, F., & Germani, M. (2021). A CAD-based design for manufacturing method for casted components. *Procedia CIRP*, 100(4), 235-240. <https://doi.org/10.1016/j.procir.2021.05.061>
- Gao, Y., Zhang, L., & Kim, J. (2026). Deep learning image generation technology for enhancing the presentation effect of image art based on artificial intelligence. *Scientific Reports*, 16, 14982. <https://doi.org/10.1038/s41598-026-45739-z>
- Gómez, E.-A., Rodríguez, S.-J.-B., Cuan, U.-E., Cabello, J.-A.-E., & Swenson, R.-L. (2021). Colored 3D path extraction based on depth-RGB sensor for welding robot trajectory generation. *Automation*, 2(4), 252-265. <https://doi.org/10.3390/automation2040016>
- Gong, Y. (2021). Application of virtual reality teaching method and artificial intelligence technology in digital media art creation. *Ecological Informatics*, 63, 101304. <https://doi.org/10.1016/j.ecoinf.2021.101304>
- Gui-Wei, B., & Guo-Bao, Z. (2024). Research on the visual impact of digital Media art based on augmented reality technology. *Computer Aided Design and Applications*, 21(S2), 186-201. <https://doi.org/10.14733/cadaps.2024.S2.186-201>
- Liu, Y., Zhao, L., & Su, Y. S. (2022). The Impact of Teacher Competence in Online Teaching on Perceived Online Learning Outcomes during the COVID-19 Outbreak: A Moderated-Mediation Model of Teacher Resilience and Age. *International Journal of Environmental Research and Public Health*, 19(10), 6282. <https://doi.org/10.3390/ijerph19106282>
- Peng, B., & Sirisuk, M. (2024). Exploration of CAD and neural network integration in art design and cultural heritage protection. *Computer Aided Design and Applications*, 21(18), 128-144. <https://doi.org/10.14733/cadaps.2024.S18.128-144>
- Qian, J. (2022). Research on artificial intelligence technology of virtual reality teaching method in digital media art creation. *Journal of Internet Technology*, 23(1), 127-134. <https://doi.org/10.53106/160792642022012301013>
- Raza, A., Rehman, A., Sehar, R., Alamri, F. S., Alotaibi, S., Al Ghofaily, B., & Saba, T. (2024). Optimized virtual reality design through user immersion level detection with novel feature fusion and explainable artificial intelligence. *PeerJ Computer Science*, 10, e2150. <https://doi.org/10.7717/peerj-cs.2150>
- Tang, J. (2026). Analysis of the use and effectiveness of artificial intelligence-assisted creation tools in digital art and design. *International Journal of Computer Information Systems and Industrial Management Applications*, 18, 12. <https://doi.org/10.70917/ijcisim-2026-0104>
- Tian, Q., & Li, Q. (2024). Combining creative adversarial networks with art design models and machine vision feedback optimization. *Computer-Aided Design and Applications*, 21, 103-116. <https://doi.org/10.14733/cadaps.2024.S16.103-116>
- Wan, G., Li, F., Zhu, W., & Wang, G. (2020). High-precision six-degree-of-freedom pose measurement and grasping system for large-size object based on binocular vision. *Sensor Review*, 40(1), 71-80. <https://doi.org/10.1108/SR-05-2019-0123>
- Wang, H., & Li, J. (2024). Integration path of digital media art and environmental design based on virtual reality technology. *Open Computer Science*, 14(1), 20240012. <https://doi.org/10.1515/comp-2024-0012>
- Wang, J., Li, L., & Xu, P. (2023). Visual sensing and depth perception for welding robots and their industrial applications. *Sensors*, 23(24), 9700. <https://doi.org/10.3390/s23249700>
- Wang, P., & Xu, P. (2024). Graph Neural networks-based virtual reality data fusion display for new Media art. *Computer-Aided Design and Applications*, 21, 15-27. <https://doi.org/10.14733/cadaps.2024.S28.15-27>
- Wang, T., Zhang, Y., & Liu, B. (2023). Model-based visual servoing for automatic docking system of circular symmetrical target with large displacement. *International Journal of Control, Automation and Systems*, 21(4), 1273-1284. <https://doi.org/10.1007/s12555-021-0417-1>
- Wu, P., Liu, Y., Chen, H., Li, X., & Wang, H. (2025). VR-empowered interior design: enhancing efficiency and quality through immersive experiences. *Displays*, 86, 102887. <https://doi.org/10.1016/j.displa.2024.102887>
- Xu, B. (2024). Practice of digital media art education based on virtual reality technology. *Journal of Electrical Systems*, 20(3s), 1714-1723. <https://doi.org/10.52783/jes.1711>
- Yan, S., Tao, X., & Xu, D. (2021). High-precision robotic assembly system using three-dimensional vision. *International Journal of Advanced Robotic Systems*, 18(3), 17298814211027028. <https://doi.org/10.1177/17298814211027029>
- Yang, H., Jiang, P., & Wang, F. (2020). Multi-view-based pose estimation and its applications on intelligent

- manufacturing. *Sensors*, 20(18), 5072.  
<https://doi.org/10.3390/s20185072>
- Yanqiong, Y. (2024). Analysis of utilizing artificial intelligence to improve the efficiency of digital Media art creation. *Journal of Artificial Intelligence Practice*, 7(4), 101.  
<https://doi.org/10.23977/jaip.2024.070412>
- Ye, C., & Kuang, C. (2024). Online works display system of art design based on VR technology and machine vision. *Computer Aided Design and Applications*, 21, 126-143.  
<https://doi.org/10.14733/cadaps.2024.S2.126-143>
- Zhang, X., & Wu, L. (2024). Automated method for digital art creation and display based on computer aided design. *Computer-Aided Design and Applications*, 21, 140-153.  
<https://doi.org/10.14733/cadaps.2024.S14.140-153>
- Zhao, X. (2025). The Impact of Live Polling Quizzes on Student Engagement and Performance in Computer Science Lectures: A Post-COVID19 Study. *International Conference on Computer Supported Education, CSEDU - Proceedings*, 1(1), 291-298.  
<https://doi.org/10.5220/0013218700003932>
- Zheng, S., & An, S. (2023). Digital art design and media practice integrating CAD and virtual reality technology. *Computer-Aided Design and Applications*, 20(S13), 86-97.  
<https://doi.org/10.14733/cadaps.2023.S13.86-97>
- Zhuge, W., & Li, Y. (2024). Augmented reality based on network physics and 6G for immersive experience of digital Media art. *Wireless Personal Communications*, 1-19.  
<https://doi.org/10.1007/s11277-024-11148-6>