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Application of Digital Pattern Techniques in Ready to Wear Fashion Based on CLO3D Software

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ABSTRACT - Fashion patterns serve as the basic templates for garment creation, playing a crucial role in ensuring the fit and comfort of the resulting clothing. Advances in digital technology, particularly in fashion, have significantly transformed the design and production processes. CLO3D software allows designers to create fashion patterns in a digital 3D format, which accelerates design, reduces costs, and supports sustainability by minimizing waste. This research employs the Research and Development (R&D) method to develop a user guide for using CLO3D. The research findings indicate that digital pattern techniques enhance efficiency, accuracy, and creativity in design. Validation of the user guide by experts shows a high level of validity with a consensus index of 1.0, indicating its relevance and effectiveness in learning. This study concludes that CLO3D not only improves the quality of designs but also contributes significantly to education and skill development in the fashion field.

Keywords: Patterns, CLO3D software, guide book.

INTRODUCTION

Fashion serves as a basic necessity and a means of self-expression, social status, and cultural values. In addition to protecting the body from weather and environmental conditions, fashion also reveals identity and self-expression. The history of fashion evolves along with time, technology, and culture, with significant changes in design, materials, and functions. Creating basic patterns is an essential skill for fashion designers, as accurate patterns affect the comfort and quality of clothing. (Maulana et al., 2023).

The fashion industry is experiencing rapid development, including new trends, the use of digital technology, and awareness of sustainability. The 5.0 revolution is influencing this industry with computer-based technology. (Hidayah & Suprihatin, 2020). The clothing industry is increasingly reliant on the use of advanced technology moving towards sophisticated versions, while the use of AI in the fashion industry plays a crucial role and is regarded as a global economic player (Soni & Munjal, 2023). The use of this technology supports the zero waste concept by minimizing waste and creating sustainable products. Digital technology brings transformation in design and pattern making, supporting the zero waste concept and product customization. (You, 2021). Patterns are not only needed in the creation of individual garments, but they have also evolved within the industrial world, home industries, and garment manufacturing (Nashikhah et al., 2020). The creation of digital patterns has become a significant transformation, where it is now more necessary than manual patterns. Digital pattern making is now more essential than manual patterns because it can accelerate the process and reduce costs (Renaningtyas et al., 2024). The fashion industry, valued at trillions of dollars, faces challenges such as climate change and environmental impact. The fashion industry is one of the fastest-growing economic sectors, but it is also one of the sectors that has the most significant impact on the

environment and society (Nurcahyo et al., 2024). The rise of industries targeting youth trends has been able to boost the creative industry sector (Dr. Muh Fakhrihun Na'am, 2018). Innovation and adaptation are crucial in the development of the creative fashion industry.

The CLO3D software allows designers to create fashion patterns in a realistic 3D format, accelerating design and reducing production costs. The use of CLO3D software can speed up the clothing business cycle and enhance design quality, although it often faces delays and difficulties in design tasks due to a lack of CLO3D-based e-modules (Diyan Vitariyanti, Nugroho Agung Pambudi, 2024). CLO3D software enables instant design modifications without physical samples, which is relevant during the pandemic to reduce physical interactions. The use of CLO3D and iClone software accelerates design mechanisms and innovation, speeding up production and supply while quickly meeting customer satisfaction (Hossain et al., 2022). Many tasks that require a long time can be completed quickly, which in turn can reduce costs and improve quality. The quality of fashion appearance depends on the characteristics of the fabric, and fashion simulation systems support sustainability by reducing time and material consumption (Ashmawi et al., 2021). The CLO3D software system embodies virtual fitting, including three-dimensional body modeling, parametric cutting, three-dimensional virtual seam fitting, fabric texture attribute settings, and dynamic displays, which realize design and appearance realization (Huang & Huang, 2022). The main application of CLO3D software, supported by other programs, is used in creating learning media for fashion design to enhance appearance by providing components and design principles for students in fashion departments (Cisilia W Galela, 2024). CLO3D software is one of the popular 3D software used in the fashion industry (Soni & Munjal, 2023).

Education in the field of fashion design needs to adapt to the latest technologies, such as CLO3D, to provide the practical skills required in the industry. This software helps designers create, edit, and simulate garments in 3D before physical production, offering valuable experience for students (Diyan Vitariyanti, Nugroho Agung Pambudi, 2024). The use of CLO3D software also analyzes the static and dynamic virtual pressure values of clothing (Liu et al., 2021). Pattern making using CLO3D software can also demonstrate that clothing samples can be optimized and determine the comfort of clothing pressure. This software can fully meet a range of design requirements that fashion designers may have, such as fashion design, pattern making, adjustments and modifications, fabric selection, appearance, and release (Wang & Liu, 2020). Designers can also ensure that the garments they create are more aligned with the comfort and fit needs of the users.

The implementation of CLO3D-based digital pattern techniques becomes crucial in preparing a generation of designers ready to face the challenges of the modern fashion industry. This research aims to explore how the application of this technology can enhance designers' quality and job readiness in the development of a more efficient and sustainable fashion industry.

METHOD

This type of research is basic research with an R&D (Research and Development) method aimed at developing CLO3D software through systematic research and experimentation. Basic research aims to understand processes without focusing on practical applications, with an emphasis on the validity of the results. (Waruwu, 2024). The R&D method is applied in various sectors to drive innovation and competitive advantage, focusing on the development of new products and testing their effectiveness. The R&D method is used to generate new knowledge and develop products, processes, or services, and includes structured steps from problem identification to solution development. (Okpatrioka, 2023).

The R&D research procedure aims to produce new products and test their effectiveness. (Prof.Dr.Sugiono, 2020). The research procedure follows the steps outlined by Sugiono, which include: (1) Potential and Problems; (2) Data Collection; (3) Product Planning; (4) Product Development; (5) Product Validation; (6) Product Evaluation and Refinement; (7) Product Results.

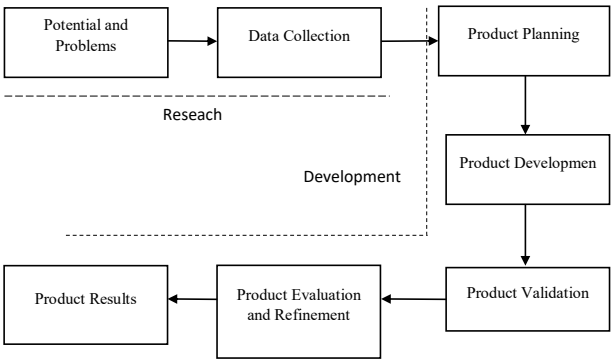

Figure 1. Research and Development (R&D) procedure.

The validation process ensures that the product meets user needs and is conducted by experts using a Likert scale and content validity coefficient analysis (Gregory, 2015). The content validity indicates that the guidebook has met most of the criteria, although there are still aspects that need improvement. This book is useful for users to understand and effectively utilize the Clo3D software.

RESULT AND DISCUSSION

CLO3D Software Guidebook

This research follows seven steps in the R&D model proposed by Sugiyono, which are:

1. Potential and Problems
   Identification was conducted to address the issue of the lack of practical guidance in using CLO3D software that supports learning and skills in the field of digital fashion, particularly in the creation of ready-to-wear garment patterns.
2. Data Collection
   Data was collected through literature studies, observations, and interviews with instructors and students in the fashion design field. The results of the data collection indicate a need for interactive, applicable learning media that aligns with technological developments in the fashion industry.
3. Product Planning
   Planning was carried out by designing the structure of the guidebook, which includes an introduction to CLO3D, the functions of tools, the process of 2D and 3D fashion design, animation creation, and print layout preparation. Each section is organized systematically and progressively to ensure ease of understanding for users.
4. Product Development
   The product in the form of a guidebook was developed using a practical and visual approach. The material is presented in the form of step-by-step tutorials accompanied by images, starting from software installation to the creation of ready-to-wear garment patterns.
5. Product Validation
   Validation was conducted by two experts in the fashion design field using a Likert scale-based assessment instrument. Analysis using the Gregory Index showed a validity coefficient of 1.0, which falls into the high validity category, indicating that this guidebook is highly relevant and effective for use in learning.
6. Product Evaluation and Revision
   Feedback from the validators was used to refine the structure and content of the guidebook, including adjustments to the order of the material, grammar improvements, and enhancements to the quality of image visualizations.
7. Product Result
   The final product is a guidebook for using CLO3D in the creation of ready-to-wear garments, which can be accessed via the link: https://bit.ly/BukuPanduanSoftwareCLO3D. This book is designed to be user-friendly for students, teachers, and fashion practitioners who wish to learn CLO3D independently and practically.

Validation Test

Validity testing is the process of measuring the extent to which an instrument, such as a guidebook, truly measures what it is supposed to measure. In the context of the CLO3D software guidebook, the validity test aims to ensure that the book is effective and accurate in helping users understand the software. The analysis of validity testing involves assessing the validity of the content, where the guidebook must cover all important aspects of CLO3D, be presented clearly, be relevant to the users' needs, and be usable effectively. By conducting validity testing, we can ensure that the guidebook is beneficial and helps users achieve their learning objectives.

The Gregory Index is used to determine the level of importance of strong and weak rankings from both validators through a contingency table.

Table 1. Contingency table.

Matrix 2x2		**Validation I**	
		Weak 1-2	**Strong 3-4**
Validation II	Weak 1-2	A	B
	Strong 3-4	C	D

The contingency table identifies four categories of relevance based on the assessments of two validators:

a) A: Equal scores (1-2) from both validators, relevance is considered weak.
b) B: Validator 1 (3-4) and Validator 2 (1-2) on the same item, strong-weak relevance.
c) C: Validator 1 (1-2) and Validator 2 (3-4), weak-strong relevance.
d) D: Equal scores (3-4) from both validators, strong-strong relevance.

The next step is to determine the content validity coefficient using the Gregory formula: Content Validity Coefficient = D/(A+B+C+D). This value is then interpreted into three categories based on the agreement index of the validators.

Table 2. Validator agreement index.

Coefficient	**Validity**
0,8 - 1.0	High Validity
0,4 – 0,79	Moderate Validity
0,00 – 0,39	Low Validity

Material validation is an important step to ensure the quality and relevance of the guidebook. Two experienced fashion design teachers in CLO3D software are responsible for the evaluation, which includes content assessment and in-depth analysis of four main aspects of the effectiveness of strategies in the guidebook. There are 25 items that are comprehensively evaluated by subject matter experts. The table below shows the details of the items in the validation instrument sheet.

Table 3. Results of the tabulation from two expert material validations.

Assessment Aspects	**Assessment**		
	Validator		**Relevance Category**
	1	**2**	
It is intended to expand, deepen, and complement the text.	4	4	D
Contains insights and skills in critical, creative, collaborative, and communicative thinking.	3	3	D
Alignment with the development of science and technology.	4	3	D
Contains elements of truth in terms of scientific knowledge, data, and facts.	4	3	D
Encourages/motivates thoughts and feelings to accept new ideas or revisit material.	4	4	D
The material is explained in a sequential manner.	3	3	D
Sequential stages in the process of creating 2D and 3D designs.	3	3	D

The tools material is presented clearly and in a logical order.	3	4	D
Text and images are original works (not plagiarized) with clearly cited sources.	3	4	D
Each section of the book is consistent, systematic, and/or coherent.	3	3	D
Text and/or images are appropriate for the target reader's abilities.	3	3	D
Adaptive to the development of science and technology.	4	4	D
Book identity.	4	4	D
Book introduction.	4	4	D
Table of contents.	4	3	D
Bibliography.	4	3	D
Accurate, effective, and logical in sentence construction.	3	3	D
Appropriate for the developmental level of the reader.	3	3	D
Consistent in using terms and symbols	3	3	D
Uses standard language in accordance with EYD (Enhanced Spelling System)	3	3	D
Every text, image, and illustration is easy to read	3	4	D
The text structure follows standard rules	3	3	D
Integration and accuracy of images and materials	3	3	D
Clear and appealing to the reader	4	4	D
Cover design, content pages, and illustrations are appropriate for the reader's development	4	3	D

The evaluation results from the two validators show a difference in assessment of the guidebook material. On the third item, the first validator gave a score of 4, while the second validator gave a score of 3, which falls into relevance category D according to Gregory's validity test. (Mirnawati et al., 2022), It shows strong relevance. Of the 25 items evaluated, all fall into relevance category D, reflecting strong agreement between the two validators. The validation test results can be presented in a contingency table to clarify each validator's assessment.

Table 4. Contingency table from two subject matter experts.

Matrix 2x2		**Validation I**	
		weak	**strong**
Validation II	weak	0	0
	strong	0	25

The table above indicates that the expert agreement index related to content validity is obtained by comparing the number of items assessed by both experts that fall into the strong relevance category to the total number of items. To determine Gregory's index, the following content validity formula by Gregory is used;

$$\text{Validity Coefficient} = \frac{\text{D}}{\text{A+B+C+D}} = \frac{25}{0+0+0+25} = \frac{25}{25} = 1{,}0$$

The assessment results from both validators showed a score of 1.0, indicating that the material validity falls into the very high category. An agreement index below 0.4 is considered low, between 0.4–0.79 is moderate, and above 0.8 is high. The material validation process, involving two fashion teachers experienced in using CLO3D software, evaluated 25 items related to the effectiveness of the strategy. All items received relevance category D, indicating strong agreement between the validators. These results confirm that the guidebook is highly relevant and effective for learning, and they provide confidence in its quality and benefits for students and designers. This validation data can also be used for further improvement to ensure the material meets users' needs optimally.

CONCLUSION

Based on research on the application of digital pattern-making techniques in ready-to-wear fashion using CLO3D software, it can be concluded that :

1. Application of Digital Pattern-Making Techniques: The use of CLO3D enhances efficiency and accuracy in pattern making, allowing for real-time simulation and visualization of designs. This saves time and costs, reduces material waste, and boosts creativity and innovation among designers.
2. Material Validation: The validation results show that the guidebook has high quality and relevance, with all items receiving relevance category D and an agreement index of 1.0. This confirms the effectiveness of the guidebook as a learning aid.

Overall, this research shows that digital pattern-making techniques with CLO3D not only enhance the quality of fashion design but also contribute significantly to learning and skill development in the fashion field, making the technology increasingly relevant in fashion education.

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