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ORIGINAL

Developing a Concept Attainment Model for Fashion Pattern Education: A Preliminary Study of Instructional Challenges and Needs

Desarrollo de un Modelo Conceptual de Aprendizaje para la Enseñanza de Patrones de Moda: un Estudio Preliminar Sobre los Retos y Necesidades Pedagógicas

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ABSTRACT

Fashion pattern-making is essential in fashion design education, yet many students, especially in vocational programs, face challenges in mastering this skill. These challenges arise from the misalignment between traditional teaching methods and students' kinesthetic learning styles, hindering their ability to apply theoretical knowledge to practical tasks. This study identifies these instructional challenges and proposes the Concept Attainment Model as a solution. The Concept Attainment Model, which emphasizes inductive reasoning and active learning through contrasting examples, aligns with kinesthetic preferences, promoting hands-on learning and improving concept retention. The study employed a mixed-methods approach, utilizing interviews, surveys, and classroom observations to analyze students' difficulties and assess the effectiveness of the Concept Attainment Model. Data gathered from 258 students revealed that a significant number struggled with pattern modification, measurement accuracy, and garment fitting, underscoring the need for more interactive, student-centered instructional strategies. The study concludes that the Concept Attainment Model can bridge the gap between theoretical understanding and practical application in fashion pattern-making education, enhancing students' learning outcomes. This model provides a framework for aligning teaching practices with industry demands, improving student competencies, and preparing students for professional success in the fashion industry.

Keywords: Fashion Pattern-Making; Concept Attainment Model; Kinesthetic Learning; Fashion Design Education.

RESUMEN

El patronaje de moda es esencial en la formación en diseño de moda, pero muchos estudiantes, especialmente en programas de formación profesional, se enfrentan a dificultades para dominar esta habilidad. Estas dificultades surgen de la falta de adecuación entre los métodos de enseñanza tradicionales y los estilos de aprendizaje cinestésico de los estudiantes, lo que dificulta su capacidad para aplicar los conocimientos teóricos a tareas prácticas. Este estudio identifica estas dificultades didácticas y propone el Modelo de Adquisición de Conceptos como solución. El Modelo de Adquisición de Conceptos, que hace hincapié en el razonamiento inductivo y el aprendizaje activo a través de ejemplos contrastantes, se alinea con las preferencias

cinestésicas, promoviendo el aprendizaje práctico y mejorando la retención de conceptos. El estudio empleó un enfoque de métodos mixtos, utilizando entrevistas, encuestas y observaciones en el aula para analizar las dificultades de los estudiantes y evaluar la eficacia del Modelo de Adquisición de Conceptos. Los datos recopilados de 258 estudiantes revelaron que un número significativo tenía dificultades con la modificación de patrones, la precisión de las medidas y el ajuste de las prendas, lo que subraya la necesidad de estrategias de enseñanza más interactivas y centradas en el estudiante. El estudio concluye que el Modelo de Adquisición de Conceptos puede salvar la brecha entre la comprensión teórica y la aplicación práctica en la enseñanza del patronaje de moda, mejorando los resultados del aprendizaje de los estudiantes. Este modelo proporciona un marco para alinear las prácticas docentes con las demandas de la industria, mejorar las competencias de los estudiantes y prepararlos para el éxito profesional en la industria de la moda.

Palabras clave: Patronaje de Moda; Modelo de Consecución de Conceptos; Aprendizaje Kinestésico; Educación en Diseño de Moda.

INTRODUCTION

Fashion design education, in particular within vocational programs, has seen significant evolution in its approach to teaching core competencies, one of the most critical being pattern-making. Originating in the early 20th century as part of formalized fashion training, this skill has been integral to the transformation of conceptual ideas into tangible garments.[1] However, pattern-making remains a significant challenge for students, impeding their ability to fully engage with the creative and technical aspects of the design process. Across various educational settings, students have consistently reported difficulties, such as misinterpretation of theoretical concepts and inaccuracies in measurements and pattern adaptation, especially in relation to different body shapes.[2,3]

A preliminary survey conducted across several universities indicated that 38 % of students regard pattern-making as the most challenging aspect of their education in fashion design. This challenge persists across all academic levels, with even advanced students struggling with foundational concepts.[2] Such widespread difficulties point to systemic pedagogical issues that require further investigation. One potential factor contributing to these challenges is the misalignment between instructional methods and the predominant kinesthetic learning styles of students in these programs. Traditional teaching practices, which rely on verbal instructions and passive demonstrations, often fail to engage students who learn best through hands-on experiences.[4,5]

The inadequacy of current instructional methodologies exacerbates these challenges. Many curricula fail to provide the necessary scaffolding to facilitate deeper comprehension, focusing more on procedural tasks than on engaging students with the theoretical concepts underlying pattern-making, such as pattern modification and garment fitting techniques.[6] As a result, while students may manage basic tasks like cutting or tracing patterns, they often struggle to understand the deeper significance of these activities within design principles or body anatomy.[7]

To address these pedagogical challenges, there is an urgent need for instructional strategies that better connect conceptual understanding with practical application. One promising approach is the Concept Attainment Model (CAM), conceptualized by Jerome Bruner.[8] CAM encourages inductive reasoning, allowing students to formulate their understanding of concepts through active engagement with contrasting examples and non-examples.[9,10] Although CAM's effectiveness has been studied in cognitive learning domains, its potential application for enhancing vocational education in fashion pattern-making deserves further exploration.

Implementing CAM could improve students' understanding and skill retention. The model aligns well with kinesthetic learning preferences by promoting pattern recognition through active exploration and analysis—skills essential for effective design.[4,7] By centering the instructional process around student inquiry, CAM can enhance engagement and facilitate independent concept formation, improving students' abilities to become confident and capable designers. The analysis will focus on identifying instructional needs, misconceptions, and challenges faced by both students and educators.[11] A mixed-methods research approach, integrating qualitative interviews, classroom observations, and quantitative survey data, will be employed to create a robust profile of existing challenges in teaching practices and learning experiences.[12,13]

The goal of integrating CAM into the curriculum is to address current educational challenges and align vocational education with industry expectations and evolving educational standards. By advancing instructional methods to foster adaptability, precision, and critical thinking—skills highly valued in the fashion industry—this research seeks to enhance educational outcomes and create viable professional pathways for students.[14,15]

The teaching and learning of fashion pattern-making, in the Fashion Pattern Construction course at the Department of Family Welfare Science (IKK), Faculty of Tourism and Hospitality (FPP), Universitas Negeri

Padang (UNP), presents significant instructional needs and pedagogical challenges. Addressing these issues is crucial for enabling students to master the fundamental concepts and techniques necessary for constructing accurate garment patterns.[16,17] By identifying the cognitive and practical barriers students face, this study will contribute to the development of more effective instructional methods in vocational fashion education.[1,2]

Students often struggle with conceptual misunderstandings related to fashion pattern-making, leading to technical inaccuracies when applying pattern-making techniques.[16,18] For instance, practical challenges in executing pattern adaptations often stem from students' limited understanding of theoretical knowledge regarding measurement and fitting.[19,20] Studies have shown that kinesthetic learning preferences among students are not addressed by traditional instructional methods, which tend to use verbal explanations and passive demonstrations.[21] This misalignment can exacerbate learning gaps, in tasks that require confident execution of psychomotor skills, such as garment construction.[22,23]

Moreover, aligning teaching methods with students' dominant learning styles is crucial for effective learning. The prevalent kinesthetic learning preference among students necessitates instructional strategies that incorporate hands-on, interactive learning experiences.[21,24] For example, thematic learning approaches grounded in kinesthetic intelligence have shown promise in fostering deeper engagement and understanding in learning environments.[21,25] In contrast, conventional approaches often fall short of promoting the experiential learning required for mastering practical skills in fashion design, contributing to students' ongoing difficulties.[8,26]

Insights from faculty members regarding current instructional models show an awareness of contemporary pedagogical challenges.[27,28] Educators recognize students' struggles but may lack readiness to adopt innovative teaching techniques that transform traditional practices into more active learning paradigms.[8,29] This provides an opportunity to effectively integrate CAM, as it encourages students to explore concepts through comparative analysis of examples, enabling a more dynamic way to internalize complex ideas.[30,31] By including both student and lecturer perspectives, this study aims to develop a comprehensive understanding of the instructional context, essential for creating an effective CAM prototype tailored to fashion pattern education.[9,22]

Given the challenges identified in current instructional practices, there is a critical need for an instructional model that bridges the gap between theoretical knowledge and practical application.[32] Current methods fail to address the kinesthetic learning preferences that are essential for fashion design education, in pattern-making. As the fashion industry values hands-on skills and adaptability, aligning instructional methods with students' learning styles is necessary to equip them with the competencies they need.[9,20] This study justifies the need for an alternative teaching approach that connects conceptual clarity with practical execution, ensuring that students can master both the technical and theoretical aspects of garment construction

This research aims to identify a comprehensive needs analysis to inform the development of a CAM-based instructional model tailored for fashion pattern-making courses. By shedding light on the cognitive and practical barriers encountered by students, investigating the transition to student-centered instructional approaches, and gauging lecturers' perceptions, the findings from this study are expected to provide valuable insights for pedagogical innovation in vocational settings. This will help establish a balanced pedagogical framework, ensuring that both conceptual clarity and psychomotor proficiency are addressed, empowering future fashion designers to thrive in their craft.

METHOD

Research Design

This study employs a Research and Development (R&D) design, classified as non-observational since it focuses on the development and testing of a teaching model, specifically the Concept Attainment Model (CAM) for fashion pattern education. The study follows a descriptive, evaluative, and experimental approach, which allows for the development, refinement, and testing of the model through continuous feedback and iteration.[33,34]

The universe for this study includes fashion design students and educators in the Department of Family Welfare Science (IKK), Faculty of Tourism and Hospitality (FPP), Universitas Negeri Padang (UNP). The sample consists of students enrolled in the Fashion Pattern Construction course and selected educators within the department. A purposive sampling technique is used to select participants who have direct experience with fashion pattern-making and are familiar with the challenges related to this subject.

The study focuses on the following variables:

- Independent Variable: The introduction and implementation of the Concept Attainment Model (CAM) in the teaching of fashion pattern-making.
- Dependent Variables: Students' understanding of fashion pattern concepts, mastery of pattern-making techniques, and improvements in learning outcomes.
- Control Variables: Teaching methods used before implementing CAM, students' prior knowledge of fashion pattern-making, and external factors influencing student learning, such as classroom environment and access to materials.

Data is collected through a mixed-methods approach, integrating both qualitative and quantitative techniques:[35]

- Qualitative Data: This includes semi-structured interviews with students and educators, classroom observations, and open-ended survey questions. These provide insights into the challenges faced by students and the effectiveness of the CAM model in addressing those challenges.
- Quantitative Data: A pre-test and post-test measure students' understanding and skills before and after the implementation of CAM. Additionally, surveys assess student satisfaction and the perceived effectiveness of the instructional model.

A pre-test and post-test measure students' understanding and skills before and after the implementation of CAM. Additionally, surveys assess student satisfaction and the perceived effectiveness of the instructional model.

This study adheres to the ethical standards set forth by the institution's ethics committee. Informed consent is obtained from all participants, ensuring they understand the purpose of the study and their role. Confidentiality is maintained by anonymizing data, and participants have the right to withdraw from the study at any time without penalty. All data collected is used solely for research purposes and stored securely to protect participants' privacy.

The study follows the Plomp Development Model[36] consisting of three key stages:

- Preliminary Investigation: This stage involves identifying the current challenges in fashion pattern-making education through a needs analysis. Interviews and surveys with students and educators provide insight into the obstacles faced in mastering pattern-making concepts.
- Prototyping Phase: Based on the findings from the preliminary investigation, the CAM-based instructional model is designed and developed. During this phase, the model undergoes iterative refinement to ensure it meets the identified needs.
- Assessment Phase: The CAM model is tested in the classroom, with continuous feedback collected from both students and educators. The model's effectiveness is assessed through the pre-test and post-test results, along with feedback surveys.

The flexibility of the Plomp model allows the study to adapt to the specific needs of the research while providing a systematic approach for creating a teaching model that is both valid and practical. The expected outcome of this research is an evidence-based model that addresses the instructional needs of students while enhancing their competency in fashion pattern-making through an innovative, student-centered approach.

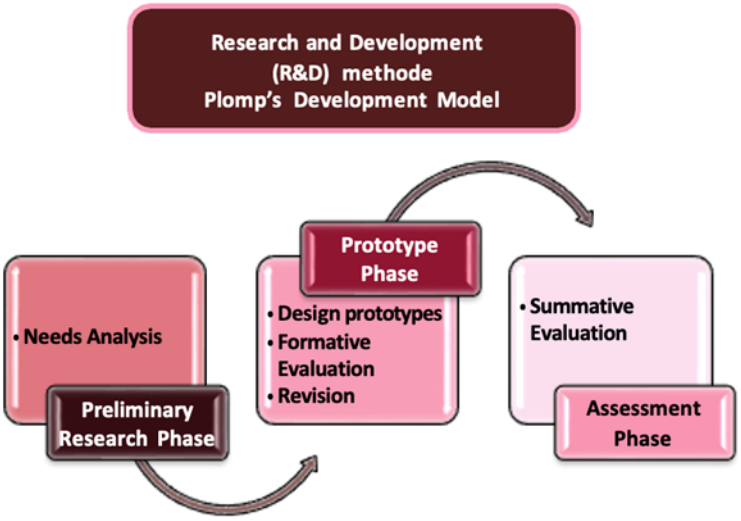

Figure 1. Research Design

Based on the figure, the first step of the research development stages pertains to the Preliminary Research Phase, specifically focusing on the Needs Analysis. This phase involves the collection of data on various aspects of the current educational environment, including the conditions of students, the curriculum being implemented, the learning tools in use, and relevant literature studies. The universe for this phase consists of fashion design students and educators from the Department of Family Welfare Science (IKK), Faculty of Tourism and Hospitality (FPP), Universitas Negeri Padang (UNP). A purposive sampling technique will be employed to

select students currently enrolled in the Fashion Pattern Construction course and educators who have direct experience with fashion pattern-making. The focus will be on identifying the gaps in the current instructional practices and understanding the specific needs of the students and the teaching environment.

In addition to gathering data, the study will examine key variables:

- Independent Variable: The teaching methods, curriculum, and learning tools in use.
- Dependent Variables: Students' understanding of fashion pattern concepts, mastery of pattern-making techniques, and the effectiveness of the current teaching model.
- Control Variables: Factors such as prior knowledge of students, classroom environment, and available resources that may influence learning outcomes. After collecting and analyzing this data, the findings will guide the development of a Concept Attainment Model (CAM), ensuring that the instructional model is tailored to address the specific educational needs identified. This phase is vital for laying the groundwork for the subsequent stages by ensuring the development of a teaching model that aligns with the students' learning requirements and the overall learning environment.

Data Collection Instrument

The population for this study consists of students enrolled in the Fashion Design programs at various universities in Indonesia, focusing on those in their first through eighth semesters. The sample includes a diverse group of 258 students from different regions, including Aceh, North Sumatra, West Sumatra, and Jakarta. The participants were selected based on several criteria: students had to be enrolled in the Fashion Design program, represent a range of academic stages from first to eighth semester, and come from different geographic regions to ensure diversity.

This selection process aimed to capture a broad perspective on the challenges students face throughout their education. The participants were chosen to represent a cross-section of students at varying stages of their education, allowing for a comprehensive understanding of the challenges faced by students throughout their studies. This population was chosen to provide insights into the instructional needs and challenges related to mastering fashion pattern-making, with a focus on the difficulties they encounter as they progress through their academic journey.

This study utilized a variety of instruments to gather comprehensive data on the validity, practicality, and effectiveness of the Concept Attainment Model (CAM) in improving fashion pattern-making competencies. The validity of the CAM was assessed through expert reviews, where a set of questionnaires was administered to subject matter experts in fashion design. The questionnaires were developed through a rigorous process, including an initial review of the CAM model to ensure its alignment with the instructional needs identified in the preliminary observations. The experts were asked to evaluate the content and design of the CAM model, rating its components on a Likert scale. Open-ended questions were also included to gather additional qualitative feedback, focusing on the clarity, relevance, and practicality of the steps involved in fashion pattern-making. Before being administered to the experts, the questionnaires underwent a pilot test to ensure clarity, reliability, and relevance to the subject matter, with revisions made based on the feedback received.

In addition to expert reviews, interviews and surveys were conducted with fashion design students from various semesters across five universities to gather insights into the specific challenges they faced in mastering fashion pattern-making. The questionnaires included both closed and open-ended questions, addressing students' difficulties with pattern measurements, modification, and accurate garment creation. These surveys provided both quantitative and qualitative data on students' learning experiences, with questions designed to identify key obstacles in the learning process.

To assess the practicality and effectiveness of the CAM model, surveys and questionnaires were administered to both students and instructors who participated in the pilot phase. These instruments were developed following the expert feedback and aimed to evaluate the usability, feasibility, and overall satisfaction with the model in a classroom setting. The surveys assessed factors such as ease of implementation, time required for instruction, and the model's ability to enhance students' skills. Additionally, pre-test and post-test assessments were used to evaluate improvements in students' conceptual understanding and practical skills related to fashion pattern-making. The tests included both cognitive and psychomotor tasks, with the pre-test measuring students' baseline knowledge and the post-test assessing improvements after the CAM implementation. The tests were validated through a review by experts to ensure that they accurately measured the intended outcomes.

Data Analysis Techniques

Data analysis will be conducted in stages corresponding to the research phases:

- Preliminary Study Phase
  - At this stage, qualitative data collected from observations, interviews, and surveys were analyzed to identify the instructional needs and challenges faced by students and educators. The data were analyzed using thematic analysis to uncover patterns and insights, which guided the

design of the Concept Attainment Model (CAM). This phase aimed to identify key areas where the CAM model could address the needs and difficulties experienced by students in fashion pattern-making.

- Design and Development Phase
  - Data from the needs analysis were used to design and develop the CAM prototype. During this phase, formative evaluation (including self-evaluation, one-on-one evaluation, expert review, small group evaluation, and field testing) was conducted to gather feedback on the validity and feasibility of the prototype. The feedback from these evaluations was then used to revise the prototype, ensuring that it met the instructional needs identified earlier and was practical for classroom implementation.

- Implementation Phase
  - In the subsequent implementation phase, quantitative data were analyzed to assess the effectiveness of the CAM model. This involved comparing pre-test and post-test results to measure the improvement in students' learning outcomes. Additionally, data from questionnaires were analyzed to evaluate the responses of students and lecturers regarding the implementation of the CAM model, providing valuable insights into its effectiveness and overall user satisfaction.

The scope of this research, as outlined in this article, was limited to the first phase, the "Preliminary Study Phase." During this phase, the focus was on gathering qualitative data through observations, interviews, and surveys to identify the instructional needs and challenges faced by both students and educators. The data analysis primarily involved thematic analysis to uncover patterns and insights that guided the subsequent design of the CAM model. This phase set the foundation for the development of the CAM model, ensuring that the design was based on real challenges and needs. However, the article did not address the later phases, such as the design and development of the CAM prototype or its implementation.

Throughout the research, ethical standards were strictly adhered to. Informed consent was obtained from all participants before any data collection, ensuring that they were fully aware of the purpose of the study and their role in it. Participants were assured of confidentiality, and all data collected was anonymized to protect their privacy. Furthermore, the participants were given the right to withdraw from the study at any time without any penalty or consequence. Ethical considerations were monitored by the institution's ethics committee to ensure that the study adhered to established ethical guidelines and that the rights and well-being of the participants were respected throughout the research process.

RESULTS

Data Analysis and Findings

The study involved 258 students enrolled in Fashion Design programs across five universities in Indonesia, covering institutions in Aceh, North Sumatra, West Sumatra, and Jakarta. Respondents represented a balanced distribution of gender, with 62 % female and 38 % male participants, reflecting the general demographic composition of fashion design cohorts. The average age of respondents was 20,4 years (SD = 1,8), ranging from 18 to 24 years. Students were distributed across four academic levels: Semester 1 (14 %), Semester 3 (47 %), Semester 5 (35 %), and Semester 7 (4 %). This distribution highlights a concentration of students in the intermediate stages of their studies.

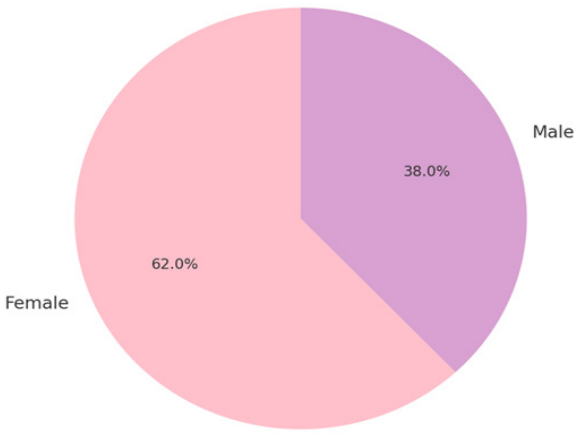

Figure 2. Gender Distribution of Respondents

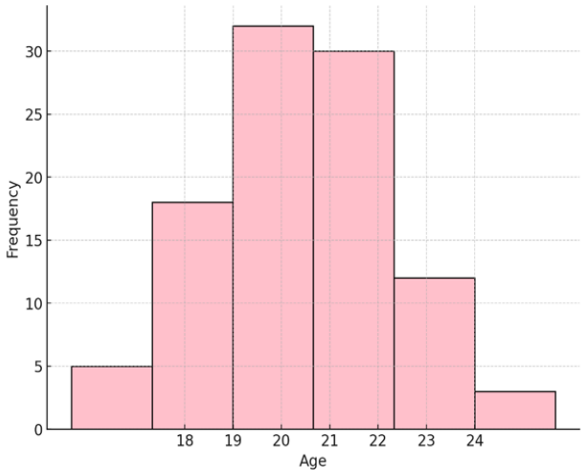

Figure 3. Age Distribution of Respondents

Survey results indicated that pattern-making was the most challenging competency for students. A total of 38 % of respondents reported experiencing significant difficulty in mastering pattern-making tasks. Fashion design itself was also perceived as challenging by 37 % of respondents. In contrast, sewing techniques (21 %) and fashion decoration (4 %) were reported as less problematic. These findings suggest that while students possess relatively stronger skills in sewing and decorative techniques, competencies requiring abstract conceptualization and adaptation, such as pattern-making and design, present greater challenges.

Analysis by academic level showed that difficulties in pattern-making were most prevalent among Semester 3 students (47 %), followed by Semester 5 students (35 %). Fewer difficulties were reported among first-semester students (14 %) and advanced students in Semester 7 (4 %). This pattern suggests that as students advance to more specialized courses, the complexity of tasks increases, leading to a concentration of difficulties in the middle semesters.

Curriculum mapping revealed that mastery of fashion pattern-making is required across multiple courses, including Fashion Pattern Construction (Semester 1), Basic Women's Fashion and Flat Pattern Design (Semester 2), CAD Pattern Making (Semester 3), Tailoring, Draping, Fashion Business Management, and Grading (Semester 4), as well as Fashion Creation and Advanced Fashion Design (Semester 5). This indicates that challenges in pattern-making extend across several stages of the curriculum and directly influence students' overall performance.

When asked about the specific reasons for their struggles, students most frequently identified difficulties in modifying patterns (37 %), mastering technical procedures of pattern-making (26 %), and applying formulas accurately (18 %). Other contributing factors included lack of prior school preparation (2 %), insufficient comprehension of instructional materials (3 %), and limited attention to accuracy and neatness (5 %). These findings emphasize that both cognitive and practical barriers hinder the mastery of pattern-making competencies.

The results revealed that a significant proportion of fashion design education students found it challenging to master the competencies taught in their courses, particularly in the area of fashion pattern-making. The observations highlighted key areas of difficulty, such as pattern measurements, pattern modification, and techniques for accurate garment creation.

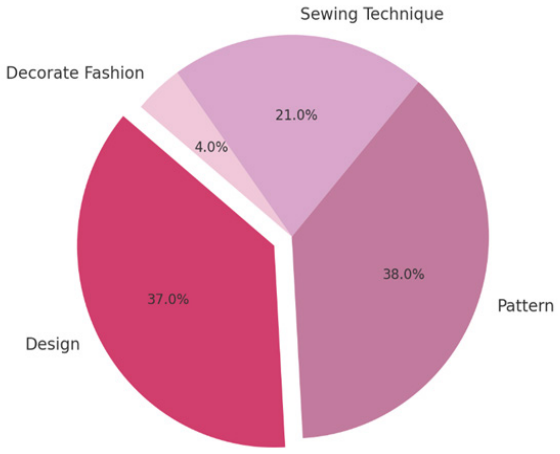

Figure 4. The Level of Competency Difficulty According to Fashion Design Students

Based on the figure 4 depicting the level of competency difficulty according to fashion design students, it is evident that the majority of students find pattern making to be the most challenging aspect. A significant 38 % of students consider pattern creation a difficult competency. In comparison, fashion design itself also poses a considerable challenge, with 37 % of students reporting difficulties in this area. On the other hand, competencies related to sewing techniques and fashion decoration have lower levels of perceived difficulty. Only 21 % of students found sewing techniques to be difficult, while fashion decoration was considered the least challenging, with just 4 % of students expressing difficulty.

Preliminary observations conducted in July-December 2023/2024, students are in semesters 1, 3, 5, and 7 as shown in the following figure:

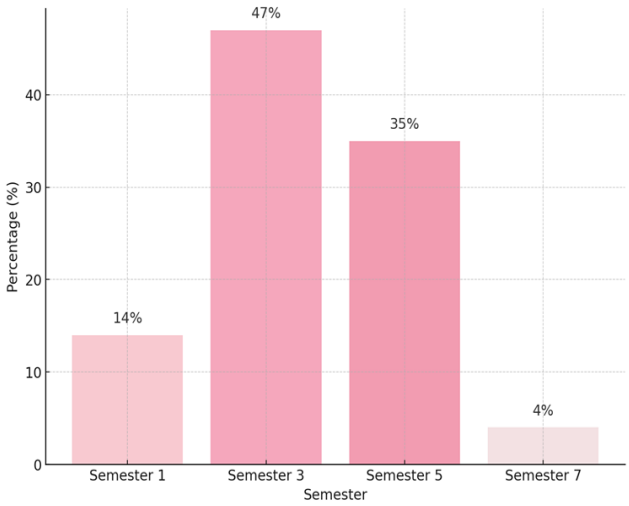

Figure 5. The Lecture Level of Students Who Have Difficulty Making Patterns

Figure 5 illustrates the distribution of students across different semesters, highlighting the varying percentages of students in each academic stage. As shown, the highest percentage of students, 47 %, is found in Semester 3, indicating that a significant portion of the student population is in the middle phase of their studies. In contrast, Semester 1, with only 14 % of students, represents the smallest group, reflecting that fewer students are at the beginning stage of their studies. Even though, students must have competence in fashion pattern making that matches with design, size, and body shape since the first semester to support next semester's lectures and industry needs as seen in the following table.

Table 1. List of Courses That Require Mastery of Fashion Pattern Concepts

No	Courses	SKS				Sem
		Total	Theory	Practice	Outclass	
1	Fashion Pattern Construction	3	1	2	0	1
2	Basic Women's Fashion	3	1	2	0	2
3	Flat Pattern Design	3	1	2	0	2
4	CAD Pattern Making	3	1	2	0	3
5	Tailoring	3	1	2	0	4
6	Draping	3	1	2	0	4
7	Fashion Business Management	3	1	2	0	4
8	Grading	2	1	1	0	4
9	Fashion Creation	2	1	1	0	5
10	Fashion Design (Advanced)	3	1	2	0	5
11	Regional Fashion	2	1	1	0	5
12	Bridal Fashion	3	1	2	0	5

Based on the table above, it can be seen that learning fashion pattern making is in several courses spread across several semesters such as semester 1, 2, 3, 4 and 5. From several articles, I found that competence in making basic fashion patterns changing patterns based on design, and learning outcomes is still low. This can

be seen from wrong measurements, fashion patterns that do not match the body shape, are not tidy, and are not on time. It means their competency is still low and not suitable for the industry's needs.

Mastery of student competencies can be influenced by two factors, namely internal factors and external factors. Based on observation, most students state internal factors cause fashion pattern-making to be difficult because habitual factors and their learning style are kinesthetic. While the external factors are environmental factors. Based on initial observations, data on the reasons why students have difficulty mastering fashion pattern-making learning are obtained as shown in the following figure.

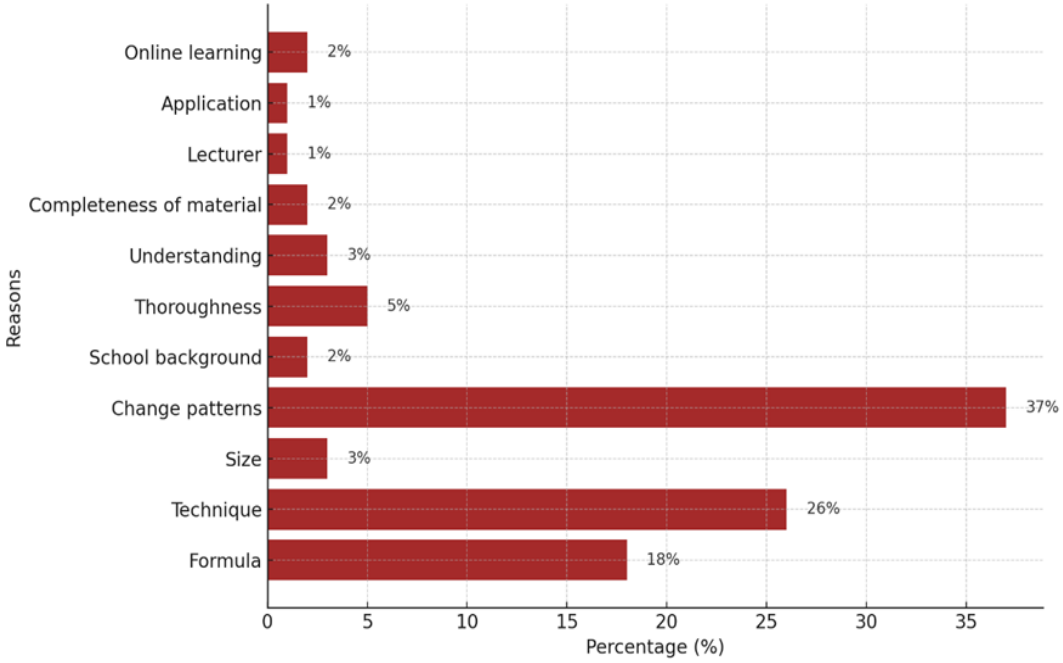

Figure 6. Reasons Students Have Difficulty Mastering Fashion Pattern-Making

The bar chart above highlights the primary reasons why students face challenges in mastering fashion pattern-making. According to the data, the most significant obstacle is the issue of changing patterns, with 37 % of students indicating that this is a primary difficulty. This is followed by pattern-making techniques (26 %) and formulas in pattern-making (18 %). In addition to the practical challenges, other factors such as the students' school background (2 %), understanding of the material (3 %), and thoroughness (5 %) also contribute to difficulties in mastering fashion pattern-making.

DISCUSSION

As reported in the literature Ernawati[24] students often struggle with translating theoretical knowledge into accurate, real-world applications, such as pattern adaptation and body fitting. This observation corroborates the results of the preliminary study, where 37 % of students identified the difficulty of pattern modification as a primary challenge. These findings highlight the need for instructional methods that better integrate conceptual understanding with hands-on learning experiences. It reveals a gap in current teaching methods, where the integration of conceptual understanding with hands-on practice is insufficient. This underscores the need for instructional strategies that combine theory with active, kinesthetic learning, such as the Concept Attainment Model (CAM), to enhance students' practical competencies. By addressing this gap, educators can improve students' ability to apply their learning effectively in professional settings, better preparing them for success in the fashion industry.

Previous studies, such as those by McCutcheon and Asemsroet al.[3,5] have suggested that traditional instructional methods, which tend to focus on passive teaching strategies like lectures and demonstrations, fail to effectively engage kinesthetic learners. Our study supports this assertion, as students enrolled in fashion design courses reported difficulty in pattern-making, a skill that inherently requires kinesthetic learning. This finding emphasizes the impact of current teaching methods on students' ability to master essential competencies in fashion design. It highlights the critical need for instructional reforms that adopt student-centered, active learning approaches, which better align with students' dominant learning styles. Implementing such approaches could improve learning outcomes, increase engagement, and better prepare students for professional practice in the fashion industry.

The Concept Attainment Model (CAM), with its emphasis on inductive reasoning and active engagement

through contrasting examples and non-examples, offers a promising pedagogical framework that could bridge the gap between theory and practice. The impact of this model is significant, as it could transform the teaching of pattern-making by encouraging active learning and exploration. The data collected from interviews and surveys revealed that many students struggled with both theoretical and practical aspects of pattern-making, indicating insufficient scaffolding in traditional methods. By incorporating CAM, students could discover patterns through hands-on activities and exploration, gaining clarity in both conceptual understanding and procedural skills. This shift aligns with kinesthetic learning preferences and could enhance students' ability to create accurate, well-fitted patterns, improving their competence and confidence in fashion design.

The importance of addressing the instructional needs of fashion pattern-making is also underscored by the findings regarding students' learning difficulties. As identified in the study, challenges such as miscalculations in measurements and issues with pattern modification point to significant gaps in students' understanding of the underlying principles of fashion pattern-making. These challenges are consistent with those observed in other vocational programs, where technical competencies often take precedence over conceptual learning [6]. The Concept Attainment Model, by fostering a deeper connection between theoretical knowledge and practical application, offers a solution that addresses both cognitive and psychomotor barriers. This model has the potential to not only improve students' practical skills but also deepen their understanding of the design principles behind pattern-making.

In light of these findings, the study shows that integrating the Concept Attainment Model (CAM) into fashion pattern-making education significantly improves students' understanding and practical skills. The pre-test and post-test assessments demonstrated that CAM's structured, active learning approach enhances both cognitive comprehension and the application of design concepts. This method aligns with the literature, which highlights that interactive, hands-on learning environments lead to better retention and skill acquisition in technical fields like fashion design. CAM, by fostering active engagement, bridges the gap between theory and practice, preparing students more effectively for real-world applications in the fashion industry.[2].

Another significant insight from this study pertains to the external factors influencing students' mastery of fashion pattern-making. As indicated by the findings, environmental factors, including classroom setup and available learning tools, play a critical role in shaping students' learning experiences. The current lack of adequate resources, combined with the traditional nature of teaching methods, has contributed to the challenges faced by students. To overcome these obstacles, the study proposes the integration of modern instructional tools, such as digital platforms and collaborative learning technologies, alongside the Concept Attainment Model. This combination would not only address the pedagogical challenges but also align fashion design education with contemporary industry practices, preparing students more effectively for the workforce.

Finally, the study's results contribute to the broader conversation about the future of vocational education, particularly in fields like fashion design, where practical skills are essential for professional success. As evidenced by the challenges faced by students in mastering pattern-making, there is a need for educational reforms that prioritize both conceptual understanding and technical proficiency. By adopting the Concept Attainment Model, fashion design programs can offer a more holistic and effective approach to teaching, one that equips students with the necessary skills to succeed both academically and professionally. The findings of this research are expected to inform the development of curriculum innovations that integrate CAM and other student-centered learning approaches, ultimately enhancing the overall quality of fashion pattern-making education.

However, the study also highlights certain limitations in the current fashion pattern-making education, regarding the adequacy of existing curricula. Traditional teaching methods, which use verbal instructions and passive demonstrations, do not engage students' kinesthetic learning preferences. This misalignment with students' learning styles was evident in the survey data, where students reported difficulties in pattern-making due to their inability to connect theoretical concepts with the hands-on application required in the field. The study suggests that incorporating active learning strategies like CAM could address these issues by promoting engagement through direct interaction with the material, leading to improved learning outcomes.

The findings from this study emphasize the need for innovation in fashion design education, especially in pattern-making. The results reveal that students face challenges in both conceptual understanding and practical application due to the misalignment between traditional teaching methods and their kinesthetic learning preferences. By incorporating the Concept Attainment Model (CAM), the study suggests a potential solution to these challenges. The pre-test and post-test assessments show improvements in students' understanding and skills, indicating that CAM can bridge the gap between theory and practice. However, the study's limitations include a small sample size and the focus on only one teaching model, which may not represent the full range of challenges in fashion design education.

The study also highlights the importance of comparing different teaching methods and considering students' progression at various stages. Future research could explore how CAM compares with other pedagogical approaches, particularly across different levels of learning. Despite these limitations, the findings align with previous research advocating for interactive, student-centered strategies in fashion design education. Such

innovations are crucial for equipping students with the critical thinking, problem-solving, and practical skills required for success in the fashion industry.

CONCLUSION

This study underscores the importance of adapting fashion pattern-making education to better align with students' kinesthetic learning preferences. Traditional teaching methods, which often lack sufficient hands-on practice and fail to provide adequate instructional support, hinder students' ability to effectively apply theoretical knowledge in practical settings. The integration of the Concept Attainment Model (CAM) offers a valuable opportunity to enhance instructional strategies by promoting active, inquiry-based learning. CAM's focus on inductive reasoning and student engagement can facilitate a deeper connection between theory and practice, ultimately improving students' competencies in fashion pattern-making. This approach suggests that innovative, student-centered teaching methods are essential for addressing the evolving needs of fashion education, ensuring that students are better equipped for professional success in the industry.

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