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From Pattern to Product: An Analysis of the Relationship Between Learning Outcomes in Fashion Pattern Engineering and Women's Fashion Production

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Abstract
Mastery of fashion pattern engineering competencies is a fundamental requirement for success in applied fashion production learning. This study aims to examine the relationship between learning outcomes in the Fashion Pattern Engineering course and the Women's Fashion Production course among students of the Fashion Education Study Program at Universitas Negeri Semarang, class of 2024. A quantitative ex post facto design was employed, involving 85 students selected through saturated sampling. Data were obtained from official academic records and analyzed using descriptive and inferential statistics, including the Shapiro–Wilk test, Levene's test, and Spearman rank correlation. The results indicated that the data were not normally distributed but homogeneous. A positive and significant correlation was found ($r = 0.447$; $p < 0.001$), categorized as moderate. These findings suggest that pattern engineering competence contributes to student achievement in fashion production. Therefore, strengthening instructional integration and supporting learning factors is necessary to improve learning outcomes.

Keywords: correlation, fashion education, learning outcomes, fashion pattern engineering, women's fashion production

INTRODUCTION

The Fashion Education Study Program at Universitas Negeri Semarang is one of the study programs within the field of Family Welfare Education, aimed at preparing vocational tourism school (SMK Pariwisata) teachers in fashion education, as well as entrepreneurs and specialists in the fashion industry who are excellent, professional, skilled, and committed to environmental, natural, social, and cultural sustainability (Wahyuningsih, 2016). Students are equipped with a range of competencies throughout their studies, spanning the fundamentals of fashion design, garment pattern construction, fashion pattern engineering, garment technology, and comprehensive fashion production, as mandated by Law Number 20 of 2003 concerning the National Education System, which emphasizes the importance of applied skills in vocational education. All of these competencies are implemented through various practice-based courses designed sequentially, wherein mastery of one course serves as the foundation for subsequent courses.

Fashion Pattern Engineering is a technically-oriented course in which manual pattern-making and construction remain the primary instructional methods (Irmayanti et al., 2020). Sawitri et al. (2023) stated that pattern-making instruction, whether conducted through manual construction or technology-based approaches such as CAD, is directed toward improving student learning outcomes and competencies, such that pattern mastery constitutes a critical foundation for supporting the fashion production process. This course requires in-depth understanding of pattern construction, body proportion, and pattern manipulation techniques, which are fundamental competencies in garment-

making. Patterns serve as the primary reference in clothing production because they determine the fit of the garment to the body and wearer comfort; accordingly, accuracy in pattern-making is an essential factor influencing the quality of fashion products (Shoumi et al., 2016). Students are required not only to understand measurement and proportion theories in an abstract sense, but also to translate them into precise pattern lines on paper, which demands a high degree of accuracy and spatial awareness that not all students possess from the outset. This challenge becomes more pronounced with garments of complex construction, such as shirts, blazers, or structured gowns, where even a minor error in determining dart lines or seam allowances can substantially affect the garment's fit. Given these course characteristics, this situation explains why technically-demanding courses such as Fashion Pattern Engineering tend to be more challenging for certain students, particularly those with limited practical background (Sari et al., 2026).

In contrast to Fashion Pattern Engineering, Women's Fashion Production is an applied course in which students directly translate patterns into the sewing process to produce finished garments (Kulsum, 2020). The product-oriented nature of this course provides a qualitatively distinct learning experience. Kusumadewi & Rosnawati (2025) who found that students' learning styles influenced their achievement in the women's fashion course. This finding is consistent with Nafisah & Wahyuningsih (2023) that active student engagement and the selection of appropriate instructional media are the primary supporting factors for successful productive learning in fashion education. Pawestri & Yuniati (2025) also demonstrated that the implementation of the Project-Based Learning (PjBL) model in industrial garment-making instruction has been demonstrated to significantly influence student learning motivation and active engagement.

These two courses are sequentially interconnected, with Fashion Pattern Engineering taken first as a prerequisite before students enroll in Women's Fashion Production (Gunawan et al., 2024). This finding is reinforced by research demonstrating that mastery of pattern construction has a significant relationship with practical garment-making outcomes, whereby higher levels of pattern mastery are associated with better practical results (Sihombing & Carolina, 2013). A similar finding was reported by Shoumi et al. (2016) who found a positive and significant relationship between sewing skills and grades in the Women's Clothing Construction course, with a correlation coefficient of r = 0.600, classified as a strong relationship. Jannah & Irmayanti (2026) demonstrated a positive and significant relationship between pattern-making skills and student learning outcomes in the tailoring course within the Fashion Education Study Program at Universitas Negeri Semarang, with a moderate correlation coefficient (r = 0.428). Amalia & Irmayanti (2026) also identified a significant and strong relationship between basic pattern-making and pattern drafting skills and student learning outcomes in the Women's Fashion Production course at the Fashion Education Study Program of Universitas Negeri Semarang, with a correlation coefficient of r = 0.537. This phenomenon indicates the existence of an issue warranting empirical investigation: whether students' mastery in Fashion Pattern Engineering is genuinely related to their achievement in Women's Fashion Production. This situation suggests that prerequisite course mastery does not automatically guarantee success in subsequent courses, particularly in practice-based learning that demands the integration of various technical skills in the field of fashion education.

Student learning outcomes are also influenced by various other factors, including learning motivation, interest, and a supportive learning environment (Yuliana & Mariah, 2017). Learning motivation has even been shown to make a substantial contribution to learning outcomes in fashion pattern instruction (Pratiwi & Ridhani, 2023). Therefore, examining the relationship between learning outcomes in these two courses is important as a basis for evaluating and strengthening instructional strategies within the study program.

Although several prior studies have examined the relationship between pattern-making skills and sewing skills, those investigations generally employed practical skills assessments as a single variable. The study by Sihombing & Carolina (2013) focused on pattern construction subjects at the vocational school (SMK) level, while Shoumi et al. (2016) dan Jannah & Irmayanti (2026) examined relationships based on technical skills rather than overall final course grades. To date, relatively few studies have specifically examined the relationship between Fashion Pattern Engineering course learning outcomes—as academic achievement encompassing both theoretical and practical aspects—and Women's Fashion Production learning outcomes at the higher education level. This research gap provides the rationale for the present

study. This study aims to determine whether a significant relationship exists between Fashion Pattern Engineering course learning outcomes and Women's Fashion Production course learning outcomes among students of the Fashion Education Study Program at Universitas Negeri Semarang, class of 2024.

METHOD

Research Design

This study employed a quantitative approach with an ex post facto design, which examines events that have already occurred without imposing any treatment on the variables under investigation (Sugiyono, 2019). The variables in this study consisted of Fashion Pattern Engineering course learning outcomes as the independent variable (X) and Women's Fashion Production course learning outcomes as the dependent variable (Y).

Population and Research Sample

The population of this study comprised 85 students of the Fashion Education Study Program at Universitas Negeri Semarang, class of 2024, who were enrolled in both the Fashion Pattern Engineering and Women's Fashion Production courses. The sampling technique employed was saturated sampling, defined as a technique in which all members of the population are included as the sample (Sugiyono, 2019). The selection of saturated sampling was based on the consideration that the relatively small population size permitted the inclusion of all population members, enabling the analysis to reflect the actual conditions of the study program without the risk of sampling bias. The use of data from all students enrolled in both courses within the same academic year ensures equivalence in terms of instructional context, instructor, and study period.

Data Collection Technique

The data collection technique employed was documentation, defined as the collection of data from pre-existing documents (Sugiyono 2019). The data collected comprised final grades for the Fashion Pattern Engineering and Women's Fashion Production courses, obtained from the official grade records of the Fashion Education Study Program at Universitas Negeri Semarang, class of 2024. Final grades were used to reflect student learning achievement encompassing both theoretical and practical aspects. Data were processed using SPSS software.

Data Analysis Technique

Data analysis techniques included descriptive statistical analysis and inferential analysis. Statistical analysis was employed to systematically present and interpret research data in order to generate meaningful information (Mishra et al., 2019), encompassing mean values, standard deviation, minimum values, and maximum values. Prior to hypothesis testing, statistical assumption tests were conducted, including normality and homogeneity tests.

The normality test was conducted using the Shapiro-Wilk method to determine whether the data were normally distributed, given that this method has been demonstrated to possess the highest test power compared to other normality methods such as Kolmogorov-Smirnov, Lilliefors, and Anderson-Darling (Razali & Wah, 2011). The homogeneity test was conducted using Levene's Test to examine the equality of variances between the two data groups as part of the statistical assumption testing process for determining the appropriate subsequent test (Sianturi, 2022). If the data were normally distributed, hypothesis testing would be conducted using the Pearson Product Moment correlation test. However, if one or both variables were not normally distributed, hypothesis testing would be performed using the Spearman Rank correlation test as a non-parametric alternative. According to Sugiyono (2019), the correlation coefficient (r) value can be categorized as shown in Table 1. Significance testing was conducted at an error level of 5% ($\alpha = 0.05$), with the criterion that H_0 is rejected when the significance value (sig. 2-tailed) < 0.05.

Table 1. Correlation Coefficient Interval

Correlation Coefficient (r)	Relationship Category
0,00 – 0,199	Very Low
0,20 – 0,399	Low

0.4 – 0.599	Moderate
0,6 – 0,799	Strong
0,8 - 1	Very Strong

Source: Sugiyono (2019)

RESULTS AND DISCUSSION

This study analyzed the relationship between learning outcomes in the Fashion Pattern Engineering course and learning outcomes in the Women's Fashion Production course. The research subjects consisted of 85 students from the 2024 cohort of the Fashion Education Study Program at Universitas Negeri Semarang. The following section presents the analysis results sequentially, encompassing descriptive statistics, assumption tests, and correlation analysis, followed by an in-depth discussion.

Descriptive Statistics

Table 2. Descriptive Statistics

	N	Mean	Std. Dev	Min	Max
Fashion Pattern Engineering	85	82,13	4,39	72	100
Women's Fashion Production	85	82,61	6,75	54	91

Source: Primary research data

The statistical analysis results in Table 2 indicate that learning outcomes in the Fashion Pattern Engineering course had a mean of 82.13 with a standard deviation of 4.39, a minimum value of 72, and a maximum value of 100. Meanwhile, the Women's Fashion Production course yielded a mean learning outcome of 82.61 with a standard deviation of 6.75, a minimum value of 54, and a maximum value of 91. Overall, both courses exhibited nearly identical mean values, with a difference of 0.48 points.

Although the mean values of both variables were relatively comparable, the degree of score dispersion indicated differences that warrant attention. The larger standard deviation in the Women's Fashion Production course (SD = 6.75) suggests that variability in student achievement was more pronounced compared to Fashion Pattern Engineering (SD = 4.39), where scores tended to cluster more uniformly around the mean. The broader score range in Women's Fashion Production, particularly with a lower minimum value (54), indicates that a subset of students encountered difficulties in completing this course optimally. This variation in achievement is presumed to be related to students' ability to apply the pattern competencies previously acquired in Fashion Pattern Engineering to the actual women's fashion production process, as well as to individual factors such as practical experience, learning style, and technical sewing readiness (Yulian & Ernawati, 2018).

Normality Test

Following descriptive analysis, statistical assumption tests were conducted, including normality and homogeneity tests, to determine the appropriate type of correlation test. The normality test was performed using the Shapiro-Wilk method to determine whether the data for each variable were normally distributed, serving as the primary basis for selecting the inferential analysis technique.

Table 3. Shapiro-Wilk Normality Test

	Shapiro-Wilk		
	Statistic	df	Sig.
Fashion Pattern Engineering Learning Outcomes	.943	85	< 0.001
Women's Fashion Production Learning Outcomes	.782	85	< 0.001

Source: Primary research data

Based on the Shapiro–Wilk test results in Table 3, the significance values for both variables were below 0.05: Fashion Pattern Engineering (SW = 0.943; sig. < 0.001) and Women's Fashion Production (SW = 0.782; sig. < 0.001). This indicates that the data for both courses were not normally distributed (Razali & Wah, 2011).

Homogeneity Test

Subsequently, the homogeneity test was conducted using Levene's Test to examine the equality of variances between the learning outcomes of the Fashion Pattern Engineering and Women's Fashion Production courses as part of the statistical assumption testing (Sianturi, 2022).

Table 4. Levene Homogeneity Test

		Levene			
		Stat.	df1	df2	Sig.
Fashion Pattern Engineering Learning Outcomes	Based on Mean	.037	1	83	.849
Women's Fashion Production Learning Outcomes	Based on Mean	2.439	1	83	.122

Source: Primary research data

The homogeneity test results in Table 4 indicate that the significance values for the Fashion Pattern Engineering course (Levene = 0.037; sig. = 0.849) and Women's Fashion Production course (Levene = 2.439; sig. = 0.122) were both above 0.05, indicating that the data variances for both courses were homogeneous (Sianturi, 2022). The statistical assumption test results indicate that although the data were homogeneous, the data for both variables were not normally distributed based on the prior Shapiro-Wilk test. Therefore, hypothesis testing was conducted using the Spearman Rank correlation test as a non-parametric test that does not require the assumption of normal distribution (Sugiyono, 2019).

Spearman Rank Correlation Test

Table 5. Spearman Rank Correlation Test

			FPE	WFP
Spearman's rho	Fashion Pattern Engineering Learning Outcomes	Correlation Coefficient	1.000	.447***
		Sig. (2-tailed)	.	< 0.001
		N	85	85
	Women's Fashion Production Learning Outcomes	Correlation Coefficient	.447** *	1.000
		Sig. (2-tailed)	< 0.001	.
		N	85	85

***. Correlation is significant at the 0.001 level (2-tailed).

Source: Primary research data

Based on the Spearman correlation test results in Table 5, a correlation coefficient of 0.447 was obtained with a significance value of < 0.001. A significance value below 0.05 indicates that H0 is rejected, and there is a significant relationship between Fashion Pattern Engineering learning outcomes and Women's Fashion Production learning outcomes. The strength of the relationship falls within the moderate category with a positive direction, meaning that higher levels of student mastery in fashion

pattern engineering tend to be associated with better achievement in Women's Fashion Production.

These findings are also consistent with numerous prior studies. Purwiningsih and Musdalifah (2026) identified a positive and significant relationship between mastery of basic pattern elements and readiness for the fashion production stage, with a relationship strength classified as strong. The research of Sihombing & Carolina (2013) also demonstrated bahwa konstruksi pola memiliki hubungan yang signifikan dengan praktik pembuatan busana. Selain itu, Shoumi et al. (2016) argued that technical skills such as sewing have a strong correlation with achievement in clothing construction courses. Collectively, these findings indicate that pattern and production competencies are not two isolated aspects but are mutually integrated within a unified fashion education learning process.

This is further corroborated by Ernawati (2022) who, in a study conducted at the Fashion Education Study Program at Universitas Negeri Padang, found that students' ability to create fashion patterns was significantly influenced by learning facilities and learning discipline. Therefore, students' pattern competence is shaped by integrated learning conditions and directly contributes to achievement in fashion production courses. These findings confirm that pattern mastery does not stand alone but is part of an interconnected competency ecosystem that supports the garment production process.

This relationship can be understood more deeply through a hierarchical examination of the two courses within the field of fashion education. The Fashion Pattern Engineering course emphasizes technical ability in designing and developing patterns as the basis for garment construction, while the Women's Fashion Production course demands the ability to apply those patterns within an actual garment-making process. Patterns serve as the primary reference that determines the form, dimensions, and fit of a garment; consequently, pattern accuracy profoundly affects the quality of the final product. This is also consistent with the research of Jannah & Irmayanti (2026) who demonstrated that pattern-making skills have a positive and significant relationship with sewing learning outcomes. Advances in educational technology indicate that the integration of 3D technology in garment pattern-making instruction can enhance achievement in the aspects of knowledge application and garment structure busana (Qiao, 2025). These findings reinforce that strengthening pattern competency remains relevant as a foundation for fashion production.

The moderate correlation coefficient also indicates that mastery of the Fashion Pattern Engineering course is not the sole determinant of success in the Women's Fashion Production course. Learning outcomes are not determined solely by technical pattern-making ability, but are also influenced by internal and external factors such as learning motivation, interest, and the learning environment (Yuliana & Mariah, 2017). Learning interest is one internal factor that influences student learning outcomes, whereby higher levels of learning interest tend to be associated with better academic achievement (Anggraini et al., 2024). Learning motivation has even been demonstrated to contribute more than 50% to student learning achievement in pattern-making subjects (Pratiwi & Ridhani, 2023). In addition to pattern competency, success in the Women's Fashion Production course is also determined by technical sewing skills and students' overall practical readiness. This is consistent with Kusumadewi & Rosnawati (2025) who showed that students' learning styles significantly affected achievement in women's fashion courses, indicating that the diversity of individual characteristics also contributes to the variation in learning outcomes in applied courses. This variability in achievement, as reflected in the higher standard deviation in Women's Fashion Production compared to Fashion Pattern Engineering, suggests the need for instructional strategies that take into account individual student characteristics in the integration of pattern and production competencies.

Overall, the above findings confirm that the relationship between fashion pattern mastery and fashion production achievement is indeed real and positive, yet moderate in nature as it is mediated by various individual and contextual factors. Therefore, the reinforcement of pattern engineering competency should be positioned as part of a more comprehensive fashion education learning ecosystem, incorporating motivational aspects, differentiated instructional strategies, and technology integration, to support the attainment of optimal learning outcomes.

CONCLUSION

Based on the analysis results, a positive and significant relationship exists between Fashion Pattern

Engineering and Women's Fashion Production learning outcomes among students of the Fashion Education Study Program at Universitas Negeri Semarang, class of 2024. The Spearman Rank correlation test yielded a coefficient of 0.447 with a significance value of < 0.001, classified within the moderate category. These findings indicate that mastery of pattern engineering competencies contributes to achievement in the Women's Fashion Production course. Conceptually, this finding reinforces that pattern competency is foundational to the fashion production process, as it determines construction accuracy, fit conformity, and the quality of the final product.

Nevertheless, the moderate relationship strength indicates that Women's Fashion Production learning outcomes are not entirely determined by pattern engineering mastery but are also influenced by other factors such as learning motivation, interest, and students' practical experience. Therefore, the reinforcement of Fashion Pattern Engineering as a prerequisite course requires optimization, accompanied by more applied instructional integration between pattern and production competencies. Such efforts are expected to enhance the attainment of student learning outcomes more comprehensively within vocation-based fashion education. Future research is recommended to incorporate mediating variables such as technical sewing skills, learning motivation, and students' educational background in order to obtain a more complete picture of the factors influencing success in the Women's Fashion Production course.

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