

The Influence of Problem-Based Learning on Skills Making Basic Women's Clothing Patterns

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Abstract.

This study examined changes in women's basic pattern-making skills after problem-based learning among 19 Grade XI Fashion students at SMK Pangeran Antasari. A quantitative pre-experimental approach employed a one-group pretest-posttest design with total sampling. Performance tasks assessed bodice and sleeve patterns at a 1:4 scale. Data were analyzed using descriptive statistics, the Shapiro-Wilk test, the Wilcoxon signed-rank test, and normalized gain. Mean scores increased from 76.79 to 86.71. The differences were not normally distributed ($p = .001$), and the Wilcoxon test indicated a significant difference ($Z = -3.830$; $p < .001$). All students improved. Mean normalized gain was 0.40577, indicating moderate improvement; 15 students showed moderate and four low gains. Problem-based learning was followed by improved skills in this group, although the absence of a control group prevents isolation of its causal effect.

Keywords: Problem-Based Learning; pattern-making skills; women's basic patterns; vocational school.

I. INTRODUCTION

Fashion Design instruction in Vocational High Schools (SMK) needs to provide experiences that connect knowledge with practical skills. Students are not only required to understand terms, tools, materials, and formulas, but also to use them to produce work that meets the dimensions and construction requirements. In the context of clothing production, basic pattern-making skills are a crucial foundation because patterns serve as a reference for shaping garment parts. Inaccuracies in the pattern can affect the appropriate size and shape of subsequent work.

Basic women's clothing patterns include interrelated parts. In this study, attention is focused on the basic body and sleeve patterns. The body pattern depicts the upper body, while the sleeve pattern is used to shape the garment that covers the arms. The relationship between the two requires precision because the sleeve head shape must match the armhole on the body pattern. Understanding body measurements, construction lines, pattern points, and pattern markings is necessary so that the results are not only complete but also can be checked and used correctly (Ernawati, 2021; Wulandari & Listiani, 2023).

Basic fashion materials provide students with the opportunity to learn the work process step by step. Students must prepare tools and materials, read measurements, use construction instructions, create lines, and check the pattern. This sequence demonstrates that pattern learning encompasses both procedural knowledge and technical skills. Basic fashion textbooks and teacher guides referenced in the research position basic fashion learning as a foundation for learning subsequent competencies (Wahyuningsih, 2022; Wulandari & Listiani, 2023). Therefore, errors in the initial steps need to be addressed through a learning process that helps students understand the relationships between steps.

The success of fashion learning is also related to the learning environment and experiences. Afidah and Russanti (2022) discussed external factors that influence creativity in fashion design. Although design creativity differs from the accuracy of pattern construction, the study demonstrates the relevance of learning conditions in the fashion industry. Research by Ma'rifatunahar and Hidayati (2022) on the STAD model in industrial clothing manufacturing indicates that the choice of learning model is also an issue studied in fashion design education. Both contexts support the need to examine practical learning by considering the characteristics of the competencies to be achieved.

Based on initial observations, eleventh-grade students of Fashion Design at Pangeran Antasari Vocational School still experience difficulties in creating basic patterns for women's clothing. These observations indicate that approximately 60% of the 19 students experienced difficulties in the 2024/2025 academic year with a Minimum Completion Criteria (KKM) of 75. This figure is used as a description of the initial

problem, not as a pretest measurement result in the odd semester research of 2026/2027. The difficulties of concern include measurement accuracy, construction suitability, and pattern shape checking.

Conventional instruction through explanation and demonstration helps students understand the sequence of work. However, when students encounter different measurements, line errors, or mismatches between the body and sleeve patterns, simply following examples isn't necessarily enough to identify the cause. Students need opportunities to examine the problematic part, relate the error to the measurement or construction, and determine how to correct it. This need underpinned the selection of Problem-Based Learning (PBL) in this study.

Problem-based learning (PBL) places problems as the starting point for learning activities. Students are guided to identify problems, seek relevant information, discuss alternatives, and present and evaluate solutions. Sarumaha et al. (2025) explain the application of problem-based learning to mathematical problem-solving skills. Although the material context is different, this research is used to explain the orientation of PBL to problem-solving activities. In pattern making, this orientation is applied to problems of size, shape, and the relationships between pattern components.

Pattern problems have characteristics that lend themselves to analysis. For example, a neckline that's too narrow requires examining its constituent points and lines. A body circumference that doesn't match requires students to revisit measurements and apply formulas. A sleeve head that doesn't fit the body frame requires examining the relationship between the two parts. Through PBL, such problems can be addressed as assignments that require students to provide a rationale for the correction, rather than simply replacing lines without explanation.

In vocational education, PBL has also been studied as an approach to support learning outcomes. Agustin et al. (2024) studied a problem-based learning model using focus group discussions in basic vocational subjects. Akhyar et al. (2024) developed a problem-based and project-based learning syntax for vocational students. Al Husaeni et al. (2025) reported the implementation of PBL combined with multimodal media. These studies demonstrate that PBL is used in vocational contexts, but differences in materials, tools, and designs need to be considered when comparing them with research on fashion patterns.

A more closely related study to the fashion industry was reported by Ernawati et al. (2023) regarding the application of PBL to fashion design learning in vocational high schools. This study references this study as a comparison regarding the improvement in learning outcomes following the implementation of PBL. Similarities in educational fields do not necessarily mean the competencies being measured are the same. Fashion design and basic pattern construction have different demands, so this research focuses specifically on body and sleeve pattern making skills.

The choice of practical competencies as the focus also distinguishes this research from PBL studies that emphasize thinking skills or knowledge outcomes. Changes in pattern-making skills must be assessed through work results and the process, assessed using a rubric. Theoretical answers can provide a snapshot of initial abilities, but they are not sufficient to replace practical assessments. Therefore, the primary measurement in this study uses performance scores before and after the treatment.

This study aims to determine the differences in basic pattern-making skills for women's clothing before and after the implementation of PBM in grade XI Fashion Design students at Pangeran Antasari Vocational School, and to determine the extent of improvement. The scope of the material includes basic body and sleeve patterns with a scale of 1:4. The results of the study are expected to be a consideration for teachers in designing learning that involves students in error analysis and pattern checking. Because one group was used without a control, the study was directed at changes observed in the group.

II. METHOD

The study employed a quantitative approach with a pre-experimental method. The design used was a one-group pretest–posttest, where one group of students was measured before and after treatment. This design allows researchers to compare two measurements on the same subject but does not provide a control group to separate changes due to treatment from other influences (Fraenkel et al., 2019). The research sequence is

denoted as O_1-X-O_2 , with O_1 representing the skills pretest, X representing problem-based learning, and O_2 representing the skills posttest.

The research was conducted at Pangeran Antasari Vocational School on eleventh-grade students in the Fashion Design program. The research was conducted in the odd semester of the 2026/2027 academic year for two days for experiments and data collection. The learning device details include an allocation of one 81-minute meeting for conventional learning and two 81-minute meetings for PBM. Therefore, the implementation day and number of meetings are understood as different units; the dates and distribution of meetings per day are not detailed in the implementation documentation.

The study population was all 19 students of grade XI Fashion Design. All members of the population were included as samples through saturated sampling. This technique was chosen because the group was relatively small and all members could be reached, as described in Sugiyono (2019). The study did not divide students into experimental and control groups. The division of small groups in PBM activities is the organization of learning in the classroom, while the measurement units for the pretest and posttest remain the same students.

Table 1. Characteristics of the study

Component	Information
Approach	Quantitative
Method	Pre-experimental
Design	One-group pretest–posttest
Subject	19 students of class XI Fashion Design
Place	Pangeran Antasari Vocational School
School year	2026/2027, odd semester
Sampling technique	Saturated sampling
Material	Basic body and arm pattern
Scale of practice	1:4

The treatment variable was the application of the PBM model, while the outcome variable was the skill of making basic patterns for women's clothing. Skills were operationalized through the ability to prepare tools and materials, read measurements, construct body and sleeve patterns, check their fit, mark the patterns, and complete the work neatly and on time. The practical limitations of the research were the standard size M and a scale of 1:4. The PBM LKPD also included cases of adjusting customer sizes, so the results need to be interpreted with attention to the characteristics of the tasks given at each stage.

Before the treatment, students participated in conventional learning. The teacher explained the basic body and sleeve patterns, including measurements and formulas, and then demonstrated the pattern-making steps. Students watched the demonstration, received a worksheet, and created a pattern using the measurements provided. The teacher supervised the work and provided assistance as needed. The results of this practice served as the basis for assessing skills in the pre-teaching phase.

The standard sizes listed in conventional LKPD include body circumference 88 cm, waist circumference 60 cm, back length 36 cm, face length 30 cm, face width 31 cm, back width 33 cm, shoulder width 12 cm, chest height 14 cm, side length 17 cm, armhole circumference 40 cm, arm peak height 12 cm, and arm length 24 cm. Students use these sizes as a reference for 1:4 scale practice. The sizes in LKPD are research assignment parameters and are not intended as universal size standards for all pattern systems.

After the pretest, learning continued with PBM through five stages. First, the teacher orientated students to the problem related to the pattern. Second, students were organized into small groups and received student

worksheets (LKPD). Third, the teacher guided students in examining, analyzing, and discussing alternative solutions. Fourth, students presented the pattern results along with explanations of the problem and its solution. Fifth, the teacher and students analyzed and evaluated the process and results of the solution. This sequence became the treatment framework used in the study.

Table 2. Implementation of PBM syntax

Stage	Main activities
Problem orientation	Observe for discrepancies in size, shape, or pattern relationships.
Organizing	Form small groups, receive LKPD, and share responsibilities.
Investigation	Examine patterns, analyze causes, and determine solutions with teacher guidance.
Presentation of results	Shows patterns and explains problems and corrective steps.
Evaluation	Discuss errors, provide corrections, and conclude the correct steps.

The cases used in the PBM LKPD cover several types of problems. The body pattern case asks students to identify differences in body and waist circumference, determine the affected area, and examine the neck and body circumference for discrepancies. Another case requires adjusting a pattern for a customer with a body circumference of 92 cm and a waist circumference of 78 cm, paying attention to the cupping. In the arm pattern, students are asked to analyze the sleeve head that does not match the body armhole and the case of a 2 cm difference in the right and left arm circumference.

These cases were used to connect measurement readings with construction decisions. Students were asked to write down problem identification, planned adjustment steps, and rationale for technique selection. Thus, the worksheets included not only drawing instructions but also questions that guided inquiry and reasoning. Although learning took place through group discussions, the primary data analyzed were 19 pairs of student skill scores. A posttest was administered after the teaching and learning activities to obtain final measurements.

Data collection used tests, observation, and documentation. The initial proficiency test consisted of 15 multiple-choice questions covering tools and materials, measurement, body pattern construction, sleeve pattern construction, and work product inspection. This test provided supporting information about basic knowledge. Core skills were measured through pattern-making practices in the pretest and posttest. This distinction is necessary to avoid equating the term initial proficiency test with all performance measurements.

Observations were used to track the implementation of learning from pre-treatment to post-treatment conditions. Documentation included student work, learning materials, activity documentation, and research documents. This supporting data helps explain the implementation context, but this article does not present individual observation scores because numerical results are not included in quantitative reporting. Inferential analysis used skill scores, not documentation data.

The main instrument is a performance assessment sheet with a rubric on a scale of 1–4. The assessment tool contains a 15-item general grid and 12 conventional LKPD descriptors. The summary in Table 3 follows the descriptors provided in the appendix, without assuming that the two sets are identical. For the preparation indicator, the highest score is awarded when tools and materials are completely and correctly prepared. For the construction indicator, the highest score is awarded when steps and measurements are correctly implemented. Lower scores indicate more deficiencies or errors.

Table 3. Indicators of the pattern practice rubric

No.	Indicator
1	Preparation of tools and materials
2	Usage measurements and instructions
3	Body pattern lines and dots
4	Body pattern construction
5	Body pattern shape
6	Sleeve pattern construction
7	Height and shape of the head and arms
8	Matching the sleeve pattern to the body pattern
9	Pattern signs
10	Accuracy of final size and shape
11	Neatness
12	Punctuality

The rubric assesses practical outcomes through indicators related to the process and product. The accuracy of lines and dots indicates construction suitability, while pattern markings and neatness facilitate reading. The fit of the sleeves to the body frame is assessed because these two components are used in pairs. Timeliness is an element of task completion but is still read alongside the accuracy of the results. Assessment indicators were developed by referencing studies related to learning patterns and learning tools (Nurhijrah & Wabdillah, 2025; Halim et al., 2022; Sinukaban et al., 2022).

The PBM LKPD has 14 indicators focused on problem identification, analysis, solution, adjustment, and evaluation. Eight indicators relate to body patterns and six indicators to arm patterns. The assessment results in PBM activity scores that are reported separately from the pretest and posttest. This separation is necessary because the problem-solving scores in the LKPD do not automatically measure the same thing as the pattern construction performance scores.

Table 4. Scope of LKPD PBM assessment

Material	Focus	Item
Body pattern	Identify size differences and neck/body mismatches	1, 3
Body pattern	Affected parts and cause examination	2, 4, 5
Body pattern	Solutions, adjustment steps, and technical reasons	6–8
Sleeve pattern	Head arm problems and relationship to the body frame	9–10
Sleeve pattern	Parts checked, solutions, steps, and reasons for adjustment	11–14

The feasibility of the LKPD and assessment instruments was examined through expert judgment by one validator with a scale of 1–4. The appendix contains ten aspects for the LKPD and ten aspects for the assessment instruments. All aspects of the LKPD received a score of 4 with a total corrected score of 30. In the assessment instrument, eight aspects received a score of 4 and two aspects received a score of 3, resulting in a total corrected score of 28. The assessment results produced an index of 1.000 for the LKPD and 0.933 for the assessment instrument.

Aiken's V is expressed as $V = \Sigma(r - l_o) / [n(c - 1)]$, where r is the validator score, l_o the lowest score, n the number of validators, and c the number of categories. Content validity analysis refers to Ariyanto (2023) and Retnawati (2016). In the aggregate presentation of ten aspects, the values 1.000 and 0.933 are read as a summary of the assessment of all aspects by one validator. These figures do not indicate agreement between validators because there is only one assessor. For the assessment instrument, a score of 4 produces an aspect index of 1.000 and a score of 3 produces 0.667; the average of the ten indices is approximately 0.933.

The results of expert assessments are used to support the appropriateness of the content but do not replace consistency checks for skills assessments. Reliability coefficients and inter-rater agreement are not yet available. Therefore, this article does not claim that the instrument has been proven reliable. The limitations of expert assessment and the potential subjectivity of the rubric are taken into account when discussing the research results.

Data were analyzed using SPSS version 22 using descriptive statistics, normality tests, the Wilcoxon test, and N-Gain. Descriptive statistics included the number of students, minimum and maximum scores, mean scores, and standard deviation. Pretest and posttest scores were presented on a scale of 0–100 in the measurement results. The mean was used to describe the trend of scores, while the standard deviation was used to assess the distribution of scores (Arifin & Aunillah, 2021; Priyatno, 2018).

$$\bar{x} = \Sigma x_i / N$$

In this equation, $\bar{x}$ is the average, x_i is the value of each student, and N is the number of students, which is 19. The comparison of two measurements is done on pairs of values belonging to the same student. The difference between each pair is expressed as $D_i = \text{posttest}_i - \text{pretest}_i$. This difference becomes the data whose normality is tested, so that the selection of the test is not only based on the distribution of the pretest or posttest separately.

The normality of the difference scores was examined using the Shapiro–Wilk test at a significance level of 0.05. Sumardiyono (2023) serves as a reference for normality testing. If the p -value is less than 0.05, the distribution of the differences is considered not to meet the normality assumptions for the paired t -test. In this study, the test results showed $p = 0.001$, so the test was continued using the Wilcoxon signed-rank test. The paired t -test, which is referred to as an alternative in the design, was not used for the final results.

The Wilcoxon test is used to compare two paired measurements when the assumption of normality of variance is not met. The null hypothesis states that there is no difference in skills between the pretest and posttest, while the alternative hypothesis states that there is a difference. Decision-making uses a two-sided significance level with $\alpha = 0.05$. The test provides information about differences in paired scores, but statistical decisions remain limited by the nature of the pre-experimental design (Sugiyono, 2019).

N-Gain is calculated to describe the magnitude of the increase relative to the remaining improvement opportunities from the initial score to a maximum score of 100. The calculation is performed on student scores, then summarized through the average and category distribution. The use of N-Gain is a supplementary analysis, not a substitute for the difference test. The analysis of learning outcome improvement is supplemented by educational evaluation references from Arikunto (2018).

$$g_i = (S_{2i} - S_{1i}) / (100 - S_{1i})$$

In the equation, S_{1i} is the pretest score of the i -th student and S_{2i} is the posttest score of the i -th student. The maximum score is 100. The categories used are low for $g < 0.30$, medium for $0.30 \leq g \leq 0.70$, and high for $g > 0.70$. These limits are used consistently in the grouping of results. The reported average N-Gain is a summary of the results of individual calculations and is not equated with the direct gain calculation of the two class averages.

III. RESULTS AND DISCUSSION

The research data contains 19 pairs of pretest and posttest skill scores, as well as PBM activity scores. All subjects were recorded in descriptive statistics. The following results are presented based on the data analysis, with rounding as necessary for readability. Table 5 maintains the accuracy of the source figures for the means and standard deviations, allowing for comparison with the analysis output.

Table 5. Descriptive statistics of student grades

Measure ment	Min.– max.	Average	SB
Pretest	64–81	76.7895	5.34976
Posttest	83–89	86.7105	2.06368
PBM Activities	89–94	91.7368	1.79016

The pretest average of 76.7895 indicates the initial group practice ability before PBM. The minimum score of 64 and the maximum score of 81 indicate a variation in skills at that stage. An average above the KKM of 75 cannot be used to conclude that all students have completed the task. The minimum score indicates that there are at least scores below that limit, but the number of students who did not complete the task cannot be determined from the minimum, maximum, and average statistics alone.

After PBM, the posttest average increased to 86.7105 with a minimum score of 83 and a maximum score of 89. The difference between the two averages is 9.9210 points, or approximately 9.92 points on a scale of 0–100. This figure represents the change in the group average, not the percentage increase or N-Gain. Compared to the KKM of 75 mentioned in the background, the minimum posttest score has exceeded that limit. However, this interpretation remains limited to the reported practice scores and does not reflect the completeness of all Fashion Design competencies.

The pretest standard deviation of 5.34976 decreased to 2.06368 in the posttest. The smaller final score distribution indicates that students' scores were more clustered than their initial scores. The score range also narrowed, from 17 points in the pretest to six points in the posttest. This change in distribution can be read as a descriptive group, but it is insufficient to explain why students with different initial abilities ended up with closer scores.

The PBM activity score averaged 91.7368 with a standard deviation of 1.79016 and a range of 89–94. This score reflects the assessment of problem-solving ability through the Student Worksheet (LKPD). Therefore, the PBM activity score is distinguished from the expert assessment of the quality or suitability of the teaching materials. This score is not combined with the posttest and is not used as a substitute for core skill scores.

The difference in assessment constructs needs to be considered when interpreting the high average scores for PBM activities. The LKPD assesses the ability to identify problems, determine causes, and explain solutions and adjustments. The practical test assesses the accuracy of pattern results along with aspects of the work process. Because the indicators for both assessments are not completely identical, a higher average score for PBM activities than the posttest does not necessarily mean students' practical skills have reached a level equivalent to the LKPD score.

Table 6. Normality test of difference scores

Test	Statistic s	df	p
Shapiro–Wilk	0.808	19	0.001

The Shapiro–Wilk test for the difference between the posttest and pretest yielded a statistic of 0.808 with $p = 0.001$. Because p is less than 0.05, the distribution of the difference does not meet the assumption of normality. The decision to use the Wilcoxon test is based on testing the distribution of the difference, not the normality of each measurement separately. This step maintains the paired nature of the data obtained from the same student.

Testing for normality of variance is relevant because the data come from repeated measurements of the same students. The relationship between pairs of scores is retained in subsequent analyses. Non-normality does not eliminate information about improvement but guides the choice of difference testing method. Therefore, inferential results are presented using Wilcoxon signed-rank tests rather than paired t -tests.

Table 7. Rank difference in the Wilcoxon test

Category	n	Average rating	Amount
Negative	0	0.00	0.00
Positive	19	10.00	190.00
Same	0	—	—
Total	19	—	—

Table 8. Wilcoxon test statistics

Statistics	Results
Z	-3,830
two-sided p	< 0.001
Significance level	0.05

The Wilcoxon test results show $Z = -3.830$ and a two-sided significance value displayed by SPSS as 0.000. This number is reported as $p < 0.001$, not $p = 0.000$, because the display of three decimal places does not mean the probability is exactly zero. With a p value less than 0.05, the null hypothesis is rejected. There is a difference in the skills of making basic women's clothing patterns between the pretest and posttest in the group of students studied.

The ranking table provides clearer information on the direction of change. All 19 students are in positive ranks, while negative ranks and ties each total zero. This means that each student's posttest score is higher than their pretest score. A negative sign in the Z statistic does not indicate a decrease in score because the analysis output calculates the statistic based on negative ranks. The direction of change is determined by the positive ranks and descriptive scores, which both indicate an increase.

Statistical significance indicates that a difference in paired scores was detected by the test used. This result does not necessarily determine the extent of practical benefit or prove that PBL was the sole cause of improvement. The magnitude of the average change and N-Gain must be considered together. Furthermore, prior learning, experience with assignments, and changes in student conditions may also influence the final measurement because there is no comparison group.

Table 9. Descriptive statistics of N-Gain

Size	Results
Number of students	19
Minimum	0.211
Maximum	0.653
Average	0.40577
Standard deviation	0.132152
Average category	Currently

Table 10. Distribution of N-Gain categories

Category	n	Percentage
Low	4	21.1%
Currently	15	78.9%
Tall	0	0.0%
Total	19	100.0%

The average N-Gain of 0.40577 is in the moderate category according to the interpretation limits used. The minimum value of 0.211 indicates the lowest relative increase, which falls into the low category, while the maximum value of 0.653 is still in the moderate category. Fifteen students, or 78.9%, fall into the moderate category, and four students, or 21.1%, fall into the low category. There are no students in the high category.

The distribution shows that improvement is not uniform, although each student experienced an increase in their score. The 19 positive ranks do not contradict the presence of four students in the low N-Gain category. The rank test explains the direction of change, while N-Gain describes the magnitude of the increase relative to the range of improvement from the initial score. Students may experience an increase in their score, but the increase is still small compared to the potential for improvement toward the maximum score.

The average N-Gain was not recalculated by simply entering the pretest and posttest averages into the equation. The average individual gain calculation may differ from the gain calculated directly based on the group average. The average individual N-Gain in this analysis was 0.40577. A summary table is used to present the trend in group improvement. Rechecking all individual calculations requires matching each student's scores and cannot be done based solely on group descriptive statistics.

Descriptive results, difference tests, and N-Gain complement each other. Descriptive statistics show the mean and spread of scores, Wilcoxon shows pairwise differences, while N-Gain describes the categories of improvement. All three support the conclusion that group skills improved after PBL, with the average increase in the medium category. This conclusion is more accurate than calling the results high improvement simply because all students had higher final scores.

Pedagogically, PBL provides students with the opportunity to examine the reasons for pattern errors. In conventional learning, the primary activity is guided by explanation, demonstration, and implementation of instructions. In PBL, students are also asked to observe discrepancies, identify areas for review, and explain corrective actions. These differences in activity provide a basis for interpreting the relationship between learning and skill change, but the mechanisms have not been tested as standalone variables.

Creating the body and arm patterns requires a relationship between measurements, points, and the final shape. The narrow neck problem cannot be addressed simply by enlarging the lines; students need to examine the construction used. The head and arm problem also requires examination of the body frame. Examining these relationships is part of the PBM task characteristic of the research. This description is based on the LKPD case and is not intended to be a new observational finding about individual student behavior.

Group discussions allow students to propose suspected causes and compare solutions. The teacher guides the investigation and provides corrections during the evaluation phase. Presenting results requires students to explain the problem and the steps they chose so that the resulting pattern can be considered along with the rationale for their actions. Such activities provide opportunities for learning through inquiry, but the study did not report separate measures of discussion quality, teacher support intensity, or individual group member involvement.

These findings align with research by Ernawati et al. (2023), which demonstrated improved fashion design learning outcomes after PBM. The similarity lies in the use of PBM in the vocational high school fashion industry. The difference lies in the competencies of this study, which specifically assess basic body and sleeve patterns. Therefore, previous research is used as a comparison, not a basis for equating all results and measures of success.

Agustin et al. (2024) compared vocational education using PBL with focus group discussions. The study showed differences in learning outcomes between PBL and direct instruction. This study used a single group with repeated measurements, thus varying the strength of the comparison. The similarity of PBL use supports the relevance of the approach in vocational education, but evidence from other studies does not eliminate the limitations of the research design being discussed.

Akhyar et al. (2024) discuss the development of problem-based and project-based learning syntax for vocational education. This study is relevant to efforts to develop problem-oriented learning activities and work outcomes. However, this research does not develop a new model or combine PBL with project-based

learning as an additional treatment. This reference is used to place learning syntax within the context of vocational education, in the implementation of learning.

Al Husaeni et al. (2025) reported on multimodal learning and teaching (PBL) for vocational students. Similarities with this study are the focus on learning outcomes following the implementation of PBL. Differences in media and materials used should be maintained when comparing findings. This article does not claim that the improvements in that study were entirely due to PBL, nor does it assume that the same tools were used in the fashion pattern research.

Halim et al.'s (2022) study on problem-based worksheets is relevant to understanding the role of student worksheets (LKPD) as a tool that guides student activities. In this study, the LKPD included cases, identification questions, adjustment steps, and technical rationales. These tools helped translate the model's orientation into student-directed tasks. However, the influence of the LKPD was not analyzed separately from the overall PBM treatment, so the contribution of each component cannot be determined.

Nurhijrah and Wabdillah (2025) discussed pattern accuracy in digital pattern-making learning. This reference was used in indicator development, particularly with attention to the accuracy of the results. This study did not test digital pattern-making and instead used a 1:4 scale practice, consistent with the practical assignment. The differences in working media are the reason why conclusions cannot be drawn regarding the superiority of manual or digital patterns from this study's results.

Sinukaban et al.'s (2022) study of handout-assisted direct learning on pattern-based learning provides context that demonstrates that pattern-based learning tools and models can be examined through learning outcomes. However, this study does not prove that conventional learning is always ineffective. In this study, conventional learning was provided before the pretest, so students' initial abilities also reflected the learning experience at that stage. Posttest improvement occurred after students gained additional experience through PBL.

The moderate N-Gain results can be used by teachers as a basis for assessing student variation in needs. Most students showed moderate improvement, while four students still showed low improvement. Teachers may consider reexamining the pattern results and providing assistance at stages not yet mastered. However, the study did not provide scores per indicator or a relationship between N-Gain and individual characteristics, so each student's weaknesses cannot be determined solely from the category distribution.

Assessment of outcomes also needs to consider task equivalence. Conventional practice uses a standard M-size, while the PBM LKPD includes a variety of problems and size adjustments. Although the main material remains the body and arms, changes in task demands can affect the comparability of scores. The mapping of pretest and posttest practical task equivalence has not been fully tested. Therefore, results are expressed as changes in scores across the learning series used, not as comparative evidence of two tests that have been proven psychometrically equivalent.

The next limitation relates to the rubric. The general grid and appendix descriptors have different numbers of indicators. The tool still provides an overview of the aspects assessed, but the item mapping and weighting to a score of 0–100 require more detailed explanation for replication. The limited detail of the weighting limits the comparability of the scores obtained. Consistency in the number of indicators and scoring procedures is an important aspect of research reporting.

Expert assessments were conducted by a single validator. Summary assessment results indicate high scores but do not yet provide information on inter-expert agreement. The aggregate score reported as Aiken's V also needs to be distinguished from the individual aspect indices. This explanation prevents over-reading of the instrument's suitability. Skill assessment remains potentially subjective, and inter-rater agreement test results are not yet available to quantify this potential.

The single-group design presents a major limitation. Students received conventional instruction, completed a pretest, then received PBL and a posttest. Because there was no comparison group, the effects of prior training, practical experience, learning conditions, and student factors could not be fully separated. Wilcoxon significance tests did not address this limitation. Therefore, the term "effect" in the title is

understood within the context of pre-experimental research, and conclusions are maintained as changes after treatment.

The study's scope was also limited to 19 students in one class, body and arm materials, and 1:4 scale practice. The results do not directly reflect the ability to create all types of patterns, actual-size practice, or student groups in other schools. The study did not provide follow-up measurements to determine whether improvements persisted over time. The short duration of the study also limited assessment of the development of skills that require ongoing practice.

Considering the results and limitations, PBM can be considered an alternative learning model that encourages students to analyze errors and take responsibility for solutions. Evidence from this research lies in the changes in the scores of groups participating in the learning series. Implementation in other classes requires adjustments to equipment, size, initial abilities, and time allocation. More robust testing is needed before declaring PBM superior to all alternative learning models.

IV. CONCLUSION AND SUGGESTIONS

Problem-based learning (PBL) was followed by an increase in basic pattern-making skills for women's clothing among eleventh-grade Fashion Design students at Pangeran Antasari Vocational School. Pairwise comparisons showed differences in skills after the learning, with an average relative increase in the moderate category. These findings support the use of pattern construction problems as part of practical learning activities that link the accuracy of the results with an explanation of the improvement process. However, single-group research cannot separate the contribution of PBL from the learning experience and other factors that occur.

Teachers can use cases of mismatches in size, body construction, and the relationship of the head and arm to the body frame to guide students in examining their work. Student worksheets should be accompanied by clear instructions, guided investigations, and evaluation of patterns and rationale for solutions. Students who show relatively low progress require follow-up based on examining their practical work, not just grouping grades. Schools can support the provision of learning tools and practical time to facilitate these analysis activities.

Future research is recommended using comparison groups, a broader range of subjects, and further measurement. The equivalence of pretest and posttest tasks, the consistency of rubric indicators, and the weighting of scores need to be detailed. Validation can involve more than one expert, and the assessment of practices can be checked for inter-rater agreement. Developing materials on other pattern sections, varying measurements, and practicing actual scales can expand the evidence regarding the application of PBL in Fashion Design learning.

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