



## Implementation of a Deep Learning Approach with the Project Based Learning Model in the Element of Fashion Style and Design Development

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### Abstract

This study aims to examine the effects, improvements, and differences in the skills and work attitudes of students through the integration of a Deep Learning approach with the Project Based Learning PjBL model in the Style and Design Development element of the Fashion Design and Production subject at vocational high schools. The study employed a quasi-experimental method with a pretest posttest non-equivalent control group design. The participants consisted of 41 eleventh grade students from the Fashion Design Program at SMK Widya Praja Ungaran, including 21 students in the control class that implemented conventional PjBL and 20 students in the experimental class that implemented PjBL integrated with the Deep Learning approach. The research instruments consisted of a skills assessment rubric and a work attitude scale that had been validated by six experts using the Percentage of Agreement test. Data were analyzed using the N Gain test and the Independent Sample t Test. The findings indicate that the N Gain value of skills in the experimental class reached 65.4%, which falls within the moderate category and is higher than the control class with 53% in the less effective category. The N Gain value of work attitude in the experimental class reached 92% in the effective category, while the control class obtained 72% in the fairly effective category. The results of the t test show significant differences in skills  $t = 13.175$ ,  $p = 0.000 < 0.05$  and work attitudes  $t = 3.212$ ,  $p = 0.003 < 0.05$ . These findings indicate that the integration of a Deep Learning approach within the PjBL model significantly improves student skills and work attitudes in vocational fashion design learning.

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## INTRODUCTION

Vocational education plays a strategic role in developing a skilled workforce capable of responding to the demands of industry and global economic competition. In Indonesia, vocational high schools are expected to produce graduates who possess not only theoretical knowledge but also strong practical competencies that are directly applicable in professional settings. Within the field of fashion design, competencies in design development and garment production constitute essential foundations for preparing students to enter the creative industry. However, the implementation of learning in vocational education still encounters several pedagogical challenges, particularly in fostering creativity, critical thinking, and professional attitudes among students (Arifudin, 2021).

One major challenge lies in the persistence of teacher centred instructional practices that limit student opportunities to actively engage in exploration, experimentation, and reflective learning processes. Such approaches often emphasise knowledge transmission rather than the development of higher order thinking and practical competencies required in creative industries (Murzyn Kupisz and Hołuj, 2021). As a result, learning activities may not fully support the formation of integrated competencies that combine cognitive understanding, technical skills, and professional work attitudes.

The urgency of improving vocational education quality is further reflected in national employment data. Statistics Indonesia reported that the Open Unemployment Rate among vocational high school graduates reached 9.42%, which is higher than the unemployment rate among general senior high school graduates at 7.41% and diploma graduates at 6.12% (Suyuti et al., 2023). This condition indicates a mismatch between the competency profile of vocational graduates and the evolving needs of the labour market, particularly within creative and design-based industries that require innovation, adaptability, and practical expertise.

In response to these challenges, innovative learning approaches that emphasize active and meaningful learning experiences have gained increasing attention. The integration of a Deep

Learning approach with the Project Based Learning PjBL model offers a promising pedagogical framework. Deep learning emphasizes meaningful learning processes in which students construct understanding, apply knowledge in authentic contexts, and develop reflective thinking skills (Wisman et al., 2021). Meanwhile, Project Based Learning encourages students to engage in real world projects that require problem solving, collaboration, and the integration of conceptual knowledge with practical skills.

Within the context of fashion design education, the combination of these two approaches is particularly relevant. Fashion design learning requires students to integrate conceptual knowledge of design principles with hands on creative processes, technical production skills, and the development of professional work attitudes. Therefore, learning models that emphasize project-based activities supported by deep cognitive engagement have the potential to strengthen both technical competencies and professional character formation.

However, empirical studies examining the combined implementation of Deep Learning and Project Based Learning in vocational fashion design education remain limited. Many previous studies tend to focus primarily on cognitive outcomes, while the development of psychomotor skills and work attitudes receives less comprehensive evaluation (Hayatina Ramadhan and Hindun, 2023). This limitation highlights the need for research that simultaneously investigates the impact of innovative learning approaches on multiple learning domains.

Based on these considerations, this study aims to: (1) analyze the effect of integrating the Deep Learning approach with the Project Based Learning model on student skills in style and design development; (2) examine the improvement of student skills and work attitudes through the learning intervention; and (3) compare the differences in improvement between the control group and the experimental group.

## RESEARCH METHODS

### Research Design

This study employed a quantitative approach using a quasi-experimental design, specifically the pretest posttest non-equivalent control group design. This design was selected because random assignment of participants was not feasible in the school setting without disrupting the existing classroom structure.

Table 1. Experimental Design Structure

Group	Pretest	Treatment	Posttest
Experimental	O <sub>1</sub>	PjBL + <i>Deep Learning</i> (4-6 meetings)	O <sub>2</sub>
Control	O <sub>1</sub>	Conventional PjBL	O <sub>2</sub>

### Research Participants

The participants consisted of 41 eleventh grade students from the Fashion Design Program at SMK Widya Praja Ungaran. The participants were selected using purposive sampling. The distribution of participants was as follows: (1) the experimental class (Class XI DPB 2) consisted of 20 students who received Project Based Learning integrated with a Deep Learning approach, and (2) the control class (Class XI DPB 1) consisted of 21 students who received conventional Project Based Learning without the integration of Deep Learning.

### Research Instruments

The instruments used in this study consisted of two main components.

First, a skills assessment rubric that included five evaluation components: preparation (10%), implementation process (40%), project quality (20%), time efficiency (10%), and presentation ability (20%). Second, a work attitude scale using a Likert scale ranging from 1 to 3 to measure ten indicators of professional attitude, including discipline, integrity, collaboration, and responsibility. The content validity of both instruments was examined using the Percentage of Agreement method based on expert judgment from six experts in vocational education and fashion design.

### Research Procedure

The research was conducted through four stages.

First, a pretest was administered to measure student initial abilities before the treatment.

Second, the treatment stage was implemented. The experimental class participated in four to six Project Based Learning sessions enriched with the Deep Learning approach, including data-based style exploration, trend analysis, and automated feedback. Meanwhile, the control class followed conventional Project Based Learning with standard instructional guidance. Third, a posttest was conducted using the same instruments as those used in the pretest. Fourth, comparative data analysis was performed to examine differences in learning outcomes between the two groups.

### Data Analysis Techniques

Data were analyzed using several statistical procedures. First, the N Gain score was calculated to measure the effectiveness of learning improvement between the pretest and posttest results in each group. Second, normality tests using Kolmogorov Smirnov and Shapiro Wilk were conducted as prerequisites for parametric statistical analysis. Third, a homogeneity test using Levene Test was performed to ensure equal variance between groups. Finally, an Independent Sample t Test was applied to analyze the significant differences in N Gain scores between the experimental and control groups at a significance level of  $\alpha = 0.05$ . All statistical analyses were conducted using IBM SPSS Statistics version 24.0.

### Description of Skills Results

The recapitulation of posttest skills results for both groups is presented in Table 2. The experimental group demonstrated significantly higher performance compared to the control group. The average posttest score for skills in the experimental group reached 91.20, while the control group obtained an average score of 88.23. Notably, the minimum score in the experimental class (90.13) was higher than the maximum score in the control class (89.90). In addition, the lower standard deviation in the experimental group (0.721 compared to 1.220 in the control group) indicates a higher level of learning consistency among students in the experimental class.

**Table 2.** Descriptive Statistics of Skill Results (Posttest)

Statistics	Control	Experimental
N	21	20
Minimum	84.78	90.13
Maximum	89.90	92.45
Average	88.23	91.20
Std. Deviation	1.220	0.721

**Description of Work Attitude Results**

Table 3 presents the comparison of average work attitude scores for each indicator between the two groups.

**Table 3.** Average Student Work Attitude Per Indicator

Attitude Indicator	Control	Experimental
Attendance Discipline	2.86	3.00
Work Safety (K3)	2.90	2.95
Facility & Infrastructure Readiness	2.90	2.90
Technical Sharpness	2.90	3.00
Integrity & Work Ethics	2.90	3.00
Scientific Attitude (Creative)	2.90	2.90
Collaboration & Teamwork	2.90	2.95
Teacher-Student Communication	2.86	3.00
Laboratory Hygiene	3.00	3.00
Reporting Accountability	2.90	2.97
<b>Total Average</b>	<b>2.90</b>	<b>2.97</b>

Overall, the experimental class obtained a higher average work attitude score of 2.97 compared to the control class with an average score of 2.90. The most prominent aspects observed in the experimental group were discipline, integrity, and scientific attitude, all of which achieved the maximum score of 3.00. These findings suggest that the Deep Learning approach contributes to the development of stronger professional work attitudes and more consistent learning behavior among students.

**N-Gain Results**

**Table 4.** Comparison of Skill and Attitude N-Gain

Variable	Control	Experimental	Difference
Skill Category	53% Less Effective	65.4% Moderate	+12.4%
Work Attitude Category	72% Fairly Effective	92% Effective	+20%

The integration of the Deep Learning approach within Project Based Learning produced a substantial improvement in student skills, with an increase of 12.4% compared to the control group. In addition, the impact on work attitudes was even more pronounced, with an

improvement of 20%. The considerable increase in work attitude indicates that the Deep Learning approach not only influences psychomotor performance but also contributes significantly to the development of student affective dispositions.

**Hypothesis Testing Results**

**Table 5.** Results of Skill and Attitude Hypothesis Testing

Variable	t	p-value	Conclusion
N-Gain Skill	13.175	0.000	Significant
N-Gain Attitude	3.212	0.003	Significant

The results of the skills test show a t value of 13.175 with  $p = 0.000 < 0.05$ , indicating a highly significant difference in the skills domain. The work attitude test also shows a t value of 3.212 with  $p = 0.003 < 0.05$ , confirming a significant difference in students work attitudes (Chasanah, 2026). These findings consistently support the superior effectiveness of integrating the Deep Learning approach with the Project Based Learning model.

**RESULT AND DISCUSSIONS**

The findings of this study reinforce the argument that the synergy between the Deep Learning approach and the Project Based Learning model can optimize vocational learning processes in a holistic manner. From a psychomotor perspective, the improvement in skills in the experimental class, which reached the moderate category (65.4%), compared with the less effective category in the control class (53%), indicates that the adoption of digital assistant technology can accelerate the development of technical competencies through more precise and immediate feedback (Rizal et al., 2024).

The substantial improvement in work attitudes (92% compared with 72%) is consistent with constructivist learning theory, which suggests that active engagement in authentic project activities naturally supports the development of professional character and work ethics (Halimah and Rusyd, 2022). These findings are also consistent with the study conducted by Roemintoyo and Budiarto (2023), which demonstrated that the Project Based Learning model can effectively develop twenty first century competencies in vocational education. However,

the present study contributes an additional perspective by demonstrating that the integration of Deep Learning technology enhances the effectiveness of Project Based Learning, particularly by elevating its impact on work attitudes from a moderate level to an effective level (Syahril et al., 2022).

The measurable improvement in student skills within the experimental class is closely related to the increasing quality of instructional implementation throughout the intervention period. The level of implementation of the Deep Learning based Project Based Learning model improved from 82.51% at the initial stage, which was categorized as good, to 94% at the final stage, which was categorized as very good. Minor challenges identified during the early phase, such as the limited availability of concrete examples during the fundamental questioning stage, were gradually addressed through continuous instructional refinement. Consequently, the quality of the learning process improved alongside the increase in the average posttest skill score of the experimental class, which reached 91.20 (Rizal et al., 2024).

The systematic learning sequence designed for the experimental class also played an important role in achieving these outcomes. Students were guided through several stages, including concept exploration, sketch design, pattern development, and final product completion, supported by an artificial intelligence based automated feedback system. This personalized and precise guidance helped bridge the gap between theoretical understanding and practical application, as reflected in the increase in the average skill score from 74.56 in the pretest to 91.20 in the posttest (Roemintoyo and Budiarto, 2023).

Similarly, the improvement in work attitudes demonstrated notable progress. The average work attitude score of students in the experimental class increased from 2.63 in the initial condition to 2.97 in the final evaluation, while the N Gain value for work attitude reached 0.918, substantially higher than that of the control group, which reached 0.723. This difference confirms that the Deep Learning based learning ecosystem inherently fosters stronger discipline, integrity, and professional consistency, as

reflected in the maximum score of 3.00 achieved for the indicators of discipline, integrity, and scientific attitude in the experimental class (Halimah and Rusyd, 2022).

The findings also indicate that the adoption of intelligent technology in vocational learning can reduce cognitive barriers commonly experienced by students during the fashion production process. With systems that provide real time technical guidance, students can allocate more cognitive resources to higher level creative processes such as design innovation and detail refinement rather than focusing solely on technical uncertainties. This condition helps explain why the minimum score of the experimental class (90.13) exceeded the maximum score of the control class (89.90), reflecting a more consistent distribution of learning achievement among students in the experimental group (Mardiah Astuti et al., 2023).

In addition to improving technical and affective competencies, the integration of the Deep Learning approach within Project Based Learning also appears to enhance student intrinsic motivation and emotional engagement in the learning process. The meaningful learning orientation embedded in this approach enables students to perceive each stage of project development as relevant to their future professional careers. As a result, students develop stronger confidence and persistence when encountering technical challenges. This is reflected in the higher consistency of learning outcomes in the experimental class, as indicated by a lower standard deviation of 0.721 compared with 1.220 in the control class (Kim and Lee, 2022).

Overall, the integration of Deep Learning based digital assistants demonstrates strong empirical potential to transform conventional learning patterns into more interactive, adaptive, and accelerated learning processes in vocational education. Efficient time management and precise feedback mechanisms enable students to complete all stages of fashion design projects with higher quality outcomes within the same learning duration. In the context of the fashion industry, where time to market is a critical indicator of competitiveness, the ability to work effectively and systematically from the early stages of

education represents an essential competency that should continue to be strengthened within the future vocational education ecosystem (Syahril et al., 2022).

The practical implication of these findings highlights the need for vocational education institutions to adopt Deep Learning based technological platforms as an integral component of Project Based Learning instructional design, in line with the direction of the 2025 curriculum, which emphasizes meaningful and student-centered learning (Kim and Lee, 2022).

## CONCLUSION

This study concludes that the integration of a Deep Learning approach within the Project Based Learning model significantly improves fashion design skills and work attitudes among eleventh grade vocational high school students compared with conventional Project Based Learning. The improvement in the N Gain values for skills (65.4% compared with 53%) and work attitudes (92% compared with 72%) is supported by strong statistical significance results ( $p < 0.05$ ), confirming the effectiveness of the intervention.

These findings suggest that vocational education institutions should develop hybrid learning ecosystems that integrate Deep Learning based technologies within industry-oriented project learning cycles. Future research is recommended to explore the long-term impact of this approach on graduate work readiness as well as its applicability to other vocational competency areas.

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