Implementation of Production-Based Learning in Wood Construction Applications

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ABSTRACT

This study aimed to examine how a hands-on learning approach, focused on practical application, could improve students' skills and learning outcomes in Wood Construction Applications. The research used a method where one group experienced this new approach, while another group followed the traditional learning method. The results showed that the group using the hands-on approach performed better in both the work process (rated as "good") and the learning outcomes (also rated as "good") compared to the group using the traditional method (rated as "low"). This suggests that the hands-on learning model was effective for Wood Construction Applications. Practicality testing also indicated a high level of suitability (89.92%) for this course. In conclusion, the hands-on learning model proved effective and practical in enhancing students' skills and learning quality. It could be a useful reference for instructors and programs, but adjustments may be needed to suit the specific characteristics of the learning environment and the students in Wood Construction Applications classes. Specific focus should be given to competencies like precision jointing, design modification skills, assembly skills, painting and lamination skills, construction quality, and the successful completion of the product.

Keywords: *Production-Based Learning, Experimental Research, Learning Model, Skills.*

1. INTRODUCTION

The advent of the Industrial Revolution 4.0 marks a shift where information technology serves as the cornerstone of human existence. This era brings about boundless possibilities through limitless computing power and data, heavily influenced by the evolution of the internet and digital technology. These advancements remain fundamental to the seamless interaction and connectivity between humans and machines. [1]. The progression of contemporary society in the age of globalization necessitates high-quality human capital. The expansion of human resources stands as a fundamental prerequisite for attaining developmental objectives. Education stands out as a crucial means to enhance human resources. At its core, education embodies a transformative process aimed at positively shaping behavior, ultimately guiding individuals towards self-realization and dignity [2].

This era will also disrupt various human activities, including the fields of science, technology, and collage. Education is a fundamental need for every human being. Education is a process to humanize individuals, mature them, and improve their behavior [3]. According to Law No. 20 of 2003, education is a conscious and planned effort to create a learning atmosphere and a learning process so that learners actively develop their potential to have spiritual and religious strength, self-control, personality, intelligence, noble character, and the skills needed for themselves, society, the nation, and the state [4]. Education has its own quality that is planned by educators and institutions to adapt to the development of education and the world of work.

Preparing education to meet the needs of a high-quality and capable workforce begins with improving the quality of education. The quality of education has been a serious topic of discussion in recent decades. This is because the quality of education will greatly determine the quality of the graduates produced by the education system. Without high-quality education, the hope of producing high-quality human resources is slim [5]. Good learning is learning that actively engages students and motivates

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them to be interested in learning something new, enabling them to build their knowledge and make learning meaningful [6]. To make learning activities more easily understood by students, it is necessary to have a teaching model that assists them in the learning process [7]. In connection with this, a more creative, innovative, and engaging learning process and teaching model are needed to capture the interest of students in the learning process.

A teaching model is a plan or pattern that can even be used to shape the curriculum (long-term learning plan), design learning materials, and guide learning in the classroom or other learning environments [8]. Teaching models are closely related to students' learning styles and educators' teaching styles, both of which are abbreviated as SOLAT (Style of Learning and Teaching) [9]. Teaching models are conceptual frameworks that describe systematic procedures for organizing learning experiences to achieve specific learning objectives. They serve as guidelines for instructional designers and educators in planning and implementing teaching and learning activities [10]. Therefore, it can be concluded that a teaching model is a conceptual framework that describes a systematic procedure for organizing learning experiences to achieve specific learning objectives [11] and serves as a guide for instructional designers and educators in designing and implementing the teaching and learning process.

There are many teaching models that can be used and developed, one of which is the production-based learning model. The production-based learning model is a structured learning procedure designed to align with real-world work standards to create products, whether they are goods or services, that meet market or industry standards. This model emphasizes learning that primarily focuses on the skills of learners in carrying out the production of goods or services that align with business or industry standards. The primary focus in production-based learning is on work planning, systematic work steps, and the resulting products (goods or services) that have market value or meet industry standards [12]. The production-based learning model is characterized as a series of methods or stages that learners undertake to facilitate active learning, participation, and interaction with a competence orientation to produce products aligned with the industrial world [13]. There are many models that can be developed and are relevant to improving students' abilities and skills, and one of them is the production-based learning model. The production-based learning model is more suitable for use in practical courses, such as wood construction applications, because these courses involve activities related to processes and efforts. Therefore, it is necessary to implement a teaching model that actively engages students in the learning process, as the teaching model used by educators greatly influences the learning outcomes that students will achieve [14].

In conclusion, a production-based learning model is a systematic procedure or workflow with the concept of meaningfulness that can facilitate active and participatory learning for students through the direct experience of creating products, whether goods or services with market value or that meet industry standards. The application of this learning model is necessary in wood construction applications, considering the lack of high-quality and suitable products, as evidenced by the presence of defects in the products created by students and their failure to meet assessment criteria. This may be due to students' insufficient skills and abilities in product creation, resulting in subpar and deficient products. Based on these issues, the need arises for a teaching model that can develop students' skills and capabilities in woodworking practices, enabling them to create high-quality products that meet assessment criteria. Therefore, the author intends to investigate the effectiveness of production-based learning in wood construction applications.

2. METHOD

2.1. Subject and Research Procedure

This research was conducted on 32 students from the Building Engineering Vocational Education study program Department of Civil Engineering at Universitas Negeri Padang who were enrolled in the Wood Construction Applications course during the January-June semester of 2023. The research method employed was an experiment using a true experimental posttest-only control design, which accurately compares the posttest scores of the experimental group, which received treatment, with the control group, which did not receive any treatment. Two homogeneous groups were randomly selected to become the experimental and control groups. The research procedure is outlined in Figure 1.

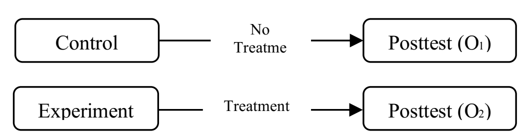

Fig. 1 Research Procedure

The control group conducted their learning as usual, using demonstration methods and completing group assignments. Meanwhile, the experimental group adopted a treatment following the syntax of the Production Based Learning model (Ganefri, 2013). In the first stage, curriculum analysis and learner characteristics were carried out. The second stage involved identifications product analysis. In the third stage, important questions related to the product to be created were formulated. The fifth stage was about question mapping. The sixth stage consisted of analyzing the equipment and materials required for the product. The seventh stage involved the production of furniture. The eighth stage focused on evaluation. The ninth stage was dedicated to creating a business plan.

In this research, modifications were made to the syntax, specifically by combining stages 5, 6, and 9 into a single stage, which is the Business Plan stage, placed as the fifth stage. The activity involved assigning tasks to students to create a business plan related to the furniture product, to be completed in groups. This business plan included product design, material requirements, work steps, a time schedule, and other details that would serve as a guide for completing the task. Here's an overview of the syntax of the implementation of the Production-Based Learning model in this research, as shown in Figure 2.

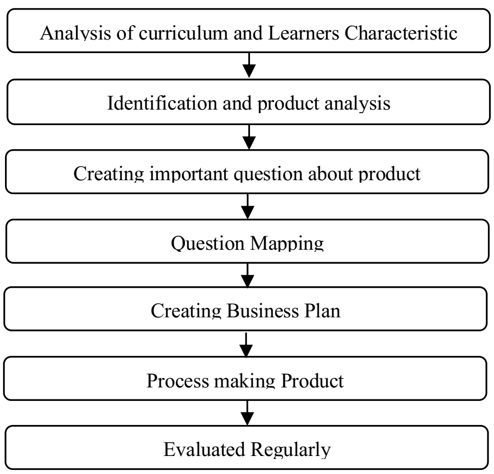

Fig. 2 Syntax of Production Based Learning Model in Wood Construction Applications Course

2.2. Research Instrument

The effectiveness data were obtained from two sources: 1) an assessment of the work process and 2) an assessment of the produced products. The effectiveness data was collected from instructors, technicians, and three practitioners. On the other hand, practicality data were obtained were gathered by administering questionnaires to 16 students and instructors who were involved in teaching. The instruments used for data collection included process observation sheets, product observation sheets, and practicality questionnaires. Before usage, these instruments were first validated by five experts in their respective fields. The assessment criteria included presentation suitability, content suitability, construction, and languages.

Based on the validation results from the experts, an overall coefficient V greater than 0.5 was obtained, indicating the validity of those indicators. The work process instrument consists of four indicators, including joint-making process, use of machinery equipment, product design, and product finishing steps. The instrument is composed of 12 valid statements (V coefficient > 0.5). The validation analysis results for the work process instrument can be seen in Table 1 below.

Table 1. Work Process Instrument

Indicator	Item	V Coef.	Interpretation
Construction process	1	0.66	Valid
	2	0.65	Valid
	3	0.65	Valid
Use Of Machinery	4	0.70	Valid
	5	0.70	Valid
	6	0.63	Valid
Product Design	7	0.72	Valid
	8	0.72	Valid
	9	0.65	Valid
Step of Product Finishing	10	0.60	Valid
	11	0.73	Valid
	12	0.65	Valid

The product assessment instrument consists of 10 statements, and an overall V Coefficient greater than 5.0 was obtained, making all 10 statements valid. For more detail, the test results of this instrument can be seen in the following table 2.

Table 2. Instrument of Assessment Product

Item	V Coef.	Interpretation
Design	0,67	Valid
Construction	0,72	Valid
Durability	0,65	Valid
Plan Suitability	0,70	Valid
Smoothness/Tidiness	0,70	Valid
Function Suitability	0,67	Valid
User-Friendliness	0,73	Valid
User Safety	0,70	Valid
Finishing Success	0,68	Valid
Accessories Suitability	0,65	Valid

In Table 3, it can be seen that the practicality instrument consists of seven indicators with a total of 14 items. From the validation results acquired, it is to know that all items obtained a V Coefficient greater than 0.5. meaning that all 14 statement items in the practicality instrument are declared valid and can be used as a data collection tools.

Table 3. Instrument Practicality

Indicator	Item	V Coef.	Interpretation
Motivation	1	0.67	Valid
	2	0.70	Valid
Interest	3	0.60	Valid
	4	0.60	Valid
Ease	5	0.70	Valid
	6	0.65	Valid
Understanding	7	0.72	Valid
	8	0.70	Valid
Collaboration	9	0.66	Valid
	10	0.65	Valid
Technology	11	0.65	Valid
	12	0.73	Valid
Creativity	13	0.70	Valid

Indicator	Item	V Coef.	Interpretation
	14	0.65	Valid

2.3. Analytical Methodology

The effectiveness data analysis is conducted based on the research hypothesis. The research hypothesis comprises two hypotheses, which can be observed in the following table 4.

Table 4. Research of Hypothesis

No	Hypothesis	Analysis Technique
1	The Production-Based Learning Model is effectively utilized in the coursework process of Wood Construction Applications (H_a)	Independent Sample T-test
2	The Production-Based Learning model effectively enhances the learning outcomes in the Wood Construction Applications course (H_a)	Independent Sample T-test

The assessment of the effectiveness of work processes and products is conducted uses a Likert scale ranging from 1 - 4, categorize as shown in table 5 below.

Table 5. Assessment Criteria

No	Score	Criteria
1	3,60 - 4,00	Very Good
2	3,10 – 3,59	Good
3	2,60 – 3,00	Low
4	1,00 - 2.59	Very Low

Meanwhile, the analysis of practicality data is conducted by determining the percentage of agreement (PoA) values with five feasibility criteria, namely, very low, low, fair, good, and very good. For further details, please refer to table 6 below.

Table 6. Criteria Percentage of Agreement Prakticality

Percentage (%)	Criteria Practice
0 - 20	Very Low
21 - 40	Low
41 - 60	Fair
61 - 80	Good
81 - 100	Very Good

(Riduwan, 2012)

3. RESULTS DISCUSSION

3.1. Effectiveness

3.1.1 Work Process

The descriptive analysis results conducted using the SPSS program, concerning tests for normality, homogeneity, mean, and deviation of standard in the work processes of both the experimental group and control groups, are presented in the following table 6.

Table 7. Descriptive Analysis, Normality, and homogeneity of Experimental and Control Group Working Process.

Group	Mean	SD	Normality	Homogenity
Experimental	3.30	0.17	0.661	0.074
Control	2.89	0.34		

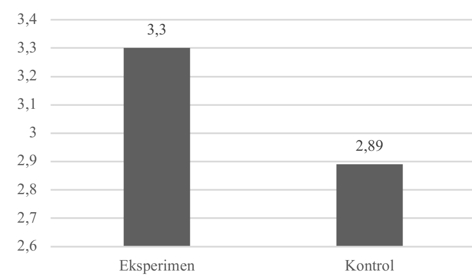

Fig 3. The Mean of Work Process

The experimental group average score of 3.30 falls within the good category, with 0.17 of standard deviation. Meanwhile, the mean score control group is 2.89, which falls into the low category, with a standard deviation of 0.34. Based on this data, it is evident that the average score of the control group is lower than that of the control experimental group.

The Kolmogorov-Smirnov test was used for assessing normality. If a significance value exceeding 5% (0.661 > 0.05), the data is deemed normally distributed. Homogeneity was evaluated through the Levene test, yielding a value of 0.074, surpassing the significance level of 0.05. Consequently, the data is considered homogeneous. Given the results of these normality and homogeneity tests, the data is suitable for conducting an Independent Sample t-test.

Table 8. Independent Sample T-test of Working Process Hypothesis

		F	Sig.	t	df
Value	Equal of variances assumed	0.667	0.007	5.806	22
	Equal of variances not assumed			5.806	16.212

Based on the hypothesis analysis results using SPSS in table 7, a significance value of 0.007 < 0.05 indicates the acceptance of Ha and the rejection of Ho.

This implies that the Production Based Learning model effectively enhances the working process in the Wood Construction Applications course.

3.1.2 Learning Outcome Product

Based on the descriptive analysis in Table 8 conducted using the SPSS program, the average score of the experimental class was found to be 3.47, falling into the good category, with 0.31 of standard deviation. Meanwhile, the average score of the control group was 2.97, categorized as low, with 0.70 of standard deviation. These data indicate that the average learning outcome products of the experimental class are higher compared to those of the control class.

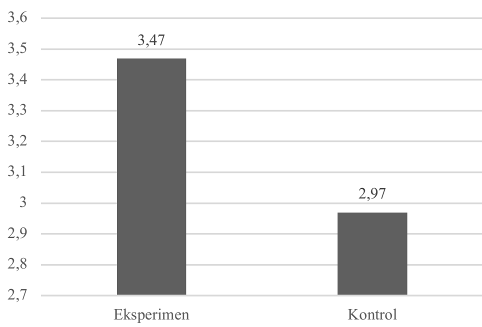

Fig 4. Mean Score of Learning Outcomes

Table 9. Descriptive Analysis, Normality, and homogeneity of Experimental and Control Group Learning outcome

Group	Mean	SD	Normality	Homogenity
Experimental	3.47	0.31	0.523	0.194
Control	2.97	0.70		

The normality test on the learning outcome data of both the experimental and control groups indicates a significance value greater than 5%. The obtained value of 0.523 is greater than the significance level of 0.05 (0.523 > 0.05), indicating that the learning outcome data follow a normal distribution. In the homogeneity test, the obtained value of 0.194 is greater than the significance level of 0.05, indicating no significant differences or homogeneity within the data. Based on the normality and homogeneity tests on the students' learning outcomes, the data can be used for further testing, namely the Independent Sample t-test.

Table 10. Independent Sample T-test of Learning Outcome Hypothesis

		F	Sig.	t	df
Value	Equal variances assumed	2.135	0.019	5.118	6
	Equal variances not assumed			5.118	5.680

According to Table 9, the significance value of 0.019 being less than 0.05 implies the acceptance of Ha and rejection of Ho. This suggests that the utilization of the Production Based Learning model effectively enhances the learning outcomes in the Wood Construction Applications course.

3.2. Practicality

Based on the practicality data collect from lecturers and students, the average percentage obtained is 89.92%, which falls into the very practicality percentage for each indicator can be further examined in Table 10 below.

Table 11. Percentage of Practicality

Indicator	Percentace of Practicality	Criteria Practice
Motivation	91.91%	Very Good
Interest	82.35%	Very Good
Convenience	89.71%	Very Good
Understanding	92.65%	Very Good
Collaboration	92.65%	Very Good
Technology	90.44%	Very Good
Kreativity	91.18%	Very Good
∑	**89.92 %**	**Very Good**

4. DISCUSSION

The research findings indicate that the production-based learning model with a practical rating of 3.47 (experimental group) and 2.97 (control group) is effective for the Wood Construction Applications course. This model focuses on creating tangible products relevant to consumers, emphasizing entrepreneurial aspects. It requires large-scale production facilities and emphasizes both skills and the produced items [15]. Known for its success in various studies [16], production-based learning was assessed in this study for its effectiveness through data collection on the learning process, skill mastery, and produced products.

The production-based learning model enhances the learning experience, especially in practical skills and the creation of tangible products for real-world use [15]. Analyzing the data, the average score in the learning process for the experimental group (3.30) falls in the 'good' category, significantly higher than the control group's average score (2.89), which is categorized as low. The experimental group showed lower scores in precision jointing (2.66), design modification skills (2.60), assembly skills (2.68), and painting and lamination skills (2.78). The hypothesis analysis yielded a significant p-value of 0.007, affirming the effectiveness of the production-based learning model in improving work processes in the Wood Construction Applications course.

These findings align with previous studies highlighting that production-based learning enhances students' productivity skills [17], boosts interest and enthusiasm for learning [18], fosters thinking skills and collaboration [19], and sparks entrepreneurial interests [20].

The product-based learning model, which focuses on tangible outcomes, emphasizes students' ability to create actual products or services by the end of the learning process [21]. In the Wood Construction Applications course, the average score for the experimental group is 3.47, indicating good outcomes, surpassing the control group's mean score of 2.97 in the low category. Two indicators in the experimental group, product construction (3.00) and finishing success (2.70), scored lower. The hypothesis test resulted in a significance value of 0.019, below the threshold of 0.05, confirming the alternative hypothesis (Ha). This suggests that the production-based learning model effectively improves learning outcomes in the Wood Construction Applications course.

The analysis of these learning outcomes aligns with previous research, indicating that the production-based learning model has the potential to enhance learning outcomes [22], improve discipline and performance [23], and provide practical experiences similar to real-world work [15]. Consequently, it prepares students not only for employment but also for creating job opportunities for others [24].

5. CONCLUSION

Based on the research findings obtained, the use of the production-based learning model, when compared to the conventional model, has shown differences in scores. The average scores for the work process and learning outcomes of students using the production-based learning model are higher than the average scores of students using the conventional model. In the work process, students obtained an average score of 3.30, categorized as "good," while in learning outcomes, students obtained an average score of 2.89, categorized as low. Looking at the level of effectiveness in the work process (0.007 < 0.05) and in learning outcomes (0.019 < 0.05), the production-based learning model has proven to be effective in the Wood Construction Applications course. In terms of practicality, both for teachers and students, the production-based learning model is highly practical (89.92%). This learning model is suitable for use, especially in practical coursework, to enhance students' skills and the quality of their learning outcomes. It can serve as a reference for teachers and study programs in their teaching methods, and it may need to be modified to align with the specific characteristics of the Wood Construction Applications course, particularly in the competencies related to precision in jointing skills, design modification skills, assembly skills, painting/lamination skills, as well as the quality of construction and finishing success of products.

AUTHORS' CONTRIBUTIONS

All authors participated in the development of this article, as outlined in Table 11

Table 12. Authors' Contributions

No	Name	Contributions
1	Yualitas Gusmareta	Conceptualization, Collected the data.
2	Fani Keprila Prima	Conceptualization, Wrote the paper.
3	Windry Novalia Jufri	Formal analysis
4	Wiwik Indrayeni	Project administration
5	Nidal Zuwida	Writing, review & editing

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