Teaching Factory Learning: Implementation of Independent Learning Policies and Independent Campus at State University of Medan

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ABSTRACT

The The development of Science and Technology in industry and/or the world of work (IDUKA) is always faster than educational institutions (technology and vocational), thus forcing educational institutions to make a real "Marriage" in order to achieve the target of technology and vocational education in addition to reducing the high cost of education itself. This study aims to determine the results of the pilot test of cooperation between educational institutions and industry and/or the world of work through the application of the Teaching Factory learning model so that the level of cooperation increases in weight. The experimental method of the model developed was to conduct a test on the Two-Group Pretest-Posttest Design. The research subjects were 82 students and 5 lecturers of Mechanical Engineering Education of Medan State University designed with Two-Group Pretest-Posttest Design. The instruments used were standardised and valid tests and non-tests. The validity of the instrument was tested using SPSS 22 software and Aiken's Formula V. The results showed that the average feasibility of the model had practicality reaching 87.72%, while the effectiveness of the model tested by t-test had succeeded in significantly increasing learning outcomes by 15.44 or 0.000 <0.05 and providing significant differences in learning outcomes between the experimental class and the control class (average 87.39 and 81.10) or 0.000 <0.05. In addition, the application of the Teaching Factory-based Metacognitive Skill (TEFA-BMS) learning model has provided ample space for students to improve affective, cognitive, and psychomotor aspects by adopting order service technology in the industry. This model is not only able to improve psychomotor skills but also form discipline and work responsibility as a manifestation of the results of metacognitive skills. However, the limitations of this research are still taking samples from one university. Then the product of the results of this study is still focused on the field of machining. IDUKA's response to students who carry out research or internships at IDUKA is good.

Keywords: *Mechanical Engineering Department, Teaching Factory, Vocational Education, MBKM.*

1. INTRODUCTION

The big goal that the Ministry of Education and Culture (Kemdikbud) wants to achieve from the Free Learning and Free Campus (MBKM) policy is to create a culture of educational institutions that are autonomous, not bureaucratic, and to create an innovative learning system based on the interests and demands of the modern world [1] . In addition, this policy that was launched in 2020 has the consequence that every educational policy stakeholder from the lowest level to the very top has a real "Marriage" between Educational Institutions and Industrial Institutions and the World of Work (Iduka). The response to Iduka's willingness to cooperate as shown in S.Riadi et al's research [2] must always be increased in depth so that the real collaboration between the Mechanical Engineering Education Department of Medan State University and Iduka is getting closer and touching the substance of the collaboration itself. The condition of this cooperation bond is very positive in supporting the achievement of the character of graduates of the Technology and Vocational Education and Training Institute (TVET) as prospective educators in the Technology and Vocational (Mechanical Field) fields who are not only technically skilled, but must also be able to think and act creatively. , as well as having high adaptability to deal with uncertainty that has become a demand-driven characteristic of the 21st century world of work [3]. In addition, cooperation between industry and universities can also increase industrial productivity and

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educational efficiency at universities, combine theory with practice to accelerate the learning process, and facilitate the transfer of knowledge to the field of production, optimizing the use of resources (human resources, capital, technology, human resources). nature), as well as to ensure sustainable development. Various forms of cooperation can also be realized in accordance with the situation and objective conditions of a university and industry that collaborate, for example research collaboration, application of learning models, and so on

The application of the learning model is one of the efforts to improve the quality of learning outcomes for prospective vocational teacher students who will become the main actors of vocational education in the future. Therefore, various efforts are made through the application of the learning model as a repertoire or enrichment of the learning experience, because if this is not the case then their hopes of being able to teach students effectively and efficiently for the future will not come true.

Teaching Factory Based on Metacognitive Skill=TEFA-BMS is a learning model that has been developed for prospective student educators in the field of machining who not only have professional skills and attitudes but also have good adaptability [4] . The design model that was created has several stages that combine the teaching factory model and metacognitive skills as shown in Figure 1.

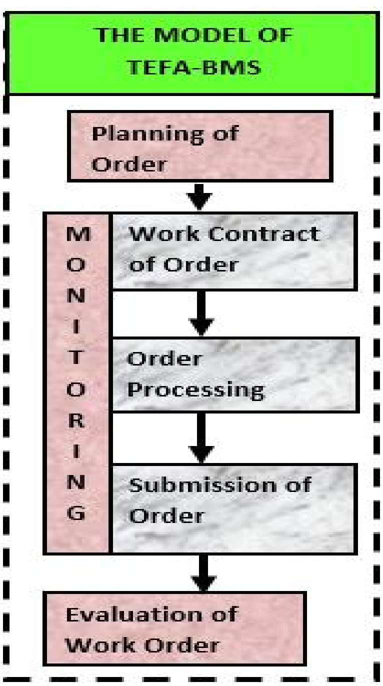

Figure 1. TEFA-BMS Model.

Several studies have shown that the teaching factory learning model is able to produce graduates who are professionals in their fields, develop a modern curriculum, demonstrate appropriate solutions in facing industry and the world of work challenges, as well as transfer technology from industries that are partners in educational institutions [5&6]. Likewise, research data on the Free Learning and Independent Campus (MBKM) policy program indicate that this program has provided the widest opportunity for people to be confident in facing challenges and increasing professionalism [7,8,9]. However, there are still obstacles as challenges in its application, especially for monitoring and evaluation [10]. Then it can be emphasized that the MBKM program is also the embodiment of the Triple Helix model revealed by Leydesdorff [11]. An overview of the Triple Helix cooperation between the Government, educational institutions, and industrial/workplace institutions which are interrelated and mutually beneficial can be illustrated by the following scheme:

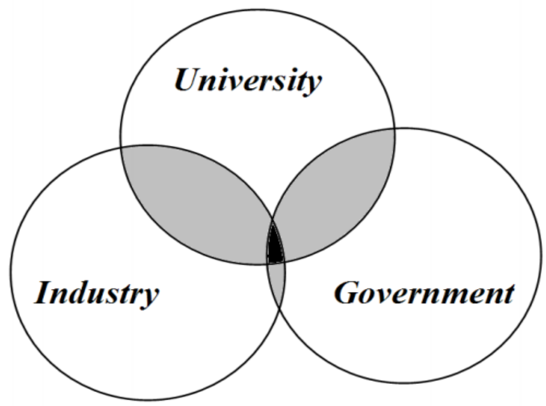

Figure 2. The Triple Helix Partnership.

2. METHOD

This research is applied research (Application Research) with the aim of testing the success of the developed model to be applied in the Machinery Technology Learning process. The process of implementing the intended model follows the ADDIE development design [12], the stages of which are as follows:

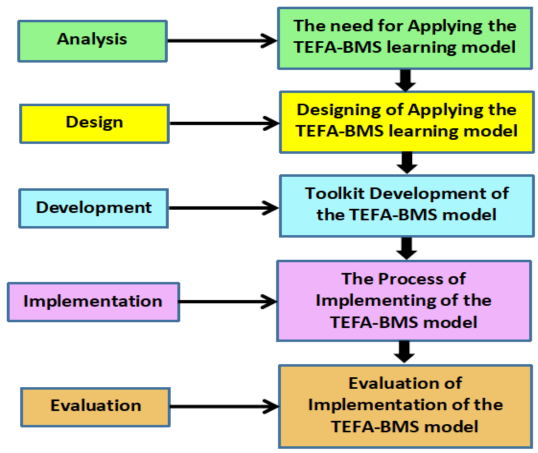

Figure 3. Schematic of Model Implementation Steps.

Experimental trials were carried out using the Two-Group Pretest-Postest Design. Before being given the model treatment, a pretest was first carried out, this was done to compare the conditions before and after the treatment [13]. The design of the research design can be seen in table 1 below:

Table 1. Research Design.

	Pre-test	Treatment	Post-test
Control (41)	Q_1	X_1	Q_2
Experiment (41)	Q_3	X_2	Q_4

3. RESULT

3.1. *Effectiveness Test Analysis*

In analysing the effectiveness test of this study, the authors used the SPSS-22 program, because the research design carried out was a Two-Group Pretest-Post test Design. After fulfilling the requirements needed to carry out an effectiveness analysis (Normality and Homogeneity), the results of the t-test of differences in student learning outcomes data are obtained by looking at the statistical tests. Table 2 shows the description of the minimum and maximum values.

Table 2. Descriptive Statistics.

	N	Min.	Max.	Mean	Std. Dev.
Pre-test experiment	41	62	82	71.95	5.152
Post test experiment	41	73	96	87.39	5.979
Pre-test Control	41	63	82	72.27	4.837
Post test Control	41	71	95	81.10	6.953
Valid N					

3.2. *Average Difference Test (T-Test)*

In carrying out this mean difference test, the T-Test was used. In this regard, it is carried out in two stages, namely the Paired Sample Test and the Independent Samples Test. Paired sample test is used to determine whether there is a difference in the mean of two paired samples. The connection with this research is to find out whether there is an average difference between the scores of student learning outcomes in the pre-test and post-test for each experimental class and control class. While the independent test is used to find out whether there is a difference in the average post-test learning outcomes of students in the experimental class and the control class. The results of the tests given to the experimental class and control class obtained the results of the analysis as shown in Tables 3 and 4 below:

Table 3. Paired Samples Test.

	Paired Differences							
	Mean	StDev	Std Error Mean	95% C.I. of the Difference		t	df	Sig. (2 tailed)
				Lower	Upper			
Pair 1 Pre-test experiment	-15.439	6.265	0.978	-17.417	-13.461	-15.779	40	.000
Pair 2 Post test experiment	-8.829	8.053	1.258	-11.371	-6.288	-7.021	40	.000

Table 4. Independent Samples Test.

	Levene's Test for Equity of Variances		t-test for Equity of Means						
	F	Sig	t	df	Sig (2 tailed)	Mean Difference	Std Error Difference	95% C.I. of the Difference	
								Lower	Upper
Students' Results Equal Variances Assumed	1.109	.295	4.394	80	.000	6.293	1.432	3.443	9.143
			4.394	78.244	.000	6.293	1.432	3.442	9.144

Equal Variances not Assumed									

Based on the results of the Paired Sample Test and Independent Sample Test in tables 3 and 4, the significance (Sig 2 tailed) is 0.000, which means less than 0.05 (<0.05). From the results of this analysis, it can be stated that the learning outcomes between students in the experimental class and the control class are significantly different.

4. DISCUSSION

From the results of applying the TEFA-BMS learning model to Machining Technology, it can be seen from several aspects, including: 1) Disciplined habits, 2) Ability to plan orders/projects, 3) Ability to work on orders through Machining Technology, especially in terms of assembling objects/orders, 4) ability to understand problems and strategies to solve them, 5) ability to evaluate in order to complete objects/orders and after work.

Judging from the student's ability to plan orders or/projects, students already have the ability to translate existing ideas into an image to work on in the machining process in Machining Technology learning with the TEFA-BMS model to fulfil order requests or solve problems. This can be interpreted that students who have attended machining technology learning with the TEFA-BMS model have fulfilled part of the qualifications of a designer, because the characteristics of the designer are: 1). Able to identify problems, 2). Have imagination to predict problems that might occur, 3). Be creative., 4). Able to simplify the problem. 5). Have expertise in Mechanics, Materials, Mathematics, and Drawing, depending on the type of design being made. 6) Be able to make the best decisions based on the correct analysis and procedures. 7. Have an open-minded nature towards criticism and suggestions from others. Of the seven characteristics of its implementation in design techniques, there is a term known as NIDA (Need, Idea, Decision and Action). This means that the first stage of a designer determines and identifies needs, in relation to the tool or product that must be designed. Then proceed with the development of ideas that will give birth to various alternatives to meet these needs, an assessment and analysis of the various existing alternatives is carried out, so that the designer will be able to decide on the best alternative. Finally, it is the process of design or manufacture (Action), but if what is designed is work equipment or something that is used directly by humans, then ergonomic factors need to be considered fundamentally to reduce the level of work fatigue, improve work performance and minimize the potential for work accidents [14].

The next ability is to work on the workpiece (as a syntax step) in accordance with the previously planned drawings. In this case students are already able to carry out the process of cutting, forming, up to assembling between the components that have been done. This success can be interpreted that planning, which is at the same time preparation for carrying out work, is a series of activities that cannot be separated. The theory developed by Thorndike through his behaviourism theory states that the success of a job will depend on its readiness (law of readiness). The form of readiness carried out by students is to formulate work steps to be carried out based on the shape and size of the planned drawings, and determine the type of machine and equipment used. In other words, before working on an order student have already done a process analysis. In practice, apart from working on orders, students are also directed to always control the shape and size of the object being worked on so that the shape and size of one component and the other components find a match (fitting). This form of self-monitoring carried out by students produces a behaviour or ability to always be precise and accurate as the embodiment of a metacognitive skill (metacognitive monitoring).

Learning Machining Technology with the TEFA-BMS Model involves processes and products so that it can train several skills that are cognitive, affective, and psychomotor. The TEFA-BMS learning model is also designed to provide opportunities for students to carry out problem-solving activities in small groups collaboratively, work independently and in groups, and be able to monitor and evaluate work, so that individual students become responsible and independent. From various studies, metacognitive skills are not only able to contribute to learning outcomes, but are also able to improve performance [15], are able to increase reading motivation, are able to improve social skills and problem solving [16]. This is because metacognitive skills always prioritize control over thought processes, then the more often a person realizes his thinking process will always reflect or evaluate and make improvements in the future on the basis of things that have been done before.

In general, from the results of an analysis of the speed of the planning process and execution of orders between experimental class students who used the TEFA-BMS Learning Model and control class students who did not apply the TEFA-BMS Learning Model. Overall, the ability of students to complete planning and execution of orders has developed well. Furthermore, the ability to complete planning and execution of orders is in a good category and has carried out the aspects that have been determined as indicators of its success.

5. CONCLUSIONS

Based on the results of the research and discussion that has been described, it can be concluded as follows:

1. The results of testing the effectiveness of the model tested by the t-test have succeeded in increasing learning outcomes significantly 15.44 or 0.000 <0.05 and providing a significant difference in learning outcomes between the experimental class and the control class (mean 87.39 and 81.10) or 0.000 < 0.05. This proves that the learning outcomes of the experimental class are higher than the control class and are significantly different, so it can be stated that the TEFA-BMS Model is effective for learning Machining Technology.
2. In general, IDUKA's attitude and response to the work of students and lecturers who carry out cooperative learning with companies/industry is good.
3. Main attitudes and competencies that must be possessed by students of the FT Mechanical Engineering Department. Unimed in carrying out learning, cooperation with IDUKA is disciplined, responsible, able to read pictures, willing and able to work in the field according to their field.

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