

The Development of Project-Based Learning Pedagogical Module for CNC EDM Die Sinking for Industrial Machining Technology Course

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Abstract: This CNC EDM Die Sinking machine is a learning topic for the Industrial Machining Technology course to obtain SKM level two certification. Project-Based Learning (PjBL) can overcome the problem of lack of skills in operating machines because it can actively involve students. This study aims to develop a module for Project-Based Learning (PjBL) of CNC EDM Die Sinking for Industrial Machining Technology program. Module development study design using SIDEK model which is divided into 3 main phases namely needs analysis phase, development design phase and evaluation phase as the main guide for module development. Next, this module develops RPH which contains two projects using project-based learning strategies from the model Adria Steinberg (1998) which contains six principles namely validity, academic accuracy, application of learning, active exploration, adult relationships and assessment. The content evaluation of this module is divided into four parts namely format appropriateness, RPH content for two projects, teaching aids and evaluation rubrics and evaluated by two experts in CNC EDM Die Sinking machining skills and a Project-Based Learning (PjBL) expert. Data were analyzed using descriptive score value for each aspect of content validity assessment consisting of 4 main items. In conclusion, the results of the evaluation showed that the EDM Die Sinking module obtained a high validity value for each item with a value (3.72) for the format appropriateness item, (3.80) for the appropriateness of module content item, (3.83) for the suitability of teaching aids item and (3.73) for the appropriateness of assessment rubrics item. The contribution of this study is to assist the teaching staff in carrying out the process of teaching the topic of EDM Die Sinking machine. This study is expected to provide guidance to instructors in carrying out the process of teaching the topic of EDM Die Sinking machines using project-based learning strategies.

Keywords: Project-Based Learning (PjBL), TVET, Vocational College

1. Introduction

Malaysia is growing towards a developed country causing changes in the country's economic sector. According to Jalani (2015), failure to produce a skilled workforce will have a negative impact on the country's economic development. Therefore, the country needs to produce more skilled manpower that can help and grow the country's economy. Technical and Vocational Education (PTV) is considered as a good channel in producing a skilled workforce that is considered as an engine to national development.

The national education system places emphasis on PTV after seeing the importance of PTV in the development of the country in the future. PTV will strive to increase skilled human capital by providing quality education (Ahmad Zainal, 2016). Vocational Colleges are developed to play a role in shaping individuals with skills in order to meet the needs of industries that require skilled manpower in the industrial sector. Vocational College is one of the institutions that offer Diploma Certificates for technical courses. After being proactively preserved PTV, this PTV stream is equipped with the Malaysian Skills Certificate (SKM) after graduating from Vocational College.

SKM is a program offered by certified skills institutions. This SKM certification is made so that the percentage of skilled manpower in Malaysia can be increased. This SKM aims to give recognition to those who are qualified for the ability and level of knowledge and skills of a person in the programs offered. From this certification, it provides a career path to academically qualified students and can produce a skilled and trained workforce in enhancing the industrial sector in Malaysia.

Machining operations is a work process that uses machines. It involves the use of conventional machines or machines that use computer-assisted programming. In addition, students will also learn about engineering drawings, machine maintenance and machine use. Machining operation is a work process that refers to the process of cutting the work piece using a machine. To obtain SKM certification, students will be exposed to the operation of Computer Numerical Control (CNC) machines, CNC Electrical Discharge Machine (EDM) Die Sinking Operation, supervision of machining operations and machine maintenance. Therefore, this program is seen to be able to provide knowledge and skills to students. In addition, students are also able to perform machine operation work.

1.1 Background of Study

Education plays an important role in shaping a society that has knowledge and skills in a field. The changing era of globalization is now impacting the teaching and learning process in Vocational Colleges. In addition, the changes that are taking place now make the challenge to the teaching staff bigger (Ahmad, 2015). There are several problems in the teaching process that is to explain the practical work process more clearly. This is due to the changes that occur in the coordination of the Vocational College Standard Curriculum (KSKV) (Bakar, 2017). In addition, Vocational College lecturers do not follow skills training related to practical work (Mohd Arshad, 2017). Vocational Colleges offer various diploma and certificate courses for technical programs including Industrial Machining Technology. This Industrial Machining Technology course can provide exposure to knowledge related to the machining process found in the industry. students will learn machining processes including operating and maintenance methods for conventional machines, CNC EDM Die Sinking machines, EDM Wire cut. In teaching and learning machine operation such as CNC EDM DIE SINKING requires skilled manpower to operate it. Therefore, the level of mastery of skills related to practical work needs to be strengthened to facilitate the teaching and learning process.

Teaching and learning the topic of EDM Die Sinking is one of the topics that need to be studied by students of industrial machining technology course to qualify skilled students in SKM level two certification. However, the teaching and learning process of this topic is still at a moderate level with limited reference resources. This is because, changes or additions in line with the needs of the latest technology. The use of good reference resources will attract students as well as help students and

lecturers in the PDP process. This is supported by Ja'apar (2017), who states that students need to be provided with adequate facilities to help the learning process. In addition, the student-centered learning process is still less applied in the teaching of this topic. For machine Die Sinking learning, the selection of appropriate teaching methods should be used. This is because, with the use of appropriate teaching methods will facilitate the delivery of teaching.

According to Ihkasan, (2007), the tendency of students to lack understanding of practical procedures is high if they are unable to identify the application of theories. Therefore, this can cause students to misunderstand the practice to be done and at the same time cause them to be less interested in doing it. Usually, practical learning in the workshop is done based on theoretical learning in the classroom. Practical learning conducted aims to improve students' knowledge and skills. However, the difficulty of understanding a work procedure is a major challenge that students need to face in doing a practical job (Ali, 2006). This is because, there are a handful of students who find it difficult to imagine a situation that has been stated in the teaching and learning process. This also causes students to not be able to explain the procedure or process of producing a project even though the project has been successfully completed.

According to Misran, (2016), students still need good resources, guidance, guidance and training to improve knowledge and skills, especially student-centered teaching. Through project-based learning in the workshop usually begins with a description related to the work process to be done. Therefore, lecturers also conduct demonstrations of machine operation at an early stage to give exposure to students about the project to be carried out (Sucipto, 2017). However, with project-based learning methods in the workshop at a time, students can not improve their skills directly due to several factors including the noisy workshop environment and the large number of students. This will cause students to take the easy way out by simply following the work procedure without knowing more about the machining process of a machine. In addition, students also do not have the opportunity to think creatively and critically in solving problems during the implementation of a project (Jantan, 2016). This is because the number of students available at one time in the workshop as well as the limited number of machines cause students to not be able to improve students' knowledge and skills.

In this regard, apart from the explanation based on the actual textbook and syllabus, the addition in terms of visuals is also a continuation of the processing of modules that want to be used as a guide to attract students to follow the learning process. Therefore, learning theory in conducting a practical is something that is important before implementing a project. Through the development of modules, various information can be used as a guide to students before carrying out practical work. Therefore, complete reference material should be emphasized in helping students to obtain early learning before and during the teaching and learning process (Charlie, 2008).

1.2 Problem Statement

Based on the background of study, in this sector of machining, the second level of qualification is a high level of supervision where students are skilled in the design, control of machines and management of machine systems. In addition, a student is suited to be called a semi-skilled worker at this upper tiers. There are still Vocational College students, however, who find it hard to obtain skilled status for level two of SKM. This is due to the absence of machine operating skills that would complicate the process of machining. Furthermore, for this Die Sinking EDM computer, the shortage of references, very limited machines or tools would make it difficult for students to develop their skills. In addition, in operating this Die Sinking EDM machine, the lack of practical learning exposure always causes students to be weak.

1.3 Project-Based Learning

Project-based learning is a one of learning method that can stimulate a student's skills. It is a long-term learning method that can improve abilities, project production skills as well as creative

thinking skills in implementing a project. Learning outcomes using project-based learning methods will be more effective because if students are often ready to implement learning activities, the learning environment will be more interesting.

Therefore, project-based learning is a learning that gives exposure to students related to practical work in implementing a project. Project-based learning requires students to think creatively and critically in applying theoretical learning in the implementation of a project.

In addition, the use of Model Adria Steinberg, (1998) is also seen as suitable as a guide for the development of project-based learning modules. Model Adria Steinberg suggests some principles for project-based learning. Figure 1 shows six principles that have been suggested by Adria Steinberg. This Adria Steinberg model is supported by a previous study by Mohd Yusof, Jamal & Ismail, (2015) based on a previous study related to the implementation of project-based learning at the Malaysian Polytechnic.

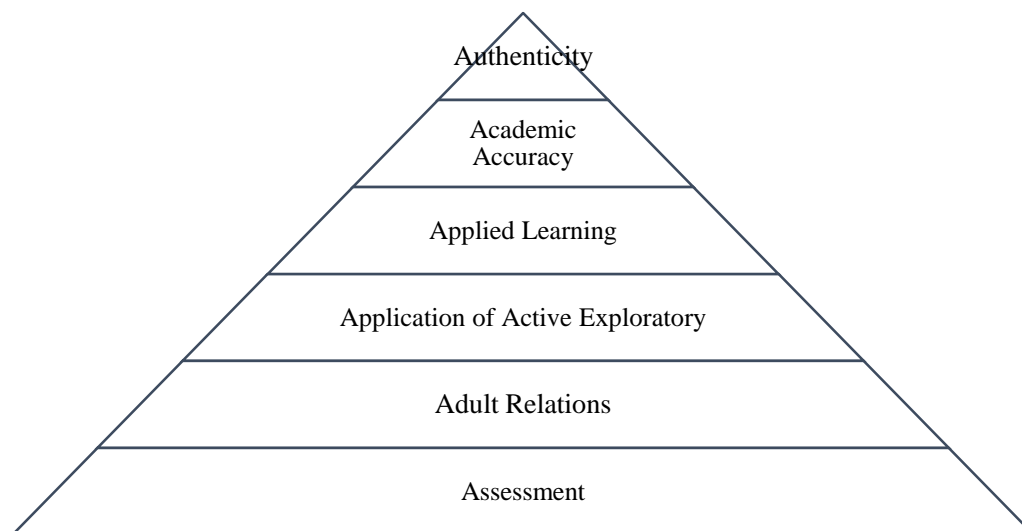


Figure 1: Model Adria Steinberg

1.4 Objectives of the Study

Development Module Project Based Learning on CNC EDM Die Sinking Machine for Industrial Machining Technology Program has three main objectives namely:

- a) Design pedagogy module project-based learning (PjBL) on EDM Die Sinking machine for Industrial Machining Technology program students.
- b) Develop a pedagogy module of project-based learning (PjBL) on the EDM Die Sinking machine for Industrial Machining Technology program students.
- c) Identify the usability of the module for the topic of EDM Die Sinking.

2 Research Methodology

The design of this study uses the study of development of module pedagogy project-based learning (PjBL) CNC EDM Die Sinking machine. The study phase involves three phases, namely, the first phase is the needs analysis phase, the second phase is the design and development phase and the third phase is the evaluation phase. The design of this study is to development of the product, namely the Development Module Pedagogy Project-Based Learning CNC EDM Die Sinking Machine for

Machining Industry Technology Program. In conducting a report, preparation is vital as it is a guide to doing it. In this study, researcher developed the module using the SIDEK model.

In addition, this study is also developed based on the project-based learning features suggested by Adria Steinberg. Researchers uses quantitative method to collect the data for research by distributing the questionnaires. The questionnaire was selected because it was easy to use, analyze the data and to be easily distributed to the research sample. The collected data will be descriptively analyzed using the frequency method.

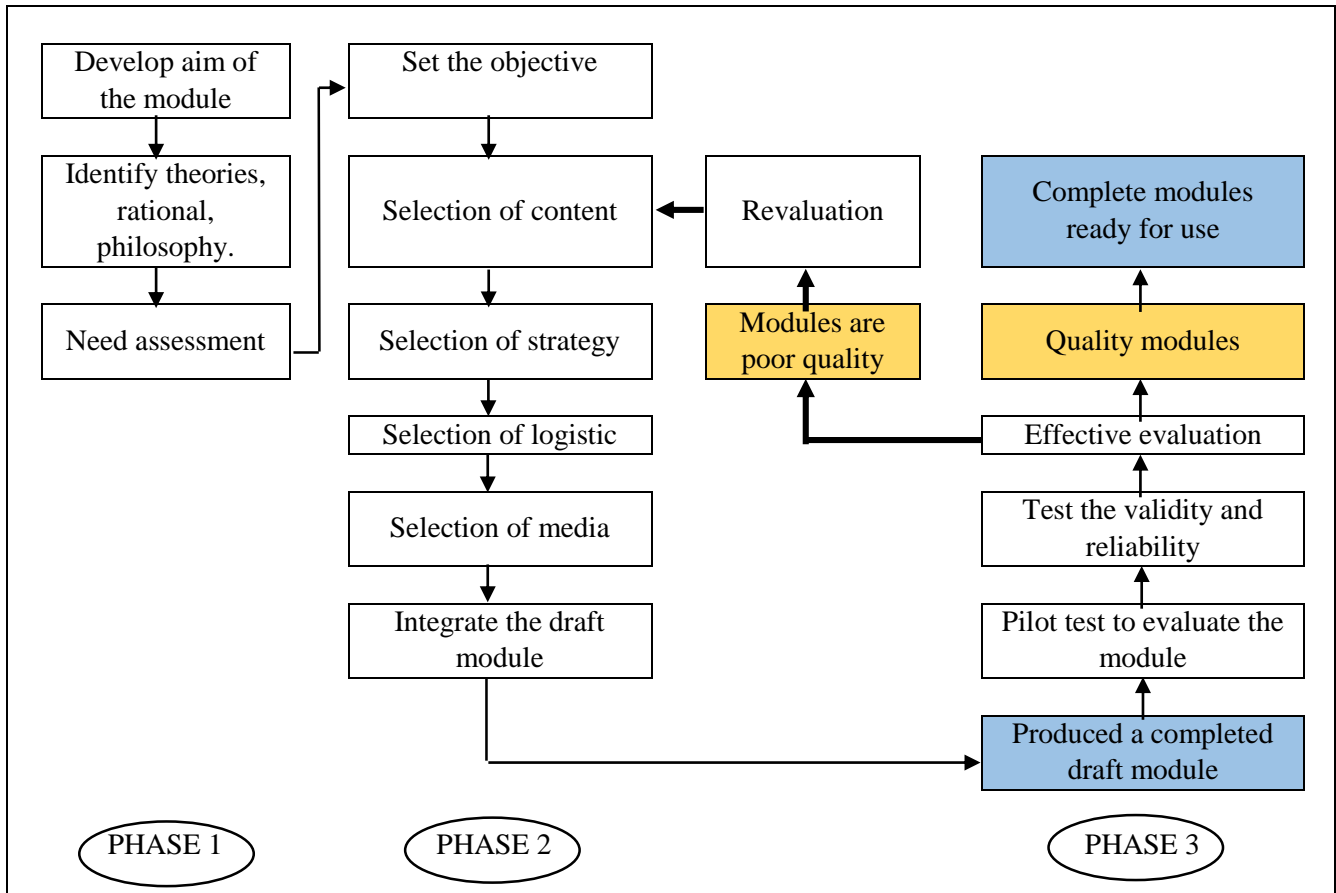


Figure 2: Flow Chart Sidek Model

The study population was the focus group of researchers who related to all those who followed the field of mechanical engineering, especially in the context of Machining Industry Technology. In addition, the researcher took 3 lecturers who are experienced and skill in the topic of EDM Die Sinking machines as a sample of studies consisting of UTHM lecturers, Polytechnics, and vocational colleges around Johor.

3 Results

Based on the SIDEK model, this module design has been developed to illustrate that each stage in this model plays a significant role in the development of this module. In terms of design, layout of content and media used, it also helps the analyst to build an organized module. They illustrate that each stage will enable developers to create the Module Pedagogy Project-Based Learning (PjBL) CNC EDM Die Sinking Machine for Machining Industry Technology Program. Based on the figure 2 shows the display of front page and contents of the module developed which are design with Microsoft Word.



Figure 3: The Display of FrontPage and Contents of the Module Developed

This module using validity testing using 4 items from 3 experts. The expert is an academicians had experiences in teaching and learning more than 10 years from polytechnic and university. Data as table 1, shows the summary consists of assessor score from the expert score preference. The cumulative score is total item value from three experts. Percentage is an expert's consensus score value, it counts by percentage from cumulative score divided by total maximum total item score. Then the validity value is cumulative score divided by total item and divided by total experts. The highest validity value is 4.

Table 1: Summary of module validity values by three expert evaluators

No.	Item	Assessor Score			Score Cumulative	Percentage (%)	Validity Value
		P1	P2	P3			
1	Format Appropriateness (6)	20	23	24	67	93.10	3.72
	Appropriateness of module content (18):						
	• RPH 1 (Electrode production)	62	71	72	205	94.91	3.80
	• RPH 2 (EDM Die Sinking machine operation)						
3	Suitability of teaching aids (2)	7	8	8	23	95.83	3.83

4	Appropriateness of assessment rubrics (5)	17	19	20	56	93.3	3.73
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Table 1 shows, the results of the evaluation showed that the module EDM Die Sinking obtained a validity value between (3.72 to 3.83). The lowest validity value is at the value (3.72 / 93.10%) which is for format compatibility items. Next, the second validity value is for the item of the suitability of the evaluation rubric with the value (3.73 / 93.3%). In addition, the third validity value is on the module content fit item with the value (3.80 / 94.91%). Finally, the highest validity value is on the item of suitability of teaching aids with value (3.83 / 95.83%). The value of the percentage of validity which is between 80% to 100% is defined as high. This coincides with the study conducted by (Isa & Zahid, 2017) on the validity value of RPH which is between 80% -100% is considered high.

Overall, the findings of data analysis obtained from expert questionnaires show high agreement on the development of this module pedagogy EDM Die Sinking. As the result of the analysis about appropriate formatting, contents and learning activities, the views and comments provided by the experts showed a positive response to the development of module pedagogy EDM Die Sinking. However, researchers need to pay attention to the views and suggestions voiced by experts on the development of this module EDM Die Sinking.

4 Conclusions

The development of a module pedagogy project-based learning (PjBL) on the CNC EDM Die Sinking machine is one of the researchers' efforts in helping the teaching staff carry out the teaching and facilitation process. Overall, all experts agree that the development of this module is in line with the learning of CNC EDM Die Sinking machines. However, researchers need to emphasize the aspects of learning activities in line with the views and comments from experts. All the improvements suggested by the experts are very helpful in improving the module so that it becomes more effective in the future.

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