



Project Based Learning (PjBL) for Vocational High School Teacher Candidates

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Abstract. Vocational education prepares graduates who are ready to work in the industry. Unnes Mechanical Engineering Education recruits prospective vocational teachers who will later teach in schools. Prospective vocational teachers must be equipped with soft skills and hard skills to become vocational teachers when they graduate. This research is a qualitative descriptive study. The research subjects consisted of prospective vocational teacher students and lecturers in the Department of Mechanical Engineering, State University of Semarang. Results based on the researcher's analysis, the implementation of project-based learning has been prepared since the beginning of the semester. Starting with a learning syllabus preparation workshop carried out by the curriculum team. Each department accommodates the preparation of Semester Learning Plans (RPS) to be able to implement project-based learning. This implementation is supported by an academic information system developed to support project-based learning. Monitoring of learning data is done easily through the Sikadu system.

Keywords: Project-based · Vocational Education · E-learning

1 Introduction

In developing countries, in general, there are two main types of education, namely public education and vocational education as stated by Jandhyala B G Tilak [1], in *The Handbook on Educational Research in the Asia Pacific Region* as follows. "General or vocational education? This is a "tough choice" in many developing countries. In the human capital framework, general education creates 'general human capital' and vocational and technical education 'specific human capital' Vocational education has an advantage, imbibing specific job-relevant skills, that can make the worker more readily suitable for a given job and would make him/her thus more productive" General education or vocational education. This is an option in some developing countries. In human resource/human capital thinking, general education will produce human resources that are still general, and vocational education or technical education will create specific human resources. Vocational education has several advantages because it can make skilled and relevant human resources ready to work and productive.

Prosser and Quigley [2], as the father of vocational education, stated that "vocational education is essentially a matter of establishing certain habits through repetitive training

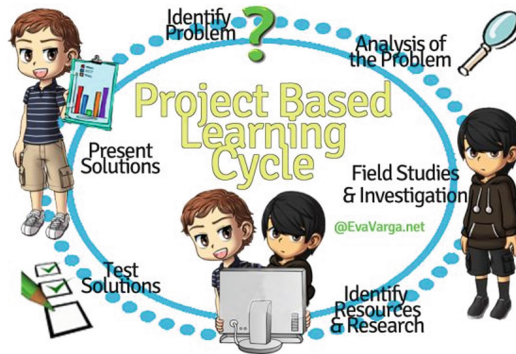


Fig. 1. Project Based Learning Cycle [3]

both in thinking and in doing, it is primarily concerned with what these habits shall be. And how they shall be taught. When considering the matter a little further, we find a general group of habits that requires 1. Habits giving adaptation to working environment 2. Process habits 3. Thinking habit”. The essence of vocational education is to teach the habit of thinking and to work through repeated training. Three habits must be taught, namely: 1. The habit of adapting to the work environment; 2. Habits in the process of carrying out work, and 3. Habits of thinking (at work).

Wenrich and Galloway suggested that vocational education is the same as technical education and is the same as occupational education [4]. The terms vocational education, technical education, occupational education are used interchangeably. These terms may have different connotations for some readers. However, all three terms refer to education for work. The terms vocational education, technical education, and occupational education are used interchangeably. These terms have different connotations for readers, but the three terms are education for work.

Wenrich and Galloway further suggested that “Vocational education might be defined as specialized education that prepares [4] the learner for entrance into a particular occupation or family occupation or to upgrade employed workers.” Vocational education can be interpreted as special education that prepares students to enter specific jobs, family work, or improve the workforce’s ability (Fig. 1).

Project-Based Learning (PjBL) is a learning method that uses projects/activities as media. Learners do exploration, assessment, interpretation, synthesis, and information to produce various learning outcomes. Project-based learning or project-based learning is a student-centered learning model to investigate a topic in-depth. Students constructively carry out deepening learning with a research-based approach to serious, real, relevant problems and questions. The exponential growth of Information and Communication Technology (ICT) has changed the education systems and contributed to improving the learning process [5–7].

Numerous studies on Didactics have demonstrated the effectiveness of student centered methods and strategies to improve results in terms of knowledge, skills, attitudes and values in Technical and Vocational Education and Training (TVET) [8]. PBL is a method developed based on a constructivist finding, its application is centered on project

development as the learning tool catalyzing knowledge discovery [9]. Characteristics Project Based Learning has features that distinguish other models. He first is Centrality. In project-based learning, the project becomes the center of learning. Secondly, driving question Project-based learning focuses on questions or problems that lead students to find solutions with appropriate scientific concepts or principles. The third is Constructive Investigation In project-based learning, students build their knowledge by conducting independent investigations (teachers as facilitators). The fourth is Autonomy, Project-based learning requires student-centered students as problem solvers of the problems discussed. The fifth is Realism, Student activities are focused on work that is similar to the actual situation. These activities integrate authentic tasks and produce a professional attitude. Objectives of Project-Based Learning Every learning model must have a purpose in its application. The objectives of project-based learning, among others: (1) Improve students' ability to solve project problems Gaining new knowledge and skills in learning, (2) Make students more active in solving complex project problems with actual product results, (3) Develop and improve students' skills in managing materials or tools to complete tasks or projects, (4) Increase student collaboration, especially in group PjBL. There are ten 21st century workforce characters developed and integrated into the implementation of the model [10].

2 Methods

This study uses a qualitative research method with a descriptive approach. The goal of descriptive research is to describe a phenomenon and its characteristics [11, 12]. The research subjects are third-semester vocational teacher candidates and lecturers in the Department of Mechanical Engineering, Semarang State University. Data collection techniques using direct observation and interviews. Data collection is carried out using a hybrid model, namely online and directly by implementing the health protocol.

3 Results and Discussion

Mechanical Engineering Education S1 is one of the long-established educational study programs in the Department of Mechanical Engineering. Mechanical Engineering Education Study Program S1 was established in July 1979. On July 11, 1996, officially obtained the Decree of the Establishment of Study Programs from the Director-General of Higher Education of the Republic of Indonesia Number 244/DIKTI/KEP/1996. The Mechanical Engineering Education Study Program has outstanding graduate achievements with an average GPA of 3.00 in the last four years; the graduation results of thesis script scores get an A or B grade. This achievement is also offset by the large number of graduates absorbed in the workforce as teaching staff, working in industry or entrepreneurship where the waiting period for graduates to get a job is not too long. Graduate users also expressed satisfaction with alumni performance from the mechanical engineering education study program.

The Mechanical Engineering Education Study Program has adequate supporting facilities, such as equipment availability with the latest technology in the machining and production laboratories, the availability of teleconference and micro-teaching rooms, and

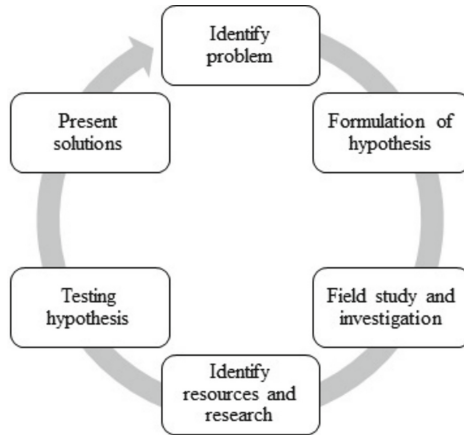


Fig. 2. Project-Based Learning Cycle [13]

wifi facilities in the campus area. With all these supporting facilities, it is expected to provide benefits for students to explore science and technology in the field of mechanical engineering. The Mechanical Engineering Education Study Program has a network of cooperation with national-scale companies engaged in the Automotive and Machinery fields to strengthen the learning process. With this collaboration, students will find it easier to gain experience in the industrial world and adapt learning to the needs of the industrial world.

The application of project-based learning aims to make students practice solving problems. The project-based learning cycle is as shown in the Fig. 2.

Lecturers give cases of real problems by the material in certain materials. The problem is obtained from the actual situation of the industry, for example. Then students will formulate a hypothesis on the issue. Investigations are carried out to find out the assigned problems. Source identification and research is carried out to solve existing problems. Hypothesis testing is done to test the hypothesis that has been set at the beginning. Then solutions are offered to solve the problem. Learning during a pandemic applies online-based learning by using a learning management system. Learning Management System (LMS) is a common platform where students and teachers can interact digitally, most especially in Open and Distance Learning (ODL) institutions [14]. A standard LMS supports an inclusive learning environment for academic progress with interceding structures that promote online collaborative-groupings, professional training, discussions, and communication among other LMS users [15]. Students commented that project-based learning was easier to understand. In addition, PBL provides opportunities for students to work together to solve a problem. Communication is established between group members, which allows interaction. Students more easily understand the mastery of the material through the implementation of the theory. Furthermore, PBL accommodates students to be able to think critically. Project-based learning (PBL) is a teaching approach designed for active learning processes. In PBL, students produce solutions to real-life problems. While they are trying to find solutions for a defined problem, they collect, classify, and comprehend data. As PBL is a student-centred approach;

it is motivational because it appeals to the students' personal differences and supports students' socialization, thinking, and self-regulation skills. PBL focuses on individual differences in a learning process whereas the evaluation of the PBL focuses on multiple points of view. Some of the basic evaluation techniques are performance-based assessment, portfolio, journal, authentic assessment (rubric) [16, 17].

Learning preparation activities are carried out through shared perceptions between teachers and workshops. The lecturer prepares a semester learning plan (RPS) that uses the project-based learning method in its application. The lesson plans and LMS have been synchronized through a system. The integrated academic information system (SIKADU) system accommodates learning for each meeting by the lesson plan. Lecturers and students have access rights to monitor ongoing learning. This has an impact on students' awareness to know to what extent the material has been delivered. Monitoring learning becomes easier through SIKADU and an LMS owned by Electronic Learning Aid (ELENA). There was a positive influence between ease of use and usefulness of Elena toward the Quality service in Learning on the student in UNNES [18].

4 Conclusion

Project-based learning provides experience for students to run a project which contains learning materials. The Department of Mechanical Engineering at UNNES has implemented this learning model to prepare students' skills before going directly. Project-based learning preparation is carried out at the beginning of each lesson with workshops for subject lecturers. Furthermore, the lecturer will make a learning plan in one semester. Project-based learning is supported by a system that can accommodate student learning. Monitoring learning activities can be done in real-time in the system menu. I hope in the future, after the COVID-19 pandemic, learning can be applied in actual practical knowledge.

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