The development of problem-based learning management in the course of Electrical instrumentation and electric circuits

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The development of problem-based learning management in the course of Electrical instrumentation and electric circuits

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Abstract

The objective of this research is to develop a problem-based learning management model in the course of measuring instruments and electric circuits. The study achievement of learners and the study the satisfaction of learners was performed. The students at the Diploma of Vocational Education (Vocational Certificate), 1st year in the field of power Khon Kaen Technical College, 40 people were used as the sample of this model. This research creates experimental tools such as teaching plans on Ohm's law and power are based on problematic learning management.

There are 7 steps: 1) define problems, 2) analyze problems, 3) define learning objectives to be studied, 4) seek data hypothesis, 5) Presenting results, 6) Knowledge summary, 7) Evaluate the results of the study of the learning achievement of learners in Measuring Instrumentation and Electrical Circuits Subject: Ohm's Law and Power.

There was a statistically significant difference in problem-based learning during pre- and post-study, with higher post-study achievement, pre-school achievement, and educational satisfaction.

Keywords: Management of problem-based learning , instrumentation and electrical circuits, learning achievement

1. Introduction

Problem-based learning is a student-centered approach to teaching and learning. Have a specific learning or learning objective, focusing on what the learner wants to learn. It starts with the problems that students are interested in or encounter in daily life that are related to the lessons. It could be students' problems or a group problem.

The teachers have to adjust the learning management plan according to the learners' interests as appropriate.

Then teachers and learners together come up with learning activities about the problem.

The problems that will be used in learning management sometimes may be social problems where teachers are encouraging learners to think from news situations and events that occur will focus on the learners' learning process.

Learners must learn from learning (learning to learn) to focus on the interaction between learners in the group. Practice and learning together (Collaborative Learning) leads to researching for answers or creating new knowledge based on the knowledge that the learner had before.

Instrumentation and Electrical Circuits are subject, according to the Higher Vocational Certificate Program, the Year 2020, type of industrial mechanic, Department of Electrical Power, Khon Kaen Technical College.

The Contents include learn and practice about the working principles of current meters, voltages, resistances, multimeters and oscilloscopes, Ohm's law, power, electrical power, the connection of various resistance circuits, Kirchhoff's Law, AC power generation, phase, and phasor diagrams, complex quantities, various R-L-C circuits power factor.

The use of different kinds of measuring instruments on DC and AC circuits and to measure the values of the learning management circuits in such courses was organized with a learner-centered focus.

Practice being able to think, to do, to solve problems, to do learning activities both inside and outside the classroom. To develop learners to become a complete human being, both physically and mentally, intellectually, and mentally, to be able to live with others and to live happily in society.

From all of the above, the researcher is interested in developing learning management and studying the learning achievement of the learners.

The management of problem-based learning (PBL) in instrumentation and electric circuits. To develop potential and use the results of the studies to develop the teaching and learning to be effective.

2. Theory and conceptual framework.

Researchers have studied theories related principles and concepts to define the research concept as follows by using problem-based learning management. It is one of the options that many educators accept that it is essential that teachers of all levels of education, including primary, secondary and tertiary levels. It should be used as a teaching activity to develop students' abilities. By seeking knowledge for themselves by doing projects, it is therefore important that all professional teachers know, understanding of the learning management process using project activities in learner development. Because this study activities are considered to be activities that respond to the learner-centered learning process as well. It is also an activity that can develop new learners in a society of diverse and modern information sources. That must have the ability to select correctly and suitable for their level and age. Including the ability to apply those knowledge well and apply it in real life, and project activities can also transform new learners in Thai society to create a culture of self-learning continuously and sustainable. Problem-based learning is a principle of problematic learning, derived from the PBL learning problem terminology. Problem-based learning is as a method of management, learning to use problems as a basis for learning from problems, etc.

In this research, the researcher will problematically use of learning terms will be based on relevant study, documentation and research. Many people make sense of the following problematic learning, given that problem-based learning is a curriculum development and teaching methodology that is problem-motivated and focused on student activities based on problems. It is not an easy learning method to solve problems by adding to it.

Also, the traditional course rather, it is a way of organizing the curriculum so that literacy activities arise from real problems in vocational training as the core of the curriculum. Knowing how to master the problem begins with students having real-life problems instead of giving them knowledge. Know the relevant subject area to solve problems. In this way, the curriculum and instruction lead students to explore knowledge. Self-knowledge and skills through a problem-solving process delivered by the course materials provided in the curriculum.

Problem-based learning management refers to the management of the study by taking the basis of the related problems or problems that the students face in daily life. It is then analyzed to generate new knowledge from the use of real-world problems as the context (CONTEXT) of learning to provide learners with analytical thinking skills and problem-solving as well as gain knowledge. According to scientists in the field of study that they study, problem-based learning is the result of a work process that requires understanding and problem-solving. There are 7 steps: 1) Defining the problem, 2) Analyzing the problem, 3) Setting objectives, 4) Studying knowledge and testing hypotheses, 5) Presenting the results of the study, 6) Summarizing the learning principles and concepts, 7) Evaluating results: 7.1 Academic achievement refers to the success of learners in terms of knowledge and performance of learners. Resulting from learning, this can be measured with a researcher-created achievement test. 7.2 The satisfaction with learning management refers to the students' feelings after the problem-based learning management in the courses of Instrumentation and Electrical Circuits.

3. Methods of conducting research.

1. The sample

The sample used in this research is 40 first-year Diploma students enrolled in Semester 1, Academic Year 2020, using the purposive sampling method, which has the following reasons:

1) It is a college where students have different talents and elements from other colleges.

2) It is a college that provides teaching and learning according to the Higher Vocational Certificate Program, B.E.

3) It is a college equipped with technology and computer labs, as well as a series of experiments that facilitate teaching and learning.

4) It is a college that has enough equipment for the number of students.

2. Research model

This research is Quasi-Experimental Research using a single group research plan with pre-test and post-test (One Group Pretest- Posttest Design) to study academic achievement. And measure the satisfaction of the sample learners with the following experimental schemes.

Table 1: experimental schemes

Group	Pretest	Experiment	Posttest
Experiment Group	T_1	X	T_2

T_1: Pre-Test
X : Project-based learning management.
T_2: Post-Test

The tools used in this research consisted of 3 parts:

1. Tools for teaching and learning, including

- learning management plan
- Content Knowledge Sheet
- Worksheet
- A set of teaching materials using an experimental cycle.

2. A test for measuring academic achievement

3. Questionnaire for assessing the satisfaction of learner

4. Data analysis

The statistics used in data analysis consist of 2 parts:

1. Statistics used to find tool quality and satisfaction
2. Statistics used in research hypothesis testing

4. Results

This research is quasi-experimental. Its objective is to develop and develop a problem-based learning management model in measuring instrumentation and electric circuits.

By studying the learning achievement of the learners in the Instrumentation and Electrical Circuit courses and studying the satisfaction of the learners in the Instrumentation and Electrical Circuit courses using a problem-based learning management model.

After the research has been carried out, and then the data obtained is analyzed for statistical results.

1. The results of the development of a model of a problem-based learning process for industrial technician students.

2. The results of the study of the learning achievement of the students in measuring instruments and electric circuits subject Ohm's law and power factor, which organizes problem-based learning.

3. The results of the study of the satisfaction of the students in instrumentation and electrical circuits subject to the problem-based learning process.

Table 2: The learning achievement of the sample group.

	N	$\bar{\bar{x}}$	S.D.	T
Pre-test	30	14.26	4.24	22.56
Post-test	30	38.17	5.06	

From Table 2, it was found that the calculated values were 22.56 when compared with the values obtained from the table opening for the critical values of (where df is 25 and the significance level at. 05) obtaining the critical point value from the table equal to 1.708, it can be seen that the calculated value is higher than the value (from the table), which shows that the learning achievement of the learner in Electrical Instrument and Circuit by organizing problem-based learning.

The basics between before and after classes are different. The post-test achievement (X = 38.17) was significantly higher than the pre-test achievement (X = 14.26) at the 0.05 level.

Table 3: the results of assessing learners' satisfaction towards the problem-based learning process model, instrumentation, and circuit learning environment.

Assessment Items	$\bar{\bar{x}}$	S.D.	Meaning
1. Learning management using problem-based learning makes learners fun.	4.77	0.43	The most
2. Learning management with problem-based learning allows learners to learn independently by themselves.	4.85	0.37	The most
3. Learning management is problem-based learning that allows students to discuss and exchange ideas with friends.	4.92	0.27	The most
Average	4.85	0.35	The most

From Table 3, it was found that when considering the results of assessing the learner's satisfaction with the problem-based learning management model, instrumentation, and electrical circuits. In terms of overall learning atmosphere, it was most appropriate and satisfactory at all levels, with an average of 4.85 and a standard deviation of 0.35. It was found that the issue of learning management with problem-based learning led students to discuss and exchange ideas with friends on all three issues. The learners first commented on suitability, and the satisfaction with problem-based learning management made the learners last happily enjoyable.

Table 4: the results of assessing the student's satisfaction towards the problem-based learning management model, instrumentation, and electrical circuits in the benefits of learning.

รายการประเมิน	$\bar{\bar{x}}$	s.d.	**Meaning**
1. Learning management using problem-based learning makes it easier for learners to understand the content being studied.	4.73	0.45	The most
2. Problem-based learning management provides learners with skills in acquiring knowledge from various sources.	5.00	0.00	The most
3. Problem-based learning management provides learners with group work skills.	4.92	0.27	The most
Average	4.88	0.24	The most

From Table 3, it was found that when considering the results of assessing the learner's satisfaction with the problem-based learning management model, electrical measuring instruments and circuits. In terms of learning benefits, it was found that the overall level was the highest with the mean of 4.88, the standard deviation of 0.24. When considering the details, it was found that the learners were satisfied with problem-based learning management. Learners have skills in seeking knowledge from various sources, followed by problem-based learning management, enabling learners to have group work skills and problem-based learning management to understand the content learned more easily, respectively.

5. Conclusions and discussions

The results of the study of the learning achievement of the problem-based learners. The learning achievement of the problem-based learning learners in the electrical measuring instruments and circuits.

The experiment was conducted with a sample group of 40 students in Diploma Year 1, comparing the difference of scores obtained from taking the pre-test and post-test using statistic-test dependent. That the learning achievement of the learner in Electrical Instrumentation and Circuits by managing problem-based learning during pre- and post-study was different from higher post-study achievement (X = 38.17). The learning achievement before school (X = 14.26) was statistically significant at the 0.05 level.

The results of assessing students' satisfaction towards the problem-based learning management model. The results of assessing the satisfaction of the learners after the problem-based learning management were found that the learning atmosphere, overall assessment results, were at the highest agreeing level. The overall assessment was at the highly agree level and the learning benefit was at the most satisfactory level.

Discussion of research findings, results of the development of problem-based learning process models, electrical measuring instruments and circuits The research can summarize the key points to be analyzed and discussed as follows: The results of the development of problem-based learning process models found that there were differences in the problem-based learning process or process from many sources. Varies according to the concept, purpose, or suitability to the normal status.

However, the process and the essence of problem-based learning remain the same, with the problem-based learning process being student-centered teaching and learning management model that keeps the learner engaged. In considering the selection of a problem-based learning process in teaching and learning, the teacher had to understand the aims and principles of the problem-based learning process.

References

[1] Delisle, Robert, 1 9 9 7 ,“ The Problem-Based Learning Process ", How to Use Problem -Based Learning in the Classroom, Association for Supervision and Curriculum Development, USA. pp. 1-2.

[2] Albanese, M. A., & Mitchell, S. (1993). Problem-based learning: A review of literature on its outcomes and implementation issues. Academic Medicine, 68(1): 52–81.

[3] Ngeow, K., & Kong, Y.(2001). Learning to learn: Preparing teachers and students for problem-based learning. Retrieved August 14, 2008, from ERIC database.

[4] Norman, G. R., & Schmidt, H. G. (1992). The psychological basis of problem-based learning: A review of the evidence. Academic Medicine, 67(9): 557–565.

[5] Tan, O. S. (2003). Problem-based learning innovation: Using problems to power learning in the 21st century. Singapore: Thomson Learning.