



## Problem-based Learning for Programmable Logic Controller Subject

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## Problem-based Learning for Programmable Logic Controller Subject

*P. Raksat, Wittawat Poonthon<sup>1</sup>, S. Arunrungrusmi, K. Tunlasakul, N. Mungkung,  
<sup>1</sup>Department of Electrical Technology Education, Faculty of Industrial Education and  
Technology,  
King Mongkut's University of Technology Thonburi, Bangkok, Thailand  
Email: narong\_kmutt@hotmail.com*

### Abstract

*This research presents problem-solving learning in the Programmable Logic Controller program. For students with Diploma in Computer Hardware Technology. To study the quality of the learning worksheets and compare the learning achievement of learners who used the worksheets together with practice. Research tools include problem-solving worksheets on circuit design, ladder diagrams. To control equipment in industrial production processes and a test to measure achievement. The samples used in this research were second-year students with a Diploma (Vocational Certificate) in Computer Hardware Technology of Samut Sakhon Technical College, a total of 20 people. and after learning with quizzes compare academic achievement with t-test and data analysis to determine the efficiency of learning worksheets in conjunction with practice with E1 / E2 values. Which the research results showed studying using the learning worksheet. The problem-solving model, coupled with the students' actual performance. The learner had significantly increased academic achievement at the 0.05 level, where the learner was able to think, analyze and solve situations arising in the operation of the industrial process equipment control circuit rather than the theoretical teaching.*

**Keywords:** Programable logic control, problem-based learning

### 1. Introduction

At the present time, instruction in educational institutes under the supervision of the Office of the Vocational Education Commission is usually based on one textbook or many textbooks with the same title. The instructors usually give lecture to students or solve problems in front of the classroom so that students can learn how to imitate and do exercises at the end of each chapter. This kind of teaching aims at giving more

knowledge to students so that they have to learn a lot and they are forced to remember. However, to gain higher understanding and idea and to solve problems require the application of various teaching methods so that learners can use brains to tackle with the contents and develop understanding inside the learners. Therefore, this research was to compare the conventional teaching approach with the problem-based learning approach on the topic of a Logic Controller to develop knowledge and ability of students. The research was done in the following steps:

1. Selection of subject topic
2. Planning and checking the teaching plan
3. Development of learning achievement test and checking the quality of the test
4. Development of behavior observation form
5. Treatment
6. Data analysis

In this study on the comparative study of learning achievement between conventional and problem based learning approaches, the students were split into 2 groups: Group 1 was the experimental group and Group 2 was the control group to consider the learning achievement.

This article will present the results from the comparison of learning achievement between conventional and problem-based learning approaches.

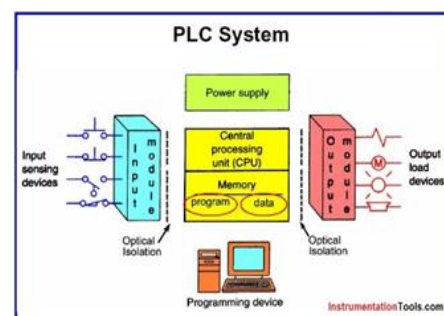


Fig.1. PLC Structure



## 2. Experimental

2.1 The test about previous knowledge about Logic Controller was given to students until both experimental and control groups reached the requirement of 80%.

2.2 The pretest of 30 items with 4 multiple choices was given to both experimental and control groups.

2.3 The experimental group was given problem based learning approach while the control group was given conventional one.

2.4 The posttest was given as a learning achievement and this was the same pretest but the items and choices were rearranged for both experimental and control groups.

2.5 The data were analyzed and the score from both groups was compared with previous knowledge, learning achievement, and behavior through t-test statistical technique. Both groups were independent. Previous knowledge and learning achievement were compared using one-way t-test technique.

## 2. Results

The research on the learning achievement of both experimental and control groups through learning achievement test containing 30 items of 4 multiple choices. Their scores were compared through t-test statistical technique. It was found that the experimental group and the control group showed significantly different learning achievement at the statistical level of 0.01. This means that the experimental group showed higher learning achievement than the control group. Problem based learning approach could help the experimental group achieve better scores than the group with conventional teaching approach.

**Table 1: Comparison of learning achievement between the experimental and control groups**

Sampling group	N	$\bar{X}$	S.D.	t-value
Experimental group	20	16.25	1.78	-3.12
Control group	20	18.35	2.43	

According to the analysis of the data from Table 1, it was found that the value was statistically significant (0.01, df = 38). The t value from the table was 2.457 and the t value from calculation was -3.12. This means that the experimental group and the control group had statistically significant difference for their learning achievement.

**Table 2: shows the mean, standard deviation and t-test value for the learning achievement pretest of the experimental group.**

Experimental group	N	$\bar{X}$	S.D.	t-value
Pretest	20	16.25	1.78	-13.68
Posttest	20	23.35	1.49	

According to the analysis of Table 2, it was found that the t value was statistically significant (0.01, df = 38). The t value from the table was 2.457 whereas the t value from the calculation was -13.68. This means that the learning achievement from pretest and posttest for the experimental group was statistically significant. Students with problem based learning approach showed higher learning achievement.

**Table 3: shows the mean, standard deviation and t-test value for the learning achievement pretest of the control group.**

Control group	N	$\bar{X}$	S.D.	t-value
Pretest	20	18.35	2.43	-4.47
Posttest	20	21.85	1.31	

According to the analysis of Table 3, it was found that the t value was statistically significant (0.01, df = 38). The t value from the table was 2.457 and the t value from calculation was -4.47. This means that the learning achievement for pretest and posttest of the control group was statistically significant. Students with conventional teaching approach showed difference in their pretest and posttest learning achievement.

**Table 4: shows the mean, standard deviation and t-test of the posttest learning achievement for both experimental and control groups.**

Sampling group	N	$\bar{X}$	S.D.	t-value
Experimental group	20	23.35	1.49	3.38 **
Control group	20	21.85	1.31	

\*\* Statistically significant at the 0.01 level

According to the analysis of Table 4, it was found that the t value was statistically significant (0.01, df = 38). The t value from the table was 2.457 whereas the t value from calculation was 3.38\*\*. This means that the learning achievement for posttest of the experimental group and the control group was statistically significant. In other words, the students with problem based learning approach showed higher learning achievement than students with conventional teaching approach.

**Table 5:** shows the mean, standard deviation, t-test value of posttest learning achievement of experimental and control groups as classified by learning behaviors

Learning behaviors	Experimental group			Control group			t-value
	N	$\bar{X}$	S.D	N	$\bar{X}$	S.D	
Memory	20	17.8	1.7	20	13.2	2.4	-3.497**
Understanding	20	17.2	2.3	20	12.8	4.3	-2.015
Application	20	17.2	2.8	20	13.8	3.5	-2.814**

\*\* Statistically significant at the 0.01 level

According to the analysis of Table 5, it was found that the t value was statistically significant (0.01,  $df = 38$ ) The t value from the table was 2.457 while the t values from calculation were -3.497, -2.015 and -2.814 according to learning behaviors as in memory, understanding and application. The mean of the experimental group was higher than the mean of the control group. This means that students with problem based learning approach showed higher learning achievement on the topic of a Logic Controller than students with conventional teaching approach.

#### 4. Conclusion

This research presents problem-solving learning in the Programmable Logic Controller program. For students with Diploma in Computer Hardware Technology. To study the quality of the learning worksheets and compare the learning achievement of learners who used the worksheets together with practice. Research tools include problem-solving worksheets on circuit design, ladder diagrams. To control equipment in industrial production processes and a test to measure achievement. The samples used in this research were second-year students with a Diploma (Vocational Certificate) in Computer Hardware Technology of Samut Sakhon Technical College, a total of 20 people. and after learning with quizzes compare academic achievement with t-test and data analysis to determine the efficiency of learning worksheets in conjunction with practice with  $E1 / E2$  values. Which the research results showed studying using the learning worksheet. The problem-solving model, coupled with the students' actual performance. The learner had significantly increased academic achievement at the 0.05 level, where the learner was able to think, analyze and solve situations arising in the operation of the industrial process equipment control circuit rather than the theoretical teaching. According to the research on the learning achievement between the experimental and

items with 4 multiple choices, the scores were analyzed using t-test technique with 2 independent sampling groups and it was found that the experimental group and the control group showed statistically significant difference in their learning achievement at the level of 0.01. The experimental group showed higher learning achievement than the control group. Therefore, the problem-based learning approach could help the experimental group students gain better results than the control group with conventional teaching approach.

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