Development of Problem-Solving Ability, Using Problem-Based Learning of Mathayomsuksa 5/8 Students at Borabuwittayakhan School, Mahasarakham, Thailand

Pramote Rungsri, Mahasarakham University, Thailand
Ritthikrai Chai-ngam, Mahasarakham University, Thailand

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Abstract
This action research aims to develop the problem-solving ability and learning achievement, using the Problem-based Learning (PBL) in Physics. The target students are 27 students in Matthayomsuksa 5 from Borabuwittayakham School, Mahasarakham, Thailand. The research process is divided into 2 main periods. Each period is consisted of 4 cycles having 4 steps; planning, acting, assessment and learning reflection, one cycle one Physics - problem situation. In order to develop the ability, various situations, many of objects, and instruments are restricted. The problem must be solved within a limited time. Students in a group, 4 members, have to think and make up their decision how to solve the problem. The problem-solving ability test, 3 scoring rubrics, was developed and used during students study. In addition, learning process and learning outcome are present on flip chart of 0.80 x 0.45 square meters, which is used for presentation in front of the classroom. As a result, after the both periods, we found that 1) Student's problem-solving ability increases from 75.03% to 95.13% on average. 2) Student's achievement increase from 54.44% to 62.27% on average. These PBL achievements are higher than that non-PBL, 48.15%.

Keywords: problem-solving ability, Problem-based Learning, Learning achievement.

Introduction

The enrichment science classroom is an important part for promoting students who will be the science of developing leaders, improving students to the best persons in science, mathematics and the technology. Moreover, it makes students have kindness, morality, health and ready to be officials for developing the country. (Suranaree witaya school, 1 : 2557)

The enrichment science classroom students are important groups of person for developing the Thailand's science. The Institute for the Promotion of Teaching Science and Technology (IPST) has set main goal of the institute that developing and support talent-science students (Suranaree witaya school, 1 : 2557)

As analyzing the 5/8 student final test, found that the average is 9.69 and the percentage is 32. The result is weak in the enrichment science classroom level and the students' Problem-solving ability is weak because they are unsuccessful in the test. From the observing teaching, we found teacher teach in passive learning style. However, the Problem-based leaning is the leaning by active learning style (Delisle, 1997 : 26-36). So the Problem-based leaning was bring to improve the Problem-solving ability and student' achievement.

Action and assessment plan.

This action research was divided into 2 phases, big circles. Each phases were consisted of 4 smaller circles celled the cycle. Cycles in the figure 1 are depend on appropriate contents of Physics in the upper secondary school and on limitations of laboratory equipment that the schools have. Overall, main process of the research was shown in the figure 1.

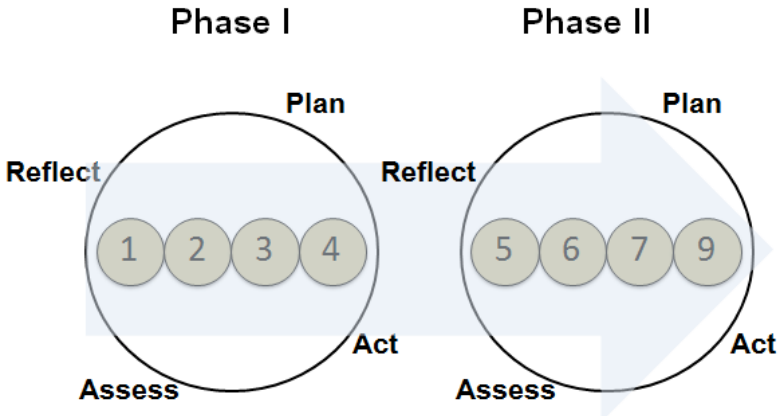

Figure 1 : The process of the action research (Inoue N. 2015 : 1)

As you see in the Figure 1, there are 4 steps of processes: Planning, Acting, Assessing and Reflecting which are explained fallowing these;

Planning is the first step of preparing the action plan or to use the instruction innovation as well as the assessment plan.

Acting is using the prepared plans to the target. 8 instructive plans were designed by fallowing Problem-Based leaning ideas. The 4 plans were used in the Phase 1 and other plans were used in Phase 2

Assessing; the Problem-solving ability was assessed by the Problem-solving ability evaluation from which was developed. The ability was assessed after the Problem-based plans had used in each Phases.

Reflecting; evident such as student works, picture and the evaluated result were brought to analyze and reflected. Then the results become the facts called Finding and can use for developing the instructive process in the next phase.

Action plan

According to the Planning, the Problem-Based leaning plans would be used in the Acting and they depend on the contents which are shown in the table 1. Then an example of teaching processes in the Refraction of light cycle was shown in the table 2.

Table 1 : The structure of contents following the problem-based leaning.

Phases	Cycles	Contents	Time (hr.)
1	1	Reflection of light in the plane mirror	2
	2	Reflection of light in the curved mirror	2
	3	Refractions of light	2
	4	Tin lane	2
2	5	Ohm's law	2
	6	Electrical resistivity and conductivity	2
	7	Magnets and magnetic fields	2
	8	Motor	2

Table 2 : The example of teaching processes in the Refraction of light cycle.

Step	Detail
Preparing the students.	Teachers talk about how to lean in the Problem-based leaning and what students and teacher support to do as well as grouped students.
Giving student the problem situation.	Teachers give a problem situation and some related tools.
Proving the problem.	Let the students solve the problem. they might search the related knowledge, plan and doing something to solve the problem.
Analyzing their answer.	Students might find the error of their answer, analysis their mistake or replay to solve the problem again.
Synthesis their knowledge.	Students might gather the gained knowledge and preparing to the presentation in front of the class by writhing their problem-solving method, answer and the knowledge.
Assessing students.	Asking student some questions during their presentation.

In addition, the problem situation which was given to the students in the step 2 is that let students try to identify what is the given translucent cube. Equipment follows that 1) a translucent cube 2) a low intensity laser 3) a paper 4) a ruler 5) a slit

Assessment

According to the Planning, the Problem-solving ability was assessed by a test was developed. The evaluation of the ability was similar to what the students' activities taken during they leaned. There was a problem situation and related tools gave and let student try to solve the problem as before. During they are taking the activity, the Scoring Rubric observation would be used to assess the students as groups. The scoring rubric observation are detailed in the table 3,

Table 3 : The detail of the scoring rubric observation

Problem-solving ability	Sub-title problem-solving ability
Understanding the problem ability	Know the elements of the problem
	Know the knowledge that should take
	Set hypothesis
Planning ability	Plan
	Gather knowledge form sources
Doing ability	Doing by follow the plan
	Result
	Record
	Calculation
Concluding and evaluation ability	Concluding and evaluation

The results of Problem-solving ability

Table 4 : Problem-solving ability of Phase 1 and Phase 2

Problem-solving ability \ Content		Thin lane (Phase 1)	Motor (Phase 2)
Understanding the problem ability	Know the elements of the problem	2.16	3.00
	Know the knowledge that should take	2.50	3.00
	Set hypothesis	2.50	3.00
Planning ability	Plan	2.50	3.00
	Gather knowledge form sources	3.00	3.00
Doing ability	Doing by follow the plan	1.83	2.50
	Result	1.50	2.33
	Record	2.50	**
	Calculation	2.50	**
Concluding and evaluation ability	Concluding and evaluation	1.16	3.00
Average		2.26	27.00
Percentage		75.30	95.13

Table 5 : The students' achievements between Problem-based leaning versus Normal leaning

Learning forms	Content	Percentage	Average
Problem-based leaning	Reflection of light in the plane mirror	54.07	54.44
	Reflection of light in the curved mirror	58.00	
	Refractions of light	62.69	
	Tin lane	38.39	
Problem-based leaning	Ohm's law	76.54	62.27
	Electrical resistivity and conductivity	83.95	
	Magnets and magnetic fields	55.55	
	Motor	47.02	
Normal leaning	Electrostatic	55.30	48.15
	DC resistor in series and parallel	22.96	
	Electrical Measurement	51.85	
	Electrical energy	51.85	

Discussions

a) The problem-solving ability significantly increases. As a result of the ability, it is clear that every sub-titles of the ability rose in Phase 2 compared with Phase 1. The percentage is 75.30 in Phase 1 and 95.13 in Phase Phase 2 because the result of the Problem-solving ability in Phase 1 and other evident was collected, reflected and analysis to find weak points and improved them. For example, Concluding and evaluation ability was developed by adding the recording solution form in Phase 2 leaning. My students can use it to record their answer with the interesting questions in the form. The problem situation had given to the students before they take the class 3 days because they would prepare themselves to leaning.

b) The doing by follow the plan and the result ability was improved. They got 1.83 and 1.50 in Phase 1 respectively, and changed to 2.5 and 2.33 in Phase 2. It means that the doing by follow the plan and the result ability are in the good level. Because the Problem-based leaning in this plans engaged in the active leaning such as thinking, planning and doing by themselves as well as talking each other, this make students improve their skills such as measurement's skill, observation's skill and Formulating hypotheses' skill. These skills make good results which related the Problem-solving ability as well.

c) The students' achievements of Problem-based leaning style is obviously higher than the normal leaning style because they can remember what they do thought out many cycles. There is the presentation in the end time of the class and it is the important thing that makes the students more remember the contents.

Conclusion

The action research occurs though out 2 Phases and 8 cycles. The problem-based leaning was used to be the good innovation teaching in my mind because it make students more remember the context and it can develop the Problem-solving ability higher than before. More students are careful in measuring and the good observation and they have higher achievements.

References

Suranaree wittaya school. The enrichment science classroom Course. Nakhon Ratchasima : Office of Education 31 Nakhon Ratchasima province, 2557.

Delisle, Robert. How to use Problem-Based Learning in the Classroom. Virginia : Association for Supervision and Curriculum Development, 1997.

Inoue N. Beyond actions : Psychology of action research for mindful educational improvement. New York : Peter Lang Publishing. 2015, p.1-13.

Contact email: uzumakiimode@gmaiil.com