THE STUDY OF CRITICAL THINKING SKILLS BY USING PROBLEM-BASED LEARNING ACTIVITIES WITH INFORGRAPHICS FOR TWELVE GRADE STUDENTS

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ABSTRACT

Research on the study of critical thinking skills by organizing problem-based learning activities together with infographics. The objectives are as follows: 1) To compare the critical thinking skills of Grade 12 high school students before and after learning by organizing problem-based learning activities in conjunction with infographics. 2) To study the critical thinking skills of Grade 12 high school students after learning with problem-based learning activities combined with infographics. The target group for the research was high school students in grade 12, Suan Sunandha Rajabhat University Demonstration School. A total of 13 students were students studying in the second semester of the academic year 2022 using a specific selection method from students whose critical thinking scores were 70% lower than the target set by the school.

The results showed that after organizing problem-based learning in combination with infographics. Students had higher average critical thinking scores after studying than before in all 3 areas: importance, relationship, and principle, and students had statistically 70% higher critical thinking with statistical significance at the level of .05

INTRODUCTION & LITERATURE REVIEW

The 21 century was a period of rapid economic change, politics, society, science, and technology. Today's technological developments are happening at a rapid pace. Make communication happen without limits. Information is constantly changing. This directly affects our daily lives greatly. This requires the development of thought processes to lead to appropriate adaptation and change. Therefore, learning management to develop learners' thinking processes is considered an important element and an essential skill for living in this information age. The National Education Act B.E. 2542 as amended B.E. 2545 states that the purpose and principles of Thai education management must be for the development of Thai people. To be a complete human being in body and mind, intellect, knowledge, morality, ethics and living culture. To enable learners to have the ability to learn and develop themselves. Schools should therefore focus on developing cognitive processes along with knowledge to learners. This will affect the thinking abilities of the learners and create a lifelong learning and learning society.

Critical thinking is an important aspect that is intended for learners. As Klinon and Saengloetuthai (2016) explained that the importance of critical thinking is an intellectual process through which human beings can synthesize or generate knowledge. Existing information to ensure accuracy, precision, synthesis, and creation of new knowledge from existing elements. Therefore, training the learner to know understanding and being able to practice critical thinking is therefore very necessary. Because critical thinking is the basis of all thinking. People with critical thinking skills will be able to solve everyday problems and

know the facts of the situation. Events can determine what caused the occurrence of the incident. It leads to decisions and conclusions that can be used to solve problems reasonably. (Phimphisan, 2019: 42) The ability to think critically is essential in the 21 centuries, as shown by the study of Seubsang and Boonphadun (2021) cited Kay (2010) and De-Young (2003) as saying that developing critical thinking abilities for graduate teachers will enable them to solve problems. It summarizes stories logically and can provide inductive and deductive reasoning. Bloom (1971) cited in Cumrod, Singlop and Sirisawat (2021) states that critical thinking skills have 3 characteristics:

1. Analysis of element: It separates what determines what is causal, what is consequential, what is important or necessary, or plays the most role, consisting of 1) type analysis, 2) important analysis, and (3) implicit analysis.

2. Analysis of relationships is the search for sub-relationships of stories or events to see how they correlate or correspond or contradict each other.

3. Analysis of organization principles is the search for the structure of systems and things about how they combine to maintain such conditions.

From the study of learning outcomes of students in grade twelve of Suan Sunandha Rajabhat University Demonstration School. In the past academic year 2022. It was found that the results of learning management in biology course in the unit on ecosystem and environmental pollution. It hasn't been as successful as it should be 13 students were unable to take the critical thinking test. This results in lower learning outcome scores. This is 70 percent lower than the target set by the school. Researcher as a teacher in Biology Course be aware of the importance of learners' critical thinking skills and think that it is a problem that should be addressed. It was found that problem-based learning is one of the learning management approaches that can help learners develop critical thinking processes. From the actual issues or situations that the teacher has established. Allowing students to find ways to solve problems by searching for information from various sources on their own according to their abilities and interests. It helps learners develop critical thinking skills because they must think in all dimensions about the problem or problem situation presented by the teacher. (Nakphong, *et al*., 2021)

Problem-based learning consists of 6 steps: 1) problem determination. 3) Stage to understand the problem. 4) Stage of the study. 5) Cognitive synthesis stage. and 6) presentation and evaluation stage. (Sriwichai, 2017) In addition, effective use of information technology teaching materials such as infographics in conjunction with the teaching process and giving students a summary of knowledge. How to solve a problem in each situation using infographics It also helps learners develop critical thinking skills. This is because students must design content and graphics that go through a process of critical thinking. Summarize key messages and use ideas to transform knowledge and facts. (Namwong, 2017: 20)

From the problem condition and the study of the concepts of various educators. Therefore, the researcher is interested in studying the critical thinking skills of twelve grade students in the unit on ecosystem and environmental pollution using the problem is based on infographics. We believe that problem-based learning activities combined with infographics will help students develop critical thinking skills in line with school goals and develop students' thinking competencies in accordance with the core curriculum's objectives and the skills needed to meet 21-century expectations.

OBJECTIVES

1. To compare the critical thinking skills of twelve grade students before study with after study by organizing problem-based learning activities together with infographics.

2. To study the critical thinking skills of twelve grade students after studying by organizing problem-based learning activities together with infographics compared to the 70% threshold.

METHODOLOGY

This research is quasi-experimental. The target group used in this research was students in grade twelve of Suan Sunandha Rajabhat University Demonstration School. In the second semester of the academic year 2022, 13 students. Purposive Sampling was conducted from 46 students in grade 6twelve Math-Science Study Plan. Students with lower critical thinking scores this is 70% lower than the target set by the school and uses the content in the unit on ecology and environmental pollution.

1. Research Instruments Problem-based learning management plan in conjunction with infographics.

The researcher has created a learning management plan according to the following steps:

1. Conduct problem-based learning activity plan writing together with infographics based on the core curriculum of basic education. B.E. 2551 for twelve grade students on Ecology and Environmental Pollution. It covers the learning objectives and content used in the learning management of 2 plans with a total of 4 lessons of 50 minutes each.

2. Bring the created learning management plan to 3 experts. It consists of two science teaching experts and one technology teaching expert. Review quality assessments to determine the appropriateness of content and activities. It was found that the learning management plan developed by the researcher had an average of expert opinion between 4.2 and 4.4 and a standard deviation of between 0.57 and 0.68.

3. The learning management plan on ecosystem and environmental pollution, which has passed the quality assessment from experts, was put to trial on grade twelve studying in the academic year 2022 who are not the target group. The researcher is responsible for conducting self-instruction to verify accuracy, appropriateness and record any problems found and improve them before applying them to the target group.

2. Critical Thinking Skills Assessment.

The researcher has created a model to measure critical thinking skills according to the following steps.

1. Create a 4-choice multiple-choice assessment of 20 questions. It is used to measure 3 aspects of critical thinking, namely critical thinking, correlation critical thinking, and principled critical thinking. 5 items on each side, for a total of 15 items.

2. Take the generated critical thinking skills assessment model presented to 3 experts. To assess the suitability and conformity (IOC) of each test against the learning objective. It was found that the model measures critical thinking skills developed by the researcher. It has a conformity index value ranging from 0.67 to 1.

3. Take a measure of critical thinking skills that have been assessed by experts. The trial was conducted on 30, grade twelve students studying in the 2022 academic year. Through a trial learning management plan. Problem-based learning activities are then combined with infographics. The score was then analyzed to determine the difficulty (p) and power of discrimination (r). It was found that the model measures critical thinking skills developed by the researcher. Difficulty (p) ranges from 0.63-0.80 and power of discrimination (r) ranges from 0.25-0.75.

4. Use the analytical thinking skills measurement Form to find the confidence of the test using the formula. KR-20., which has a confidence value of 0.31. Secondary School, twelve grade students Semester 2 Academic Year 2022 Next.

COLLECT DATA

1. Conducted data collection with twelve graders who were targeted. The test measures critical thinking skills before learning (Pretest) that has been quality checked and revised. At the end of the course, students take the test after class. Using the Critical Thinking Skills Test (original version).

2. Use the scores obtained from the pre-study and post-study critical thinking skills tests to analyze comparatively dependent t-test with SPSS.

3. Comparative analysis of critical thinking skills before and after class. The problem was used as a base in conjunction with an infographic with a 70% threshold using the One Sample t-test.

RESULTS

1. Analyze the results of comparing critical thinking skills of twelve grade students who were given problem-based learning management together with infographics of students before and after study, as shown in Table 1.

Table 1: Comparison of critical thinking skills of twelve grade students who received problem-based learning management together with infographics of students before and after study.

critical thinking skills test	**n**	**score**	**pretest**		**posttest**		**t**	**Sig**
			$\bar{x}$	**SD**	$\bar{x}$	**SD**		
namely critical thinking	13	5	2.00	1.22	4.15	0.80	7.87	.00*
correlation critical thinking	13	5	1.69	0.85	4.31	0.85	9.82	.00*
principled critical thinking	13	5	1.85	1.07	4.46	0.66	10.84	.00*
total	13	15	5.54	1.66	12.92	1.12	17.73	.00*

* Statistical significance level .05

From the table, it was found that the twelve grade students who were organized learned using problems as a base together with infographics. They have an average score of 5.54 before study and 12.92 after study. It was found that the score of critical thinking skills after study was statistically significantly higher than before study at the .05. When considering each component of critical thinking skills, namely significance, relationship, and principle, it was found that after study, students had statistically significantly higher critical thinking skills than before study .05.

2. Analyze the results of comparing the critical thinking skills of twelve grade students who were given problem-based learning management together with infographics of students after learning compared to the 70% threshold as shown in Table 2.

Table 2: Comparison of critical thinking skills of twelve grade students who received problem-based learning management with infographics of students after study compared to 70% threshold.

critical thinking skills test	**n**	**score**	**criterion (70 percent)**	**Post test**		**t**	**Sig**
				$\underline{x}$	SD		
namely critical thinking	13	5	3.50	4.15	0.80	2.94	.01*
correlation critical thinking	13	5	3.50	4.31	0.85	3.41	.005*
principled critical thinking	13	5	3.50	4.46	0.66	5.25	.00*
total	13	15	10.5	12.92	1.12	30.47	.00*

* Statistical significance level at .05

According to the table, the average score of critical thinking skills of twelve grade students after problem-based learning management with infographics ($\underline{x}$ =12.92) was statistically significantly higher than the 70% threshold of .05. It was found that after class, students had critical thinking skills statistically significantly higher than the 70% threshold at the level of .05.

CONCLUSION & DISCUSSION

1. Comparison of critical thinking skills of twelve grade students who received problem-based learning management together with infographics of students before and after study. It was found that the average score of critical thinking skills after studying was higher than before studying ($\underline{x}_{\text{after study}} = 12.92 > \underline{x}_{\text{before study}} = 5.54$) statistically significant at the level of .05. It was found that after study, students had statistically significantly higher critical thinking skills than before studying at the level of .05 in all aspects. It consists of 6 steps: 1) problem determination, 2) problem understanding, 3) research process, 4) knowledge synthesis, 5) conclusion and evaluation of answers, and 6) presentation and evaluation of results. It can make students have higher critical thinking skills. Thanongsin, Suwanjinda and Chaowakeratipong (2020) cites Vanichwatanavoracha (2016) says that problem-based learning management is a teaching arrangement in which teachers use real problems or problem situations to encourage students to analyze and find solutions to problems. Encourage learners to build their own knowledge. By searching for information from various sources by yourself according to abilities and interests. It helps students develop critical thinking skills. Because students must think in all dimensions about the problem issues or problem situations that the teacher presents. In addition, infographics are used in conjunction with teaching and learning. It also makes each student's ability to think critically higher. This is because infographics are tools that promote students' critical thinking abilities.

Silapol and Kongmanus (2017) explained that who studied the effect of using infographics and inquiry-based learning processes on critical thinking abilities of the twelve grade students, found that students' critical thinking abilities after study were significantly higher than before study at a level of .05. Rattanakorn, R. and Kaewkhongkha (2021) cites Nisra. Silapol and Kongmanus (2017) found that the use of infographics in teaching and learning can encourage learners to think critically. This is because students create infographic

pieces through the process of thinking and analyzing data. Design & creativity encourage learners to build their own knowledge. Conceptual process occurs systematic analysis is possible.

2. The results of the comparison of critical thinking skills of the twelve grade students who received problem-based learning management combined with infographics of students after learning compared to the 70% threshold were found to be statistically significantly higher than the 70% threshold. It was found that after study, students had a statistically significantly higher critical thinking skill of 70% at the level of .05. This is because the learning activities developed encourage students to work in groups, study together, research and plan actions. Thus, students are exposed to environmental problems around them. Eager to solve problems, stimulating learning. In particular, the learning activities in the problem understanding stage and the summary and evaluation of answers are the stages that allow students to practice analyzing and evaluating the root cause of the problem. The impact of the problem and the solution to the problem from the environmental situation determined by the teacher. This gives students a clear understanding of the problem. We have seen a variety of alternatives and methods to solve that problem. This allows students to have critical thinking skills above a certain threshold. Ponoi (2018) that found that students in the seven grade students have an increased ability to think critically through problem-based learning management.

SUGGESTION

1. Choosing problem situations to motivate students to learn. The teacher should choose the current situation that is close to the student and suitable for the student. It is content that interests' students because they can be found in everyday life, or it is a problem that directly affects students. This will make students more eager to solve problems.

2. The teachers should group small learners of 3-5 people. To encourage learners to work together, to divide duties in their work, and to engage in activities on their own.

3. Research should be conducted to develop problem-based critical thinking skills in conjunction with infographics on other subjects such as ecosystems and maintaining the balance of living organisms.

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