

Problem based learning to increase competence of critical thinking and problem solving

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ABSTRACT

Critical thinking and problem solving is one of the competencies that must be possessed to meet the 21st Century. This competence is very important to be mastered by students, especially vocational high school students. One learning model that can hone 21st Century competencies is Problem Based Learning. This research was carried out on productive subjects of the Trial. This study aims to determine the improvement of critical thinking and problem solving competencies, and student learning outcomes on subject matter subjects. This study uses a classroom action research design with measurement of competence using observation and measurement of learning outcomes using a multiple choice written test. The results of the study showed an increase in thinking and problem solving critical competencies from the first cycle of 37.4% to the second cycle of 78.2%. While the average value of the first cycle is 70.4 and the second cycle is 86.4. Students who reach KKM in cycle I are 38% and in cycle II 82%.

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1. INTRODUCTION

The 21st century is a century that requires every individual to have life skills. The 21st Century is known as the knowledge age. In this era, all alternative efforts to fulfill the needs of life in various contexts are more knowledge-based. Efforts to fulfill the needs of knowledge-based education, knowledge-based economic development, knowledge-based community empowerment and development in knowledge-based industries [1].

In line with the demand for 21st Century skills, the Ministry of Education and Culture formulated that 21st Century learning emphasized the competency of students in finding out from various sources not only teachers who became the main source of learning but other literacy such as books, internet, print media, visual media and so on, formulating various problems, analytical thinking, creative and collaborating and collaborating in solving problems.

The National Professional Certification Agency formulates 16 learning principles that must be fulfilled in the 21st century education process. Meanwhile, Minister of Education and Culture No. 65 of 2013 stated 14 principles of learning, related to the implementation of the 2013 Curriculum. Meanwhile, simplified it into 4 principles, namely [2]: (i) Instruction should be student-centered, where the teacher as a facilitator and students play an active role in participating in learning. (ii) Education should be collaborative, education or teaching must teach students to collaborate, work together with others so that they will form good soft skills. (iii) Learning should have context where contextual learning integrates with the situation and daily life

as material, so students can apply learning in real life. (iv) Schools should be integrated with society, in school learning, community life is also integrated into learning, from these learning students can take a role in socializing and socializing with the environment.

21st Century Learning must contain Critical thinking and problem solving skills, communications skills, creativity and innovation skills and collaboration in the teaching and learning process, namely: (i) Critical thinking and problem solving skills, Thinking critically is independent, self-disciplined, self-monitored, improving the process of thinking alone. (ii) Communications skills, Communication is the process of transmitting information, ideas, emotions, and skills by using symbols, words, pictures, graphics, numbers, and so on. (iii) Creativity and innovation skills.[3] argues that creativity is a way of thinking that is divergent, productive thinking, empowered to invent heuristic thinking and lateral thinking. (iv) Collaborations, Collaboration in a learning process is a form of collaboration with one another to help each other and complement each other to perform certain assignments in order to obtain a predetermined goal. Collaboration in groups is very important to train soft skills for better life skills.

Critical thinking and problem solving skills, Thinking is an activity that humans always do, even when they are asleep. For the brain, thinking and solving problems is the most important work, even with unlimited competence. Thinking is one of the most important forces and is a characteristic that distinguishes humans from animals. According to [4], thinking is a mental activity to be able to formulate understanding, synthesize, and draw conclusions. As stated by [5], thinking is an activeness of the human person which results in discovery directed towards a goal. Humans think to find the understanding / understanding they want. [6] also expressed his opinion that thinking is or managing and transforming information in memory. Thinking is often done to form concepts, reason and think critically, make decisions, think creatively, and solve problems. If thinking is part of the activities that the brain always does to organize information in order to achieve a goal, then critical thinking is part of thinking activities that are also carried out by the brain. According to [6] critical thinking is reflective and productive thinking, and involves evaluating evidence.

Mentioned by [7], critical thinking means an effective and reliable mental process, used in pursuing relevant and correct knowledge about the world. According to [8], also expressed his ideas about competency in critical thinking, namely the activity of analyzing ideas or ideas in a more specific direction, distinguishing them sharply, choosing, identifying, studying and developing them in a more perfect direction. Based on some expert opinions, conclusions can be drawn regarding the notion of critical thinking competence, namely the competence possessed by each person to analyze ideas or ideas in a more specific direction to pursue relevant knowledge about the world by involving evaluating evidence.

Critical thinking competency is very necessary to analyze a problem to the stage of finding a solution to solve the problem. People who have the competence to think critically do not only know an answer. They will try to develop possibilities for other answers based on the analysis and information that has been obtained from a problem. Critical thinking means doing the reasoning process for a problem until the complex stage of "why" and "how" the process of solving it.

a) The Purpose of Critical Thinking

According to [9], the purpose of critical thinking is to test an opinion or idea, including making considerations or thoughts based on the opinions proposed. These considerations are usually supported by criteria that can be accounted for. Critical thinking competence can encourage students to come up with new ideas or thoughts about problems about the world. Students will be trained how to select various opinions, so that they can distinguish which opinions are relevant and irrelevant, which opinions are true and not true. Developing critical thinking competencies students can help students make conclusions by considering data and facts that occur in the field.

b) Develop Critical Thinking Competencies

As stated by [7] in his book entitled "brain-based learning", argues that intelligence thinking can not only be taught, but also a fundamental part of the package of essential skills needed for success in the world. The primary focus on creativity, life skills, and problem solving makes teaching about thinking very meaningful and productive for students. Table 1 shows some skills that must be emphasized at the level of developing abstractions in teaching problem solving and critical thinking according to [7]:

Table 1. Critical thinking skills

No.	Critical Thinking Skills
1.	Gather information and utilize resources
2.	Develop flexibility in form and style
3.	Predict.
4.	Ask high-quality questions
5.	Consider evidence before drawing conclusions.
6.	Using metaphors and models
7.	Analyze and predict information.
8.	Conceptualizing strategies (eg mind mapping, registering pros and cons, making charts)
9.	Transact productively with ambiguity, difference and novelty
10.	Produce possibilities and probabilities (eg brainstorming, formulas, surveys, cause and effect)
11.	Develop debate and discussion skills
12.	Identify errors, gaps, and irregularities
13.	Check alternative approaches (for example, shifting reference frames, out-of-box thinking)
14.	Develop hypothesis testing strategies
15.	Analyzing risk
16.	Develop objectivity
17.	Detect generalizations and patterns (for example, identify and organize information, translate information, across applications)
18.	Sort events.

Based on some expert opinions, conclusions can be drawn regarding the notion of critical thinking competence, namely the competence possessed by each person to analyze ideas or ideas in a more specific direction to pursue relevant knowledge about the world by involving evaluating evidence. Critical thinking competency is very necessary to analyze a problem to the stage of finding a solution to solve the problem. From the opinion of the experts above it can be concluded that, people who have the competence of critical thinking do not only know an answer. They will try to develop other answers based on the analysis and information that has been obtained from a problem. Critical thinking means doing the reasoning process for a problem until the complex stage of "why" and "how" the process of solving, this is called problem solving.

Problem Based Learning, In Vocational High School (SMK) especially in the Department of Culinary there is a great need for the integration of 21st century skills in learning. Especially Critical thinking and problem solving skills So that there needs to be a learning model that can bring up these skills in the learning process, one of them is Problem Based learning. Problem based learning is problem-based learning. "The problem based learning is the modern methods of teaching that allow each learner to construct his own schema" [10]. Which means that problem based learning is a method that allows each student to build their own knowledge scheme. Whereas according to [11] problem based learning is learning with a constructionist approach that emphasizes students with the involvement in meaningful learning and learning processes.

If viewed from the purpose of problem based learning according to [12] it is not the amount of knowledge given by the teacher to students, but rather the development of critical thinking competence and competency in problem solving and developing the ability of students to actively build their own knowledge. Likewise the opinion of [13] which states that one of the objectives of the problem based learning model is to think critically and be able to analyze and solve complex real-world problems.

2. RESEARCH METHOD

This study uses classroom action research methods. Research design with models created by Kemmis and Taggart, as presented in Figure 1 [14].

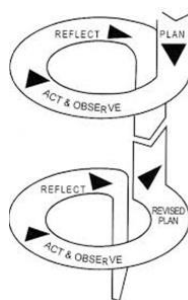


Figure 1. Kemmis and taggart research design

The procedure of action research can be divided into four stages of activity in one cycle (cycle), namely: planning - action and observation - reflection. Activities and observations are combined at one time, namely when there are actions taken while observations are carried out. The results of observations are then reflected to plan the next stage of action. The cycle is then carried out continuously until the researcher feels satisfied with the results of the action and the problem can be resolved and the increase in learning outcomes is maximal or does not need to be improved again.

The study was conducted at Muhammadiyah 1 Moyudan Vocational School in January 2019 with the subjects of this study being class X A Cullinary totaling 25 students in the subject matter of the course.

The data analysis technique used is:

- a. Techniques for percentage analysis Competency critical thinking and problem solving
 $\% = \frac{\text{Total score obtained by students}}{\text{maximum score}} \times 100\%$
 Table 2 shows the grid of observation guidelines critical thinking and problem solving
- b. Technique of analyzing data on learning outcomes
 - a. Calculated the value of both the pre test and post test

$$x = \frac{\sum x}{N} \times 100$$
 x = Value
 $\sum x$ = Amount of all scores
 N = Many questions
 - b. Calculated the average value of both the pre test and post test

$$x = \frac{\sum x}{N}$$
 x = Average value
 $\sum x$ = Amount of all scores
 N = Many subjects [15]
- c. Presented completeness of student learning outcomes
 $\% \text{ completeness} = \frac{\text{the number of students is complete}}{\text{total student}} \times 100\%$.

Table 2. Grid of observation guidelines critical thinking and problem solving

No.	Competency Critical Thinking and Problem Solving
1.	Able to reason a problem
2.	Able to analyze and interact
3.	Able to judge and make decisions
4.	Able to analyze evidence, arguments
5.	Able to interpret information
6.	Able to draw conclusions based on analysis
7.	Demonstrate critical thinking on learning experiences and processes
8.	Able to solve new problems encountered
9.	Able to solve problems in innovative ways
10.	Able to identify and ask significant questions to get the best solution

Source: 21st Century Skills

Table 3 presents the answer criteria in observing thinking and problem solving competencies using a Likert scale with the following criteria:

Table 3. Skala likert criteria

No.	Criteria	Score
1.	Very good	4
2.	Good	3
3.	Not good	2
4.	Very not good	1

Tests used to measure student learning outcomes, especially cognitive aspects. This study uses pre-test and post-test to determine the improvement of student learning outcomes. The test used in this study is in the form of multiple choice. Multiple choice problem indicator shown in Table 4. Basic competencies taken from the 2013 curriculum, curriculum syllabus, namely KD 3.5, analyze table set up and table supply.

Table 4. Multiple choice problem indicator

No.	Criteria	Score
1.	Students can identify Various kinds of table set ups.	1-3
2.	Students can distinguish Difference between American service With French service.	4-7
3.	Students can mention American special equipment Service.	8-9
4.	Students can mention Special Russian equipment Service	10-15

3. RESULTS AND ANALYSIS

Based on the research conducted by looking at the learning process by using the problem based learning model in the subject matter of class XA Cookery classes conducted with 2 cycles, namely cycle I and cycle II, from the two cycles there was an increase in critical thinking and problem solving and increased results significant learning with a marked number of students completing KKM of 75, shown ins Figure 2.

In the first cycle, the percentage of critical thinking and problem solving competencies was 37.4% with the discussion of mineral nutrient material, still quite low, as well as the pretest value which was an average of 67.8, post test value 70.4 and completeness achieved in the first cycle of 38%. Because it still lacks the research target, at least 75% increase in thinking and problem solving critical competencies and 75% completeness in the achieved grades, then cycle II research is conducted.

In the second cycle, the increase in the thinking and problem solving critical competencies was 78.2% and the pretest value was 73.5, the posttest value was 86.4, the average score was 86.4 and the KKM completeness was achieved at 82% shown in Figure 3. In cycle II the target has been achieved so that the research has been maximized or does not need to be improved again. The following is a comparison table of percentage of critical thinking and problem solving competencies, pretest values, posttest scores, and completeness of KKM cycle I and cycle II, as Illustrated in Figure 4.

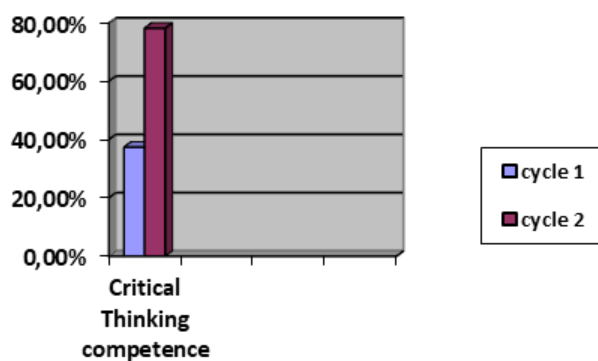


Figure 2. Increased critical thinking and problem solving competence in cycle i and cycle ii

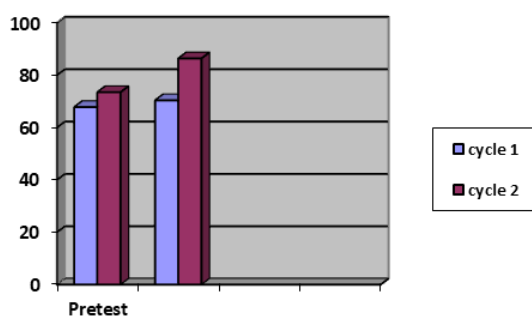


Figure 3. Increasing the average pretest and posttest value in cycle i and cycle ii

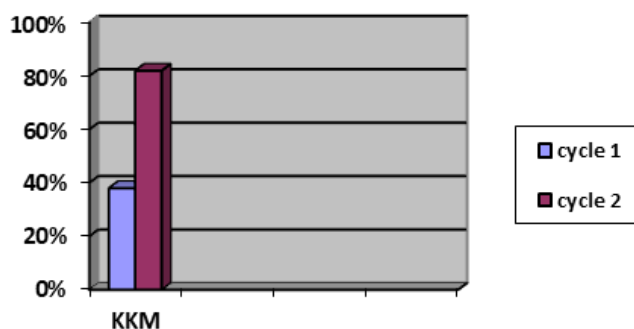


Figure 4. Increased KKM in cycle i and cycle ii

From the class action research it can be concluded that there is an increase in thinking and problem solving critical competencies from cycle I to cycle II by 40.8%, while the increase in the average value of the pretest and posttest from cycle I to cycle II can increase as many as 5.7 points and for posttest 16 points. To increase KKM in cycle I to cycle II by 79%.

Research conducted shows an increase in thinking and problem solving critical competencies with problem based learning learning methods from cycle I to cycle II. According to [13], one of the objectives of problem based learning learning models is to think critical and able to analyze and solve complex real-world problems.

From the results of [16] improvement of critical thinking and problem solving skills with the Project Based Learning learning model shows that the project based learning process can improve critical thinking and problem solving competencies and the presence of variables that affect such as age, gender, background education.

According to [17] in her research produced a Project based learning model that had a significant influence on the skills of students thinking critically in students, in the process of group work. As explained by [18], students become independent learners and think critically when they are able to analyze, evaluate, and synthesize information from various sources and explain according to what they understand. Students are not only expected to have knowledge and information, but must have skills so that their personal lives are more effective. As stated by [18], also concluded that students must have critical thinking skills in order to be able to solve problems. In addition to increasing critical thinking and problem solving learning competencies, increasing the achievement of minimum compliance criteria on hindara subjects showed a significant increase between cycle I and cycle II.

4. CONCLUSION

From the classroom action research cycle I and cycle II that have been carried out, it can be concluded that the problem based learning learning model can improve one of the 21st century competencies, namely critical thinking and problem solving in the course subjects. In addition to increasing critical thinking and problem solving competencies, increasing learning outcomes are seen from the average value of the pretest and posttest that increased from the first cycle and the second cycle. And the increase in KKM which has reached 75 is 82% in cycle II.

This research can be done in other schools or at other school levels that have characteristics similar to those of Vocational High Schools, because problem based learning is very good if done on subjects that are practical. In addition to critical thinking and problem solving competencies can also examine 3 other competencies needed in the 21st Century such as creativity and innovation, collaboration and communication.

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