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The use of creative problem solving model to develop students' adaptive reasoning ability: Inductive, deductive, and intuitive

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A B S T R A C T
This study was aimed at investigating adaptive reasoning ability of junior high school students through the implementation of the creative problem solving model. This study employed a mixed-method approach using an embedded concurrent strategy. Thirty students were selected randomly as the sample from 180 Year 8 students, and six students were selected to be observed and further interviewed after the final test. The instruments used were a test and interview questions. The results showed that there was a significant increase in the students' ability between the pre-test and post-test. In addition, there was also an increase in the ability of the six students based on an adaptive reasoning rubric. The increase was more dominant for the first and fifth indicators while the increases of the second and fourth indicators varied. Some students were able to solve the problem based on the indicators, but it was incomplete due to miscalculation, and some students were lacking in the ability to find the pattern and drawing a correct conclusion as a result of the profound basic knowledge. In general, these results indicated that students were able to develop adaptive reasoning although the maximum score could not be achieved.

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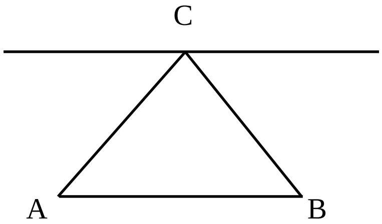
1. INTRODUCTION

Education in Indonesia, as reflected in the national curriculum of 2013, is directed to develop critical and creative thinking skills so that learning processes should involve these five steps, i.e., observing, questioning, associating, simulating, and communicating (Kemdikbud, 2013). These steps aim to develop higher-order thinking skills because this ability can help critical and creative thinking and encourages students to be active in learning (Conklin, 2011). Other experts also state that higher-order thinking ability supports students to think critically, creatively and reflectively, because this thinking skill is a process that requires students to use critical thinking skills to apply previously learned knowledge (Brookhart, 2010; Ansari & Sulastri, 2018).

Some students are proficient at solving problems at the level of creating because they are equipped with the ability of inductive, deductive and intuitive reasoning (Ostler, 2011). Therefore, there is a link between higher-order thinking ability and inductive, deductive, and intuitive reasoning. Inductive reasoning is the ability to discover patterns of a mathematical problem as this process involves observing pattern by pattern, determining the relationship between patterns and estimating the rules to form a pattern; deductive reasoning is the student's ability to make predictions, to present reasoning and to examine the truth of an argument; and intuitive reasoning is the ability to create an accurate estimate spontaneously, without hesitation or conducting a formal analysis beforehand (Fischbein, 1987). Inductive and deductive reasoning has been combined by the National Research Council (NRC) in its research in 2001, which was then introduced as adaptive reasoning. Adaptive reasoning is divided into two aspects, namely intuitive-inductive reasoning and intuitive-deductive reasoning (Bransford et al., 2005).

Based on the nature of adaptive reasoning ability, it can be inferred that students with this type of reasoning can think logically and reflectively on materials related to mathematics as well as manage to explain and make some considerations of what has been done. However, there has been limited attention to reasoning ability, especially in formal education. The current educational process seems to favor rote learning (Rofiki et al., 2017), looking for one correct answer without discovering other solutions nor promoting higher-order thinking (Blakemore & Frith, 2005). Consequently, the majority of students are lack of adaptive reasoning abilities despite the fact that the process of adaptive reasoning is one of the learning objectives since junior high school years (Dawkins & Roh, 2016). A preliminary study illustrates the problem related to the proof given to the students to examine the initial adaptive reasoning ability of students in this study.



Prove that:
$\angle A + \angle B + \angle C = 180^0$

Figure 1. A problem related to proof to examine students' initial adaptive reasoning ability

Students' answers showed that the ability of adaptive reasoning, such as checking the validity of the argument, was lacking. Although their answers were correct, no clear reason was presented. The students knew that the total of angles in a triangle is 180^0; however, they had difficulty to provide reasoning for each step of the proof; they directly divided 180^0 by three obtaining 60^0. This indicates that the students were less accustomed to using deductive reasoning in their thinking process.

To address the student's poor adaptive reasoning, teachers are expected to apply a learning model that can encourage and give students opportunities to train their adaptive reasoning ability. There are two learning models that can be used, namely, collaborative teaching and Creative Problem Solving (CPS). Collaborative teaching consists of two teachers, where one teacher explains the materials in the classroom, and the other assists the students in learning by supervising the students who have difficulties in understanding the learning materials. Students are given many opportunities to seek guidance when they have not fully understood the materials. The guidance in the process of the exercises results in students having more time and chances to consult the teacher (Ansari & Wahyu, 2017). The CPS learning model is a model focusing on learning and problem-solving skills, followed by reinforcing the skills (Dumas, Schmidt, & Alexander, 2016; Mitchell & Walinga, 2017). In addition, Mitchell and Kowalik

(1999) argued that the CPS model is closely related to adaptive reasoning ability as both are intended to find solutions to the problems as well as a combination of logical, divergent, and convergence thinking based on intuition. Hence, this study focuses on examining students' adaptive reasoning ability through the implementation of the CPS model.

Adaptive reasoning has broader coverage than reasoning in general as it includes inductive, deductive and intuitive reasoning (Bransford et al., 2005). To achieve a higher-order thinking skill, students should be able to develop their adaptive reasoning ability (Ostler, 2011). This is due to the fact that adaptive reasoning includes reasoning based on patterns and analogies, as well as logical thinking and valid proof in the learning process (Bransford et al., 2005). In addition, adaptive reasoning refers to the capacity to think logically about relationships between concepts and situations as well as to finally justify by proving the truth of a mathematical statement or procedure (Kilpatrick et al., 2001).

Kilpatrick et al. (2001) argued that students would be able to develop adaptive reasoning if they meet the following three conditions, namely (1) new knowledge is inserted after having sufficient basic or prerequisites knowledge; (2) the assigned tasks can be understood and can motivate students; (3) the context presented is well known and enjoyable for students. Having fulfilled these conditions, students are expected to be able to develop adaptive reasoning. One manifestation of adaptive reasoning is mathematical proof with formal and non-formal logical reasons. Furthermore, Kilpatrick et al. (2001) mentioned that there are five indicators of adaptive reasoning ability, namely: (1) the ability to propose predictions or conjecture (2) the ability to provide reasons of the given answers, (3) the ability to find patterns of a problem, (4) the ability to examine the validity of an argument, and (5) the ability to draw conclusions from a statement.

Creative Problem Solving (CPS) model is associated with mathematical adaptive reasoning ability (Kristanti et al., 2018). Adaptive reasoning ability is based on logical combinations, convergent and divergent thinking on the basis of intuition. The patterns of convergent thinking are indicated by calm and unhurried, firm and clear, avoiding too early decisions, seeking clarity, building the truth and not deviating from the purposes (Mitchell & Kowalik, 1999). Furthermore, the patterns in divergent thinking are suspending a justification, paying attention to a set of ideas, accepting the whole idea, adding their own ideas to the ideas gathered and trying to combine them. Students are more skilled as they have a well-composed internal procedure, and therefore together with adaptive reasoning they can foster the divergent and convergent thinking processes (Chant et al., 2009).

Mitchell & Kowalik (1999) mentioned that, there are six learning stages in the CPS model, namely Stage 1. Exploration of the challenge: (1) Objective-finding (identifying the problem situation); (2) fact-finding (listing all known and unknown facts related to problem situations); (3) problem-finding (identifying all possible problem statements and then choosing the most essential issues related); Stage 2. Ideas Generation: (1) idea-finding (finding some possible ideas for solving problems); Stage 3. Taking action: (1) solution-finding (selecting solutions and ideas that have been found to solve problems systematically); and (2) acceptance-finding (trying to accept the problem solutions). The interconnection between the steps is presented in Figure 2.

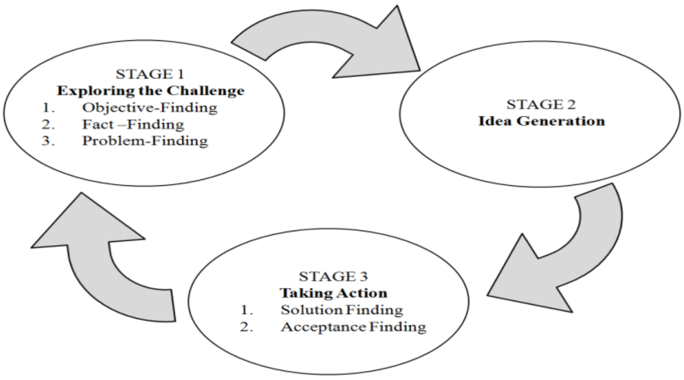


Figure 2. Stages of creative problem solving

2. METHOD

2.1. Research Design

This study employed a mixed-method approach with a concurrent embedded strategy, a strategy in which both primary and secondary methods were used simultaneously. The primary method is to obtain the main data, and the secondary methods are to gather data supporting the primary one. In this mixed-method approach, both data collection and analysis are carried out simultaneously (Creswell & Creswell, 2017). Both methods are not necessarily to be compared; however, they can be described side by side to address each research problem. In this research, the quantitative method preceded the qualitative method, and the results of both stages were combined. The quantitative method was designed to describe students' adaptive reasoning based on the pre-test and post-tests. The qualitative method was used to profoundly reveal the adaptive reasoning abilities based on the CPS stage and the difficulties faced by the six students selected and their causes.

2.2. Participants

This research was conducted in one of the junior high schools in Banda Aceh in 2019. The school was A-accredited, the highest accreditation level in the Indonesian education system. Students had homogeneous abilities and were lacking adaptive reasoning ability. The sample size was 30 students randomly selected from all Year 8 students (aged 13-14 years old) who were then taught by implementing the CPS model. After conducting the preliminary test and discussions with mathematics teachers, in-depth interviews were carried out for six out of 30 students to describe the achievement of each indicator of the adaptive reasoning ability. They were selected because (1) their answers were not in line with the indicators, (2) they were able to arrange the pattern yet failed in the final solution, and (3) they were able to provide a correct solution, but they could not present the reasoning or draw conclusions.

2.3. Instruments

The instrument used to collect the data was the test of adaptive reasoning abilities. This instrument has satisfied the validity criteria of experts. This test was utilized to describe the adaptive reasoning abilities of students before and after they were taught using the CPS steps. Interviews and triangulation of data were carried out after the test to determine and clarify the students' difficulties in using CPS steps to solve adaptive reasoning problems

2.4. Data analysis

The stages of data analysis were (1) reducing research data by calculating the score of each student based on the CPS stage, (2) presenting data into tables, and (3) analyzing the results and concluding.

2.5. Procedure

The treatment using the CPS model was then conducted for two months, and the material presented was algebra, the plane and 3D geometry. Students learned in groups, and they were directed to achieve five indicators of adaptive reasoning ability in solving the problems, namely: (1) the ability to propose conjectures, (2) the ability to draw conclusions from a statement, (3) the ability to find the pattern of a problem, (4) the ability to provide reasoning for the solutions given, and (5) the ability to check the validity of an argument.

The next step was to triangulate the data by checking the validity of the students' results of the post-test by observing and interviewing six students based on the rubric of mathematical adaptive reasoning assessment presented in Table 1.

Table 1. Rubric of mathematical adaptive reasoning

Indicator	Excellent (E)	Good(G)	Moderate (M)	Poor (P)
1. The ability to propose a conjecture	Correct and complete	Correct and incomplete	Less complete	Presenting wrong conjecture
2. The ability to draw correct conclusion	Correct and complete	Correct and incomplete	Managed to write the conclusion	Without conclusion
3. The ability to find the patterns of a problem	Correct with calculation	Correct with some miscalculatio n	Less complete with some miscalculation	Wrong pattern and calculation
4. The ability to present reasoning for the solution	Correct and complete	Correct and incomplete	Managed to present the reasoning	Incorrect or providing incorrect reasoning
5. The ability to examine the validity of an argument	Correct with calculation	Correct with some miscalculatio n	Less correct (some miscalculation) .	Miscalculat ion

Adapted from Lerís et al. (2017)

The final test of adaptive reasoning ability consisted of five items which met the criteria of the five indicators of adaptive reasoning ability. All test items have been tested for validity and reliability. The following section presents three samples of the post-test items, consecutively measuring indicators of the ability to find patterns of a problem (inductive reasoning as shown in number 2), the ability to examine the validity of an argument (deductive reasoning as shown in number 3) and the ability to draw conclusions from an statement (intuitive reasoning as shown in number 1).

(1) A right triangle *ABC*, right-angled at A, and therefore $BC^2 = AC^2 + AB^2$. Is the conclusion of the statement correct? Give your reason.

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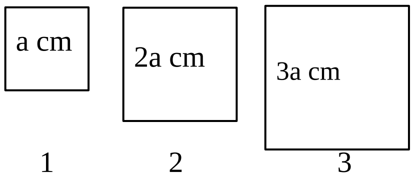
(2) Look at the patterns of the following squares.



If the area of the second square is 100 cm^2, what is the area of the n^{th} square?

(3) A rectangular pyramid T. ABCD, with T as the peak. If *TA* = *TB* = *TC* = *TD* = 8√5 cm and the length *AB* = *BC* = *CD* = *AD* = 16 cm, Amir has calculated that the volume of the pyramid is 84√3. Is Amir's calculation correct? Please check.

3. RESULTS AND DISCUSSION

This research aims to find out the upgraded adaptive reasoning of students before and after the implementation of the CPS model and to describe the learning outcomes with the CPS model. The data were analyzed using the statistical tests and adaptive reasoning ability assessment rubrics with a descriptive method.

3.1. Description of the pretest and post-test results

Table 2. Descriptive statistics of the pretest, posttest, and gain scores

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Posttest	30	50	95	75.80	11.55	133.338
Pretest and Pretest	30	10	60	28.47	12.38	153.269
Posttest-Pretest (gain)	30	5	69	48.00	15.56	242.345

Table 2 reports the mean of pretest (M=28.47, SD=12.38), posttest (M=75.80, SD=11.55), and gain (posttest-pretest difference) (M=48.00, SD=15.56). The data described in Table 2 show the average differences, while the gain data indicate the magnitude of the increase in the adaptive reasoning ability. Further statistical tests were required to examine the significant increase in students' adaptive mathematical reasoning ability.

Table 3. Normality test of the pretest, posttest, and gain scores

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Posttest	.142	30	.126	.942	30	.100
Pre-test	.114	30	.200*	.949	30	.160
Post-test Pre-test	.190	30	.007	.916	30	.021

Based on Table 3, the results of pre-test and post-test of adaptive reasoning ability show the value of Sig> 0.05., suggesting that the scores were normally distributed. The next test of hypotheses was performed with a paired-samples t-test.

Table 4. Paired sample t-test of adaptive reasoning ability

		Paired Differences					T	Df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Posttest – Pre-test	48.000	15.567	2.842	42.187	53.813	16.888	29	.000

The testing criterion is that H_0 is rejected if the value of Sig. is lower than the significance level ($\alpha = 0.05$). Based on the data presented in Table 4, H_0 was rejected, and therefore it can be concluded that there was a significant increase in students' adaptive reasoning ability between the pretest and posttest during the learning process with the CPS model.

3.2. Description of adaptive reasoning ability through the CPS model

The adaptive reasoning ability of six students after learning with the CPS model was then described to examine the extent of students' adaptive reasoning indicators achieved during the learning process using a qualitative analysis. The individual assessment was conducted based on the adaptive reasoning rubric, as shown in Table 1, and the result is presented in Table 5.

Table 5. Data of adaptive reasoning score for the six students

Students	Scores		Stages of the CPS model			Qualitative data					Remark
	Pre test	Post test	Exploration of the challenge	Ideas generation	Taking action	1	2	3	4	5	Item number
						1	2	3	4	5	Adaptive reasoning indicator
HS	18	50	G	M	P	M	G	P	G	P	Adaptive reasoning levels (see Table 1)
SA	20	55	G	M	M	M	G	M	P	G	
CT	60	80	G	G	G	E	M	G	G	E	
ZA	50	80	E	G	G	E	E	G	M	G	
GC	70	95	E	G	E	E	M	E	E	E	
TG	65	96	E	E	E	E	E	E	G	E	

The next post-test worksheets presented by three students are provided in Table 5, which describes the ability of adaptive reasoning to three items of a different problem, namely HS, TG and ZA. The worksheet shows the students' answers to the question number 2, about the ability to draw conclusions from such a statement; number 3, about the ability to find patterns of a math problem; and number 5, about the ability to examine the validity of an argument.

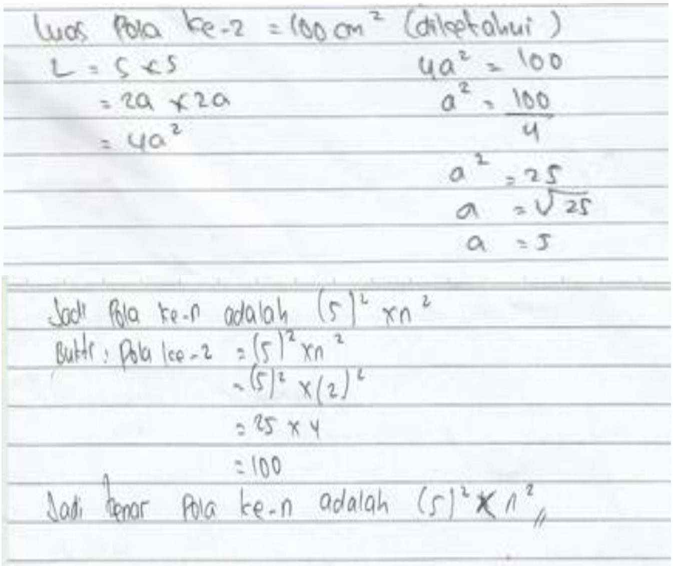


Figure 3. TG's answer about the ability to find patterns of a math problem

Based on Figure 3, TG was able to find the pattern of a problem. TG wrote the general pattern is $(5)^2\ n^2$, and this means that the student already has the capability of inductive reasoning.

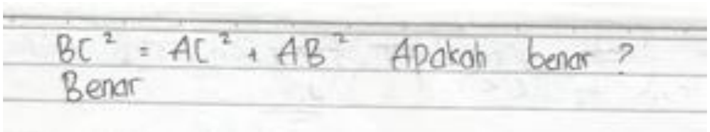


Figure 4. The answer of HS about the ability to draw conclusions from such a statement

Based on Figure 4, HS has not obtained the ability to draw conclusions from the given problem, and this means that HS did not have intuitive reasoning yet.

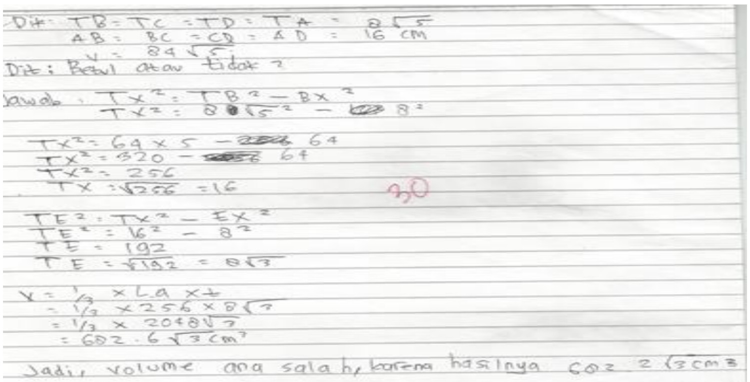


Figure 5. ZA's answer about the ability to examine the validity of an argument.

Based on Figure 5, ZA provided answers which were less complete, with an error in the calculation. Students' answers were for the indicator of examining the validity of an argument.

Reasoning and intuitive ability are essential aspects in understanding mathematical concepts, either through conjecture or proof. Therefore, when students solve problems, they have the freedom to provide solutions analytically using thinking or intuitive steps. Both intuitive and reasoning abilities are found in adaptive reasoning, namely intuitive and deductive intuitive reasoning.

In addition, we describe and discuss the answers to six students, as shown in Table 5, based on the post-test, class observation, and interviews. The post-test results show that the answer to finding patterns, giving the reason answers, checking the validity of an argument and drawing conclusions correctly did not include the reasons for each step or the link between concepts, and there were some miscalculations.

Based on observations of the six students, it was found that GC, TG, and CT, in the early learning activities, could express ideas in responding to questions by teachers/friends, could ask questions when there was less clear information from the teacher and could predict a given situation quickly. Those in the group discussion were also able to register all of the given problems, could give a lot of ideas, and suggested another alternative to a problem, could collaborate on the ideas of fellow members of the group, and could provide primary reasons for their statements. In addition, they were also able to choose what was most important from a problem, to find patterns of problems, to check the validity of an argument, and to draw conclusions from such a statement.

Meanwhile, the students, SA and ZA, were lacking in giving adequate ideas and suggesting another alternative to a problem. They also lacked idea collaboration with their group members, and they could not provide reasons for their statements. Similarly, HS could not choose what was most important from a problem, find patterns of problems, or check the validity of an argument.

In addition, GC, TG, CT, and ZA were able to draw conclusions for the statement in question number 1, while SA and HS still required background knowledge to answer question number 1. The ability to find patterns of a mathematical problem has been acquired by GC and TG to answer question number 2. CT and ZA have not been successful in finding patterns, while SA and HS could not find the pattern of question number 2. GC, TG, CT, and ZA were superior at checking the validity of an argument in question number 3, while SA and HS could only partially check the validity of an argument.

To illustrate some of the conditions, further interviews were conducted with three students, and the detail is provided in the following.

3.2.1. Student TG

The ability to find patterns of a mathematical problem (the question number 2)

R : For this one, can you mention what is actually the problem?
TG : Yes. It is difficult to find what is between the second square and the third square.
R : Did you use the correct procedure? What is the proof?
TG : I think that's enough because the result is correct.
R : Is the answer you gave based on your own thoughts?
TG : Yes.

Based on the interview, students could complete question number 2 correctly and completely to find patterns and could do the calculation.

3.2.2. Student ZA

The ability to examine the validity of an argument (the question number 3)

R : Is a method that you used to answer the questions appropriate?
ZA : I think so.

R : Did you have any problems in answering these questions?
ZA : Yes, especially the question number 3.
R : What was the problem?
ZA : It is difficult to use the formula and to do the calculation.

Based on the interview, it can be assumed that ZA could solve the problem. However, there was a calculation error. Thus, ZA has a good inductive reasoning ability, although he/she was not sure with his/her own answer.

3.2.3. Student HS

The ability to draw conclusions from a statement (the question number 1)

R : Did you answer the question number 1 successfully?
H : Yes.
R : Do you think the conclusion that you gave was correct?
HS : I think so.
R : Are you sure that your conclusion was accurate?
HS : Yes, of course.

Based on the interviews, HS was convinced that the result was correct. However, the answer was incomplete, and it shows a lack of understanding of the rules needed to support the conclusions. Thus, HS was not able to draw a conclusion from a statement. It is indicated that HS is still incapable of using intuitive reasoning.

The results of the interviews show that there is still the difficulty in connecting between one pattern and another and between one formula with another formula to answer question number 2 and 3 This difficulty indicates that the method used in teaching students adaptive reasoning has not been entirely successful because there were still students who have not been able to develop deductive and inductive reasoning. This lack of success might be caused by the fact that students were initially less familiar with the higher-order thinking (HOT) and have initial low mathematical knowledge, so students could not comprehend the questions in the test (Wimer et al., 2001; Zohar, 2006). This phenomenon is in accordance with the findings of a study conducted by Korp, Sjöberg, and Thorsen (2019), who found that the learning process in formal education institutions is more to rote learning and less to training higher-order thinking, resulting in just finding the one valid answer without finding out a solution to the others.

Our data indicate that, for most students in the sample, naming variables and understanding relations were not difficult for the simple problems that we used. Most students who tried algebra could name quantities, and there was little difficulty related to expressing several quantities in terms of one variable. Also, there were several instances of students who named the three parts in a problem appropriately.

Furthermore, students wrote the equation for Problem 1 (intuitive reasoning) as shown in Figure 6.

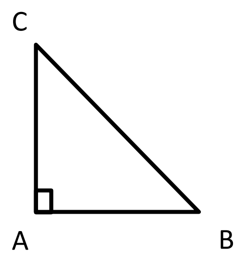


Figure 6. Right triangle ABC

$AB^2 = BC^2 – AC^2$; $AC^2 = BC^2 - AB^2$; thus $BC^2 = AB^2 + AC^2$. This one is correct because, BC is hypotenuse. If the hypotenuse is asked, it should be added instead of subtracted. Other students wrote $BC^2 = AB^2 + AC^2$, which is correct because BC is hypotenuse. Is $BC^2 = AB^2 + AC^2$ true? Some students provided the correct answer, without any argument.

These students have perceived the equations as a formula for calculating. They were not familiar with the concept that algebra can also be used to extend and support logical reasoning, and its purpose in problem-solving is not to describe a solution procedure that has already been constructed mentally. Consequently, the majority of students had a lack of adaptive reasoning abilities despite the fact that the process of adaptive reasoning is one of the learning objectives since junior high school years (Dawkins & Roh, 2016). In addition, some findings revealed students' difficulties in solving adaptive reasoning problems, namely at the stage of ideas generation, solution finding and acceptance of finding. For example, TG had difficulty in finding what is between the second square and the third square. ZA found it challenging to connect the formulas and to do the calculation. Generally, the difficulty experienced by students were in idea generation and taking action, so they found it difficult to solve and draw conclusions from a statement, to find the pattern of a problem, and to provide reasoning for the solutions that they propose.

Based on the data presented in Table 5, there are some similarities between the results of our research with those of the research by Treffinger and Isaksen (2005). The indicator (1) of adaptive reasoning "the ability to submit conjectures" in the CPS model is reflected in "ideas-finding"; indicator (2) "the ability to draw conclusions from a statement" in the CPS step model is illustrated in acceptance-finding"; indicator (3) "the ability to find patterns of a mathematical problem" in the CPS step model is reflected in "problem finding and solution finding"; and indicator (4) "the ability to give reasons for answers" in the CPS model step is illustrated in "objective-finding." These can be achieved if students are motivated to solve problems.

Based on the student data of learning with CPS, there was an increase in the motivation of students before and after the instruction. The score of motivation before learning was 49.06 and after learning was 57.23 with an increase of 8.10. While the final test results indicate that there is an increase in the ability of the students prior to learning Adaptive reasoning (27.80) and after learning i.e. 75.80, with a gain of 48.0. These results show that learning with the CPS can increase motivation and achievement in mathematical learning because the motivation factors could make students to think scientifically, practically, and intuitively, and to work on the basis of its own initiative, honesty and openness (Brophy, 1998).

The results are no coincidence because the students who learn the CPS did focus on learning and problem-solving skills, followed by the strengthening of the skills (Pepkin, 2004). This is possible because the CPS and adaptive reasoning equally motivate students to find the solution for the given problem and to use simultaneously logical thinking, convergent and divergent thinking, based on intuition (Mitchell & Kowalik, 1999). The data can at least provide evidence that learning with the CPS can enhance students' learning and motivation, as well as adaptive reasoning, to help them solve problems at the level of Higher Order that creates Thinking (Ostler, 2011).

Finally, some of the findings from this research provide contributions to mathematics education. First, adaptive reasoning ability can encourage students to think logically and reflectively to solve mathematical problems. Second, it helps students in providing reasons for their solution and helps them link the various patterns before providing a solution. One of the manifestations of mathematical proof is adaptive reasoning with formal or non-formal logical reasons.

4. CONCLUSION

The present study concluded that there is a significant increase in students' adaptive reasoning ability after comparing the pre-test and post-test scores (M=28.47, SD=12.38; and M=75.80, SD=11.55 for the pre-test and post-test respectively). Furthermore, the qualitative analysis after the triangulation of data on six students indicates the ability of students' adaptive reasoning based on five indicators, namely: (1) two students were less able and four students were able to solve problems related to the first indicator; (2) only two students were able to solve correctly and provide a complete answer for the problem related to the indicator; four students were categorized as good and adequate; (3) two students were able to solve the problem correctly and completely, two students provided incomplete answers and the rest could not solve the problem for the third indicator; (4) one student provided correct and complete answers, two students presented incomplete answer due to miscalculation, and three students could not solve the problem related to the fourth indicator; (5) three students provided correct and complete answer; two other students also presented correct answer but the final solution was incorrect, and one student was less able to draw a conclusion with logical reason due to the lack of prerequisite knowledge. For the next study, it is essential to explore the characteristics of students’ adaptive reasoning.

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