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Submission date: 12-Dec-2024 10:49AM (UTC+0700)
Submission ID: 2549792417
File name: 4._The_Effect_of_Concept_Attainment_Model_on_Mathematical.pdf (371.15K)
Word count: 6602
Character count: 36864

International Journal of Instruction *January 2021 ● Vol.14, No.1*
e-ISSN: 1308-1470 ● www.e-iji.net *p-ISSN: 1694-609X*
pp. 727-742

Article submission code: 20191120052050
Received: 20/11/2019 Revision: 25/07/2020
Accepted: 16/08/2020 OnlineFirst:15/11/2020

The Effect of Concept Attainment Model on Mathematical Critical Thinking Ability

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This research is generally conducted to solve the difficulties of students in understanding courses in mathematics education especially in the real analysis course, in addition, this research specifically aims to examine, describe and compare differences in the ability to think mathematically critically between students who obtain learning concept attainment model and conventional learning model based on mathematical initial abilities of student. The design of this study was two groups randomized subject post-test only with 2 x 3 factorial design. The subjects of this study were students majoring in Mathematics Education at the Universitas Islam Riau, which consisted of 60 students in semester IV of the 2018th/2019th academic year. The instrument used in this study was a test about mathematical critical thinking skills consisting of 3 indicators. Data processing was performed by parametric test (Anova 2 ways) or non-parametric test followed by Scheffe further tests. From the results of the study obtained information that the mathematical critical thinking abilities of students who use the Concept Attention Model (CAM) learning is better than students who use Conventional Learning (CL) based on mathematical initial abilities of students.

Keywords: concept attainment model, conventional learning, mathematical critical thinking abilities, mathematical initial abilities, analysis real

INTRODUCTION

Maričića & Špijunovićb (2015) define that, "Critical thinking as a complex intellectual activity which emphasizes the following skills: problem formulation, evaluation, problem sensitivity". Critical thinking is an intellectual activity carried out by an individual in determining the steps to solve a problem so that it is in accordance with reasoning and emphasizes some capabilities.

Critical thinking really needs to be developed, as Peter (2012)states "Critical thinking is important, students who are able to think critically are able to solve problems", according to Peter critical thinking ability is important because someone who can think critically, he can also to solve the problem, because before taking action, someone will

Citation: Angraini, L. M. & Wahyuni, A. (2021). The Effect of Concept Attainment Model on Mathematical Critical Thinking Ability. *International Journal of Instruction*, 14(1), 727-742. https://doi.org/10.29333/iji.2021.14144a

first consider what possibilities there will be in accordance with the reasoning he has. In addition, Aizikovitsh-udi & Cheng (2015) states "The benefits of critical thinking are lifelong, supporting students in the regulation of their study skills and subsequently empowering individuals to contribute creatively", according to Aizikovitsh-Udi the perceived benefits of critical thinking are benefits for the long term, because critical thinking makes it possible to support a person in terms of learning abilities, in addition it enables a person to be creative, so that someone who thinks critically can develop their learning abilities and push ahead himself to contribute creatively.

The ability to think critically will bring someone to think and work more thoroughly (Cottrell, 2011). Mathematics requires a process that requires students to think critically, namely thinking to tests, questions, connects, evaluates all aspects that exist in a situation or problem that triggers. Such situations have not yet emerged in conventional mathematics learning, so students' critical thinking skills are poorly trained. Though critical thinking skills are needed by students to solve various problems in daily life. Mathematics learning can be used to improve critical thinking skills. Critical thinking will also help someone in sorting out relevant information or not with various mathematical problems or outside mathematics. Therefore, mathematics learning should be maximized to improve critical thinking skills.

The formation of critical thinking on students makes them more curious because of the curiosity and desire to obtain the truth. The habit of critical thinking will improve students' mathematical abilities, because students are encouraged to carry out various activities such as: facing various challenges in learning, discovering new things, and solving problems that are non-routine. Students who think critically are students who can understand problems well, make problem solving plans, and make alternative solutions to problems in a more practical way, therefore students who have critical thinking skills are expected to achieve a good quality solution of mathematical problems that are need to be solved.

Meanwhile, the process of learning mathematics in the classroom also does not improve the ability to high-order thinking skills, one of them in terms of critical thinking skills, and less directly related to daily life (less application, less grounded, less realistic or less contextu One of the problems that occur in the class is due to the lack of quality teachers in improving students' critical thinking skills during learning, on the other hand, students as prospective teachers also experience the same problem (lack of critical thinking skills during lectures) at the university. Complaints like these not only focus on basic mathematical skills, but also more important are the ability of graduates to express facts in solving problems or engage in reasoning and high-order thinking in mathematics (Pranoto, 2013).

There are several resolutions to critical thinking according to some experts. Cottrell (2011) discusses critically the ability to interpret, analyze, and understand ideas and arguments. The ability to think critically is now considered as a basic ability that is very important to be mastered such as the ability to speak and write. Critical thinking is characterized by realistic activities such as: counteracting information based on a particular theory, linking theory with practice, making claims and justifying it, using

data to support argumentation, making relations or relationships between relationships, looking for questions, find out, predict, describe something, analyze, synthesize, categorize, compare or contrast, compare problems and solve them. Then Sumarmo, et al. (2011) explained that the ability to think critically requires the ability to: (1) analyze and evaluate arguments and evidence; (2) compiling clarification; (3) make valuable judgments; (4) compile an explanation based on relevant and irrelevant data, and (5) identify and evaluate assumptions.

Indicators of critical thinking ability used in this study are: (1) Ability to Identify Relevance, namely the ability to write the concepts contained in the statement given and write the parts of statements that describe the concept ; (2) Ability to Formulate Problems into a Mathematical Model, namely the Ability to Express Problems into Mathematical Symbols and Give Meaning to Each of these Symbols; (3) The ability to deduce by using principles, namely the ability to draw conclusions from statements presented using the rules of inference.

The learning process will run well and creatively, if the lecturer gives the opportunity for students to find a rule through examples that illustrate or represent the rules that are the source, in other words, students are inductively guided to understand a general truth (Ostad & Soleymanpour, 2014). Kauchak & Eggen (2012) suggestion that concept attainment model is an inductive learning model, designed by lecturer for helping students learn the concepts and trained the students in practicing high-level thinking skills. Concept attainment model is a learning model that aims to help students understand a certain concept (Mon 2013). This learning model can be applied to all ages, from children to adults. This learning model is more appropriate to use when the emphasis of learning is more focused on the introduction of new concepts, so that it can train the ability to think inductively, train analytical thinking skills, critical, creative and others.

Bruner, Goodnow, and Austin revealed the concept attainment model was deliberately designed to help students learn concepts that can be used to organize information, so as to make it easier for students to learn the concept in a more effective way (Anjum, 2014). Joyce & Weil believes that the concept attainment model focuses on ways to strengthen human internal drives in understanding science, by exploring and organizing, and developing language to express it (Bhargava, 2016).

Several international research related to the application of the Concept Attainment Model conclude that: Jones & Hilaire (2014) who concluded that the Bruner's Concept Attainment Model was explored in the undergraduate religion classroom. Kaur (2017) who concluded that the concept of the attainment model of teaching is superior and effective in terms of physics concept understanding of students in comparison to conventional methods. Kumar & Mathur (2013) who concluded that the concept of the attainment model of teaching is superior and effective in terms of physics concept understanding of students in comparison to conventional methods.

Several national research related to the application of the Concept Attainment Model conclude that: Aningsih & Asih (2017) which concluded that the application of the

Concept Attention Model improved the ability to understand mathematical concepts in terms of students' curiosity. Nainggolan (2014) concluded that the application of the Concept Attainment Model improves students' understanding of mathematical concepts. Widiastuti (2014) concluded that the Concept Attainment Model improves student learning outcomes. Research on CAM has been done a lot before, as well as research on the ability to think critically mathematically students have also done so much, but research on the effect of CAM on mathematical critical thinking abilities based on students' initial mathematical abilities, especially in real analysis subjects so far has not been available, and this is a novelty in this study.

Concept attainment models are more appropriate when the emphasis of learning is more focused on the introduction of new concepts, so that practice high-order thinking skills (Sharma & Pachauri, 2016). Concept attainment models are deliberately designed to help students learn concepts that can be used to organize information, so that make it easier for students to learn the concept more effectively (Jain & Upadhyay, 2016).

The stages of CAM learning used in this study are the stages of CAM learning according to (Joyce, Weil, & Calhoun, 2011), namely: the first stage is the presentation of data and identification of concepts, at this stage students are asked to compare the characteristics of examples and nonexamples, students are asked to make and test hypothesis, then students make a definition of the concept of essential traits, here students are trained to think critically because students compare the characteristics in the examples and nonexamples so that they are able to find definitions of the concepts of the essential traits of the concept.

The second stage of learning , namely the stages of testing the achievement of concepts, at this stage students are asked to identify examples of concepts and make additional examples, here students are trained again to think critically because students think about what characteristics represent a particular concepts and examples that fulfill the criteria of the concept.

In the third learning phase (Joyce et al., 2011), students are trained to express the results of their mathematical critical thinking, because students are asked to express concepts in their own words, express reasons related to make additional examples, and writing completion steps a matter of the concepts being studied, as well as formulating the mathematical concepts.

Based on the background of the problem above, the purpose of this study is to determine the differences in mathematical critical thinking skills between students who obtain learning concept attainment models and conventional learning based on students' initial mathematical abilities.

METHOD

This research is a quasi-experimental research. The selection of research samples for this quasi-experimental were two groups randomized subject post-test only with a 2 x 3 factorial design.

The subjects of this study were students majoring in Mathematics Education at Riau Islamic University, which consisted of 60 students in the fourth semester of the 2018th /2019th academic year. The final test used is an essay test, the final test is used to measure students' mathematical critical thinking abilities. The final test is needed to obtain data about students' mathematical critical thinking ability after being given treatment, this test refers to the material learned during the application of concept attainment models and operational definitions of mathematical critical thinking abilities.

The data analysis technique used was the two-ways Anova test and continued with the Scheffe further test. This test is used to determine differences in mathematical critical thinking abilities between students who obtain learning concept attainment models and conventional learning based on students' initial mathematical abilities.

Initial mathematical ability of students consists of three categories, namely: high, intermediate, and low category. Before this research was carried out, both classes were given the same test to find out the initial mathematical ability of each group. Test results are collected and analyzed and then grouped by high, intermediate and low initial ability category.

The instrument used in this study was a test instrument. The test instrument consists of tests of mathematical critical thinking abilities. While the research flow below illustrates the initial steps of the study to obtain conclusions. (1) Identify problems and formulate them, study literature, and others. (2) Development of research instruments, trials and analysis of trial results. (3) Random sample selection (random class). (4) Research implementation. (5) Tests (Pretest and Posttest each of 3 questions). (6) Data collection (through tests). (7) Data processing and analysis (two-ways Anova test and Scheffe advanced test). (8) Report.

FINDINGS AND DISCUSSION

This research begins by identifying problems, formulating them, conducting library studies, then making research instruments. The research instrument was then tested and analyzed, then the sample was selected and carried out the study, after the study was completed both groups were given a test, then the test was collected to be processed and analyzed.

To find out the improvement of students 'mathematical critical thinking abilities, between students who obtained CAM learning and conventional learning based on students' initial mathematical abilities, an analysis was conducted on the group of normalized gain data of students who obtained CAM learning and normalized gains of students who obtained conventional learning. The following is presented a descriptive statistics of normalized data gain according to learning and the ability categories of students in CAM classes and conventional classes. Data processing using SPSS program assistance, obtained descriptive statistical data and normalized gain mathematical critical thinking abilities as follows:

Table 1
Descriptive statistics of normalized gain critical thinking abilities according to learning models and categories of mathematical initial ability

Learning models	Mathematical initial ability	Gain	Standart deviation	N
CAM	High	0.83	0.08	10
	Intermediate	0.61	0.05	10
	Low	0.55	0.05	10
	Total	0.66	0.13	30
CL	High	0.16	0.02	10
	Intermediate	0.12	0.02	10
	Low	0.07	0.02	10
	Total	0.12	0.04	30
Total	High	0.50	0.35	10
	Intermediate	0.36	0.25	10
	Low	0.31	0.25	10
	Total	0.39	0.29	30

Based on Table 1, the mathematical critical thinking abilities of students can be described as follows

1. The average gain of mathematical critical thinking ability of students who obtained CAM was 0.66, the average gain of mathematical critical thinking ability of students who gained CL was 0.12. Based on these data it can be seen that the average gain in mathematical critical thinking abilities of students who obtain CAM is higher than students who obtain CL. This means that the mathematical critical thinking ability of students who get a CAM is better than t he mathematical critical thinking ability of students who get a CL.
2. For high-ability students, the average gain in mathematical critical thinking abilities of students who obtain a CAM is 0.83, the average gain of mathematical critical thinking abilities for students who get a CL of 0.16. It was concluded that the average gain of critical thinking abilities of high-ability students who obtained CAM was higher than the average gain of mathematical critical-thinking abilities of students who gained CL. This means that the mathematical critical thinking ability of high-ability students who get CAM is better than students who get CL.
3. The average gain of mathematical critical thinking ability of students who have moderate ability on students who obtain CAM is 0.61, the average gain of

mathematical critical thinking ability of students who have a PK of 0.12. It was concluded that the average gain of critical thinking abilities of medium-sized students who obtained CAM was higher than the average gain of mathematical critical-thinking abilities of students who gained CL. This means that the mathematical critical thinking ability of moderate students who get CAM is better than students who get CL.

4. For low-ability students, the average gain in mathematical critical thinking ability of students who obtain a CAM is 0.55 the average mathematical critical thinking ability of students who get CL is 0.07. This means that the average gain in critical thinking ability of low-ability students who obtain a CAM is higher than the average students who obtain CL. This means that the mathematical critical thinking ability of low ability students who obtain CAM is better than the mathematical critical thinking ability of students who obtain CL.

To find out the significance of the conclusion above it is necessary to calculate the two-ways Anova statistical test. Previously, the normality and homogeneity tests of the gain in the two data groups were first performed.

The null hypothesis and its counterparts to be tested are:

H0 : samples come from normally distributed populations

H1 : samples come from populations not normally distributed

Normality test is done by the Shapiro-Wilk statistical test. The summary of normality test calculations is presented in table 2 below.

Table 2
Normalized gain normalization test for mathematical critical thinking ability

	Analogy	Kolmogorof Smirnov		
Gain		Statistic	dk	p-value
	Experiment	1.58	29	0.13
	Control	1.31	29	0.63

From Table 2, the CAM class p-value (sig.) is 0.13> a, and the conventional class p-value is 0.63> a, so the hypothesis H0 is accepted. It was concluded that the gain data normalized mathematical critical thinking ability of students who obtained CAM and critical thinking ability of students who obtained CL were normally distributed at the significance level $\alpha = 0.05$.

To test the variance homogeneity of the two groups of CAM class gain data and the conventional class the Homogeneity of Variance (Levene Statistic) test is used.

Table 3
Homogeneity test of variance score normalized mathematical critical thinking ability

Levene statistic	dk1	dk2	p-value
34.80	5	58	0.00

From Table 3, the Levene Statistics (F) value of 34.80 is obtained with a significance value of 0.00. The significance value is small from the significance level α, it is concluded that H0 which represents the population variance of the two data groups is rejected. That is, the two groups of normalized gain score data students' mathematical critical thinking abilities have variances that are not homogeneous.

Furthermore, because the normalized gain data group of the CAM class and the conventional class have non-homogeneous variance and both are normally distributed, then to determine the significance of the difference in the average of the two groups a two-ways analysis of variance (Anova) was performed. This analysis was conducted to see the direct effect of two different treatments according to the learning model and the categories of students' initial mathematical abilities and their interactions. The results of the analysis of variance test were performed at the significance level $\alpha = 0.05$, while the summary is presented in table 4 below:

Table 4
Analysis of normalized gain variance in mathematical critical thinking abilities according to the learning model and categories of students' mathematical initial ability

Source	Type III sum of square	df	Mean square	F	Sig.
Corrected model	5.00[a]	58	1.00	358.74	0.00
Intercept	9.33	1	9.33	3596.44	0.00
Learning	4.51	1	4.51	1740.67	0.00
Mathematical initial ability	0.37	2	0.18	71.86	0.00
Learning mathematical initial ability	0.11	2	0.05	22.16	
Error	0.14	54	0.00		
Total	14.47	60			

Then the research hypothesis is tested. The hypothesis to be tested is:

Hypothesis:

The hypothesis of this research to see differences in students' mathematical critical thinking abilities based on students' initial mathematical abilities are: " Students' abilities in Mathematical Critical Thinking,who gain learning concept attainment models are better than students who obtain conventional learning based on students' mathematical initial ability" To test this hypothesis, a statistical hypothesis is formulated as follows: H0: μ1 = μ2 H1: μ1> μ2

Information:

μ1: average normalized gain CAM class critical thinking abilities μ2: average normalized gain of conventional class critical thinking abilities

The test criteria is reject H0, if sig. < α, after an Anova calculation has been carried out for two paths, the results of which can be seen in Table 4. Obtained sig. equal to 0.00 <α, the results of the null hypothesis are rejected, meaning that an increase in the mathematical critical thinking ability of students who get the concept attainment learning model is better than an increase in the mathematical critical thinking ability of students who obtain conventional learning based on students' initial mathematical abilities. Then the Scheffe test is performed which can be presented in the following table:

Table 5
Difference in average normalized gain score on mathematical critical thinking ability by category of mathematical initial ability

(I) Mathematical initial ability	(J) Mathematical initial ability	Mean difference (I-J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
High	Internediate	-0.05*	0.01	0.00	-0.09	-0.01
	Low	-0.18*	0.01	0.00	-0.22	-0.14
Intermediate	High	0.05*	0.01	0.00	0.01	0.09
	Low	-0.13*	0.01	0.00	-0.17	-0.09
Low	High	0.18*	0.01	0.00	0.14	0.22
	Intermediate	0.13*	0.01	0.00	0.09	0.17

Based on observed means.

The error term is Mean Square (Error) = ,003.

*. The mean difference is significant at the ,05 level.

Table 5 shows the difference in the average high ability student having sig. <α with average and medium ability students. This means that there is a significant difference in increasing the mathematical critical thinking ability of high-ability students with an increase in mathematical critical thinking skills of students who are of medium and low ability. The difference in the average capable student has sig. <α with the average low-ability students, meaning that there is a significant difference in increasing mathematical critical thinking abilities of students who are moderately and low-ability.

Based on the results of the analysis of the data presented above, the following discussion of the results of the study which includes the ability of student to think critical towards learning mathematics using conventional learning models and concept attainment models (CAM).Based on the results of the analysis of the data presented above, the following discussion of the results of the study which includes the ability to think critically students towards learning mathematics using conventional learning models and concept attainment models (CAM). At this point, the link between theoretical studies and the results of research that have been obtained are discussed. The hypothesis shows that an increase in students' mathematical critical thinking abilities that obtain learning concept attainment models is better than students who obtain conventional learning based on students' mathematical initial abilities.

Critical thinking is more focused on doing something, students who are able to think critically do not immediately believe the explanation of the lecturer, but the student tries to consider his reasoning and find other information to obtain a truth. For the purposes of this study, the researchers formulated the ability to think critically in mathematics learning: (1) The ability to identify relevance, namely the ability to write the concepts contained in the statements given and write the parts of the statements describing the concepts in question; (2) The ability to formulate problems into mathematical models, namely the ability to express problems into mathematical symbols and give meaning to each of these symbols; (3) The ability to deduce using principles, namely the ability to draw conclusions from statements presented using the rules of inference.

The hypothesis show that there are differences in the increase in students' mathematical critical thinking abilities that obtain learning concept attainment models with an increase in students' mathematical critical thinking abilities that obtain conventional learning based on students' mathematical initial ability. The acquisition of mathematical initial ability describes how the initial state of mathematical ability of students, especially in the ability to think critically. The mathematical initial ability to be a determining factor in distinguishing mathematical critical thinking ability.

The results of this study indicate that for high-ability students, the average gain in mathematical critical thinking abilities of students who get a CAM is 0.83, the average gain of students' mathematical critical thinking abilities that gets a CL of 0.16. It was concluded that the average gain of mathematical critical thinking abilities of high-ability students who obtained CAM was higher than the average gain of mathematical critical-thinking abilities of students who obtained CL.

The average gain of mathematical critical thinking abilities of students who have moderate ability on students who obtain CAM is 0.61, the average gain of mathematical critical thinking abilities of students who have a CL of 0.12. It was concluded that the average gain of critical thinking abilities of medium-ability students who obtained CAM was higher than the average gain of mathematical critical-thinking abilities of students who gained CL.

For low-ability students, the average gain of mathematical critical thinking abilities of students who obtain CAM is 0.55, the average gain of mathematical critical thinking abilities of students who obtain CL is 0.07. This means that the average gain of critical thinking abilities of low-ability students who obtain CAM is higher than the average gain of mathematical critical-thinking abilities of students who obtain CL.

Overall improvement in students' mathematical critical thinking abilities that are taught with CAM is better than students who are taught with CL based on students' mathematical initial ability. From the data above it is also seen that the average gain of mathematical critical thinking abilities of high, medium and low ability students who obtain CAM learning is higher than the average gain of high, medium and low ability students on students who obtain CL.

There is a better increase in mathematical critical thinking abilities of students who are taught with CAM, than students who are taught with CL, theoretically caused in CAM, there are steps that can facilitate the increase in mathematical analytical reasoning abilities of students, these steps are : The first learning stage (Joyce et al., 2011), namely the presentation of data and identification of concepts, at this stage students are asked to compare the characteristics in the examples and non-examples, students are asked to make and test hypotheses, then students make definitions of the concepts of the characteristics essential traits, here students are trained to think critically because students compare traits in examples and non-examples so that they are able to find definitions of concepts of the essential features of these concepts.

The second stage of learning (Joyce et al., 2011), namely the stages of testing the concepts achievement, at this stage students are asked to identify examples of concepts and make additional examples, here students are trained again to think critically because students think about characteristics that represent a particular concepts and examples that fulfill the criteria of the concept.

In the third learning phase (Joyce et al., 2011), students are trained to express the results of their mathematical critical thinking, because students are asked to express concepts in their own words, express reasons relating to making additional examples, and writing completion steps a matter of the concepts being studied, as well as formulating the mathematical concepts.

Next will be described the process of conducting research related to students' mathematical critical thinking abilities towards learning mathematics by using conventional learning models and concept attainment models (CAM). Related to the

mathematical critical thinking abilities of the two learning groups, the following will be explained about the learning process and the results of the mathematical critical thinking abilities of the two learning groups.

During the learning process there are a number of things that concern the researcher in terms of students' mathematical critical thinking abilities at each stage of learning using CAM. At the stage of presenting data, students as a whole look closely at it. The data presentation stage is the introduction of a general description of the concept being studied and an explanation of the work steps of the concept in the process of problem solving. The role of students in this stage is to observe it, grasp its meaning, analyze the characteristics of the concept.

At the stage of testing the concept achievement, students activities take place by discussing with friends next to them. Students are asked to discuss to identify the characteristics of the concepts learned then find concepts based on the characteristics they have found. The role of lecturers here is to provide stimuli so that they are able to find concepts through their own discoveries.

Furthermore, at the stage of thinking strategy analysis, students are asked to express the reasons relating to formulating concepts in their own words and writing them through writing. The following will be presented the answers to the results of their discussion on the material and arithmetic sequence. Sometimes the thought process they do is wrong. During the discussion process, the lecturer confirms the accuracy of the concepts being studied, so that students who are less precise in the process of finding the concept get direction about the mistakes they make.

One of the material taught in this study is the supremum and infimum set. This activity begins by conveying the learning objectives of determining the supremum and infimum set of groups. In this study students are divided into several groups, researchers make groups like the first meeting, so students do not need to readjust. Each group is given an student worksheet and is told to solve the problems that exist in the student worksheet.

The lecturer starts the data presentation stage by inviting students together to determine the supremum and infimum of a set. Students look enthusiastic doing it, because they will be asked to explain the results they find related to the questions they are working on, and the lecturer will provide additional value for those who dare to appear to explain the results of their work. At this meeting, there were many students who had difficulty in proving the theorems starting from the concept achievement stage to the analysis strategy thinking stage, so that the lecturer gave a stimulus again at the concept achievement stage until the analysis strategy thinking stage so that students were able to prove the theorem. This is due to the fact that the meeting material was far more difficult than the material of the previous meeting.

Based on the results of testing the CAM class posttests, no errors were found that were too important. Mistakes made are only due to lack of accuracy when adding together, or incorrect formulas. The errors in algebra completion are not found in the results of the

CAM class posttest. This is because during the learning process the lecturer always corrects the mistakes made by students in the operation of algebra. Learning by using the concept attainment model (CAM) gives a good influence on students' mathematical critical thinking abilities, these are evident from the overall average acquisition of mathematical critical thinking reasoning abilities obtained by the CAM classes are higher than conventional classes.

Sometimes the thought process that students do is incorrect. During the learning process, the lecturer confirms the accuracy of the concepts being studied, so that students who are less precise in the process of concept discovery get direction on the mistakes they make. In certain material, many students find it difficult to prove the theorem starting from the concept achievement stage until the analysis strategy thinking stage, so the lecturer gives a stimulus back to the concept achievement stage until the strategy analysis thinking stage so that students are able to prove the theorem.

CONCLUSION

Concept attainment model is a learning model that guides students to find concepts with the following steps: (1) The lecturer presents data to students, each data is an example and not a separate example, then students are asked to name the concept, and explain the definition concept based on its characteristics; (2) Students test their concept acquisition by identifying other additional examples that refer to the concept, and bringing up their own examples; (3) Students are asked to analyze or discuss the strategies they use until they can find the concept. Students learn to find their own concepts through examples and non-examples, different from conventional learning.

Conventional learning is defined as expository learning, in this learning the lecturer explains the lecture material, students listen and record the explanation delivered by the lecturer, students learn not in groups, then the lecturer gives exercises and students do the exercises given by the lecturer, and students are allowed to ask if there is material lecture that is not yet understood. Students do not learn to find their own concepts so that in conventional learning students are less trained in reasoning and less trained in expressing their thoughts.

There is a difference in the increasing in students 'mathematical critical thinking abilities that obtain learning concept attainment models with students who obtain conventional learning based on students' mathematical initial ability. This means that the mathematical initial abilities possessed by each student who gets the concept attainment learning model and conventional learning are able to distinguish students' mathematical critical thinking abilities. It is recommended for further research to further develop Concept Attainment Model learning in other subjects.

Based on Angraini, Kartasasmita & Dasari (2017), Angraini, Kusumah & Dahlan (2018), Angraini, Kusumah & Dahlan (2019) research and based on the conclusions of this study, a number of relevant suggestions were given, including: mathematical learning using the concept attainment model is well applied provided that the number of

students in one class is not too much. Mathematics learning using the concept attainment model is well applied with the condition that students' understanding of the basic concepts of mathematics is good and their interest in learning mathematics is good enough. It is recommended for further research to further develop concept attainment model learning in other subjects.

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