The Patterns of Students' Mathematical Critical Thinking Ability in the SSCS Model Assisted by *Microsoft Teams* with Ethnomathematical Variations in terms *of Adversity Quotient*

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Abstract

Critical thinking skills become one of the goals or outcomes of a learning. Each student has a different response in responding to the difficulties of the problem called Aversity *Quotient* (I). This study aims to analyze the pattern of students' mathematical critical thinking skills in class XI in terms of AQ. The research subjects were 11th grade students of Math-Science class of Ungaran 1 State High School in the academic year of 2021/2022. The sampling technique used purposive sampling randomly selected from each AQ category, namely quitter, camper, and climber. The data collection instrument used was a mathematical critical thinking ability test and an AQ questionnaire. Based on the results of the AQ questionnaire it is obtained that the percentage of quitter type is 28%, camper type is 56%, and climber type is 28%. It was found that most of the students were in the camper type.

Keywords: Mathematics, SSCS Model, Ethnomathematics, AQ.

1. Introduction

Mathematics is a subject that must be studied and given in primary, secondary, and higher education(Sahliawati & Patmawati, 2015). Learning mathematics is learning about the basic concepts of developing science and technology starting from concrete objects and then at higher stages being taught in an abstract form using mathematical symbols (Latifah, Elza Pristy., Wahyudi., Setiawan, 2019). In addition, one of the roles of learning mathematics is to prepare students to face the challenges of an increasingly developing life, including facing the 21st century. Competencies that must be mastered by individuals are creative, critical, independent, collaborative, and communicative ways of thinking(Kivunja, 2015).

According to National Council of Teachers of Mathematics (2000), mathematical abilities that are expected to be possessed by students in learning mathematics include: 1) mathematical communication, 2) mathematical reasoning, 3) mathematical problem solving, 4) mathematical connections, and 5) mathematical representation. Hendriana and Soemarmo (2017) state that mathematical thinking can be classified into two types, namely low-level thinking and high-level thinking. Higher order thinking Bloom's Taxonomy includes the stages of analyzing (C4), synthesis (C5), and evaluation (C6) (Farib et al., 2019). Based on the development of mathematical thinking skills, students must develop higher order thinking skills. One of the higher order thinking skills is critical thinking skills (Suriawati & Mundilarto, 2019).

Ennis (2015) argues that critical thinking is reasonable reflective thinking, which focuses on determining what to believe and do. In addition, mathematical critical thinking is the basis for the thinking process to analyze arguments and generate ideas for each meaning to develop a logical mindset (Jumaisyaroh et al., 2015). Critical thinking skills become one of the goals or outcomes of a learning (Perkins & Murphy, 2006). In line with Shanti et al., (2017) states that, one of the main goals of the world of schooling is to improve students' critical thinking skills and make rational decisions about what to do or what to believe. One of the strengths of a critical thinker is being able to identify important points in a problem, being focused and able to observe carefully, being tolerant of new points of view, willing to acknowledge the strengths of other people's points of view, and having analytical skills that can be used in various situations (Budden, 2007).

Referring to the results *Program for International Student Assessment* (PISA) in 2018, it shows that one of causing Indonesia's low rankings in the country rankings is mathematical ability which is still low and unsatisfactory. PISA is a test measuring the ability of 15 year old students who were randomly selected to take three basic competency tests, namely reading, math, and science. Indonesia's ranking is in the 72nd position out of 78 PISA participating countries (Schleicher, 2019). Indonesia's position is very low when compared to other Southeast Asian countries that also took the PISA test such as Thailand in 57th position, Malaysia in 47th position, and Singapore in 2nd position. The results of the PISA test show that the average mathematical ability of Indonesia is still below the average of other PISA participating countries.

The development of the Industrial Revolution 4.0 affects the development of education known as *Education* 4.0 which is a technology-based learning. Education 4.0 encourages people and technology to develop possible advances (Hussin, 2018). Based on the development of technology-based learning, the model of Search, Solve, Create, Share (SSCS) carried out with Microsoft Teams

as the assistance. *Microsoft* as quoted by Martin & Tapp (2019) states that *Microsoft Teams* is a digital application that features conversations, meetings, files and shared applications in a single learning management system (LMS).

The learning process created by the teacher has an impact on the quality of student learning (Satriadi et al., 2016). The quality of a learning becomes an indicator of the success of the learning carried out. In addition to these factors, the success of learning is also determined by the creativity of educators in developing learning. This is in line with the statement by Murdiana et al., (2020) states that there are at least two factors that must be considered by teachers in developing creativity in mathematics learning, namely the enthusiasm to change the paradigm of learning mathematics and the selection of methods and media in learning mathematics. Based on these learning success indicators, learning will become more interesting for students if learning methods are developed and applied in everyday life to create meaningful learning. One way that can be used to make learning activities more meaningful is ethnomathematics. Arthur Powell as quoted in (Stathopoulou & Moreira, 2013) said that ethnomathematics as a discipline emerged from a multicultural perspective involved in mathematics and mathematics education. The use of ethnomathematics in the mathematics learning process can be combined with certain learning models. As for this study, the model used is SSCS with ethnomathematics as the variations of learning to develop students' mathematical critical thinking skills in terms of Adversity Quotient.

2. Method

The research method used was a qualitative method with experimental research techniques. The population in this study were 11th grade students ofMath-science class of 1 Ungaran High School for the academic year of 2021/2022. The sampling technique used for subject selection was purposive sampling by randomly selecting students for each AQ category, namely from the low, medium, and high AQ categories. The data were collected through three techniques, namely: observation, literature study, and interviews. Researchers acted as observers as well as actors (objects) in carrying out this research. The data analysis technique used in qualitative research has four stages, namely data collection, data reduction, data presentation, and conclusion drawing and verification. To verify the validity of the research, a triangulation technique was used by checking beyond the data as a comparison against the data.

In this study, students' AQ are categorized into three categories. The classification of subjects into three categories based on Azwar (2012) can be seen in Table 1.

Table 1. The Classification of AQ Score

Interval	Categories
$X \geq \bar{X} + s$	High
$\bar{X} - s \leq X < \bar{X} + s$	Medium
$X < \bar{X} - s$	Low

Notes:
X : student's AQ score
$\bar{X}$: the average AQ value of the class students who applied the SSCS model assisted by*Microsoft Teams* with variations of ethnomathematics
S : the standard deviation of the class students' AQ scores applied

The grouping of students' critical thinking ability tests using Arikunto's reference in (Pertiwi, 2018) as follows.

Table 2. Categories of Mathematical Critical Thinking Ability Test Scores

Interpretation	Categories
$\mathbf{80 \leq skor \leq 100}$	Very Good
$\mathbf{66 \leq skor \leq 79}$	Good
$\mathbf{56 \leq skor \leq 65}$	Medium
$\mathbf{40 \leq skor \leq 55}$	Poor
$\mathbf{0 \leq skor \leq 39}$	Very Poor

3. Results and Discussion

According to Facione (2011), critical thinking skills consist of cognitive abilities and characters. Cognitive abilities in the study include interpret, analyze, evaluate, conclude, explain, and self-regulate. The important thing in critical thinking according to Fisher (2011) defines critical thinking as the ability to interpret and evaluate the results of observations and communication, information and argumentation. Critical thinking skills become one of the goals or outcomes of a learning (Perkins & Murphy, 2006).

One of the efforts to improve critical thinking skills according to Arends (2008) is to involve students with real objects directly. Learning activities that involve thinking processes and direct interaction will make it easier for students to construct knowledge and relate the concepts learned. One way that can be used to make learning activities more meaningful is ethnomathematics. Arthur Powell as quoted in (Stathopoulou & Moreira, 2013) said that ethnomathematics as a discipline emerged from a multicultural perspective involved in mathematics and mathematics education.

There are several previous studies regarding the correlation between ethnomathematics, students' critical thinking skills, and Adversity Quotient (AQ) which can be used as a reference for this research. The first study, conducted by Mahendra (2017), found that there was a significant influence on the learning model Project-based Learning contains ethnomathematics on learning motivation and mathematics learning outcomes. In addition, a research conducted by Irawan (2017) found that ethnomathematical-based realistic learning can create a more interactive classroom atmosphere so that problems related to everyday life can be studied well by students.

Furthermore, research conducted by Haryani (2011) found that learning mathematics with problem solving can train and develop students' critical thinking skills. Students' mathematical critical thinking skills are coming from the stages contained in problem solving in which students are faced with a problem in various areas of life both now and in the future.

Furthermore, Probosiwi et al., (2019) argues that SSCS learning can encourage students to think critically, creatively, independently, and provide opportunities for students to practice and develop skills in solving problems. A research conducted Rakhmi & Mastur (2018) by found that learning mathematical constructivism with the SSCS model could effectively improve students' mathematical creative thinking skills. A research conducted by Hidayat (2018) found that the teacher needs to pay attention to the students' AQ in learning mathematics because there are different student abilities in solving problems. The results of research conducted by Rahayu (2020) showed that there was an influence between AQ on mathematical critical thinking skills, which was 75% while 25% was influenced by other factors. In addition, it was also found that there is a significant relationship between AQ and critical thinking skills so that there is a description of the low, medium, and high AQ types.

Based on these studies, there are several important factors determining students' critical thinking skills, namely a class atmosphere that becomes more interactive, mathematics learning that becomes more contextual, and the classification of students' criticality levels in the mathematics learning process. These factors become important studies for this research to be able to meet the indicators of learning mathematics by using the Model Search, Solve, Create, Share (SSCS) assisted by Microsoft Teams with ethnomathematics variations in this study. As for further discussion of the research results in this article, the following results were found:

3.1. Instrument Analysis Results based on Adversity Quotient

The research instrument is the most important part in the qualitative research process, the depth of the question from the researcher to the respondent is very influential on the quality of the research. Meanwhile, based on the results of the AQ Questionnaire that has been filled out by students, the AQ category grouping is obtained as follows.

Table 3 Category AQ Learners

Category AQ	Frequency	Percentage
Climber	5	28%
Camper	8	56%
Quitter	5	28%
Total	18	100%

Table 3 provides information on the AQ categories of students who have filled out the AQ questionnaire. The data collected came from 18 respondents in 11th grade of Math-science class. From the division of AQ type, it is obtained that there are Climber type as many as 5 students with a percentage of 28%, camper type as many as 8 students with a percentage of 56%, and Quitter type as many as 5 students with a percentage of 28%. From this description, it can be concluded that most of the students' AQ types are in the type Camper. A research conducted Mursidi & Soeharto (2016) by was found that the AQ type was mostly in the type camper *with* a percentage of 69.23%, while in type Climber by 20.19% and type Quitter by 10.58%.

3.2. Critical Thinking Ability Analysis

Based on the classification described above, the next step is to classify the categories of students' critical thinking abilities based on group values. The results of the students' critical thinking ability tests obtained are as follows:

Table 4. Mathematical Critical Thinking Ability Test Results

Interpretation	Frequency	Categories
$\mathbf{80 \leq skor \leq 100}$	12	Very Good
$\mathbf{66 \leq skor \leq 79}$	6	Good
$\mathbf{56 \leq skor \leq 65}$	0	Medium
$\mathbf{40 \leq skor \leq 55}$	0	Poor
$\mathbf{0 \leq skor \leq 39}$	0	Very Poor

Based on Table 4, the results of the student's mathematical critical thinking ability test were calculated using scoring guidelines so that 12 students (67%), good categories were obtained as many as 6 students (33%), while in the medium, poor, and none categories. Based on the results of these tests, it can be seen that the results of the scores show a very good average, so it can be concluded that the application of the SSCS model assisted by Microsoft Teams with a mathematical nuance has a significant effect.

3.3. Analysis of Critical Thinking Ability in terms of Adversity Quotient

According toStoltz (1997), AQ has three forms. First, AQ is a new conceptual framework for understanding and improving all facets of success. AQ is based on sound and important research offering a practical and novel mix that redefines what it takes to be successful. Second, AQ is a measure to determine the response to adversity. So far, these subconscious patterns have actually been owned. This is the first time that patterns are measured, understood, and changed. Third, AQ is a set of tools that have a scientific basis for improving a person's response to adversity, which will result in improving a person's overall personal and professional effectiveness. In order for success to be real, Stoltz argues that the modification of the three elements, namely: new knowledge, benchmarks, and practical tools, is a complete unit for understanding and improving the basic components in achieving success. Stoltz as quoted Virlia (2015), AQ is a person's ability and resilience in the face of difficulties, failures, obstacles as well as turning difficulties or failures into opportunities to achieve goals or success. The following are the results of the respondents' answers based on AQ.

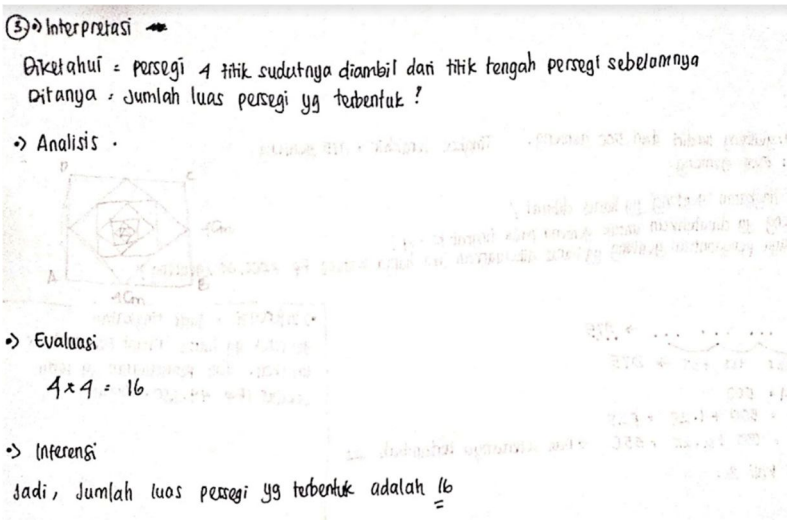

Figure 1. Answers of student with low AQ category (*quitters)*

Figure 1 above shows that student with low AQ on the indicator *"Interpretation"* including still low because he could not identify a problem. At the time of the interview, student also could not explain the identification of the problem clearly and completely. On indicator "*Analysis*", student did not write down the concepts or strategies used to solve problems. However, during the interview, the subject could mention the concept used to solve the problem. On indicator "*Evaluation*", student was still low because he could not write and explain the process of solving a problem in detail. On indicator "Inference", it has been fulfilled because the subject wrote the conclusion of the final result based on a problem.

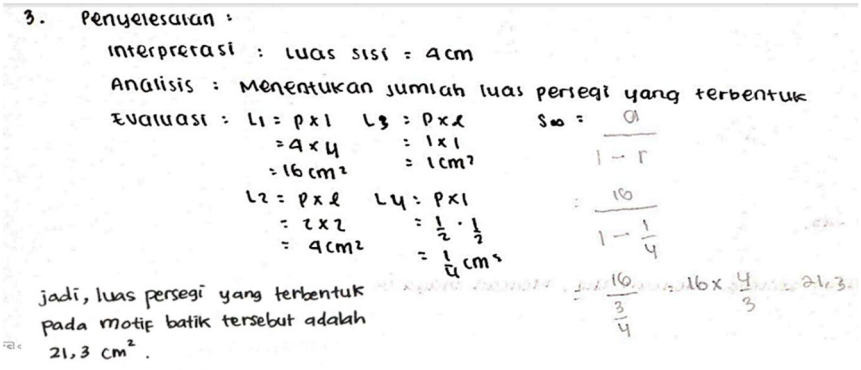

Figure 2. Answers of student with medium AQ category (*Camper)*

Based on Figure 2 above, there are indicators of critical thinking skills that have not been met. The student with medium AQ on the indicator "Interpretation" wrote down what is known but not complete. However, on the results of interviews, student could identify a problem well. On indicator "Analysis", the student could mention the concept or strategy used to solve a problem correctly. On indicator "Evaluation", the student made an error in the process of calculating the solution to a problem. On indicator "Inference", the student could conclude the solution according

to the problem. Therefore, it can be concluded that the deficiency in the AQ subject is medium which does not meet the indicators "Evaluation" due to an error in the calculation process.

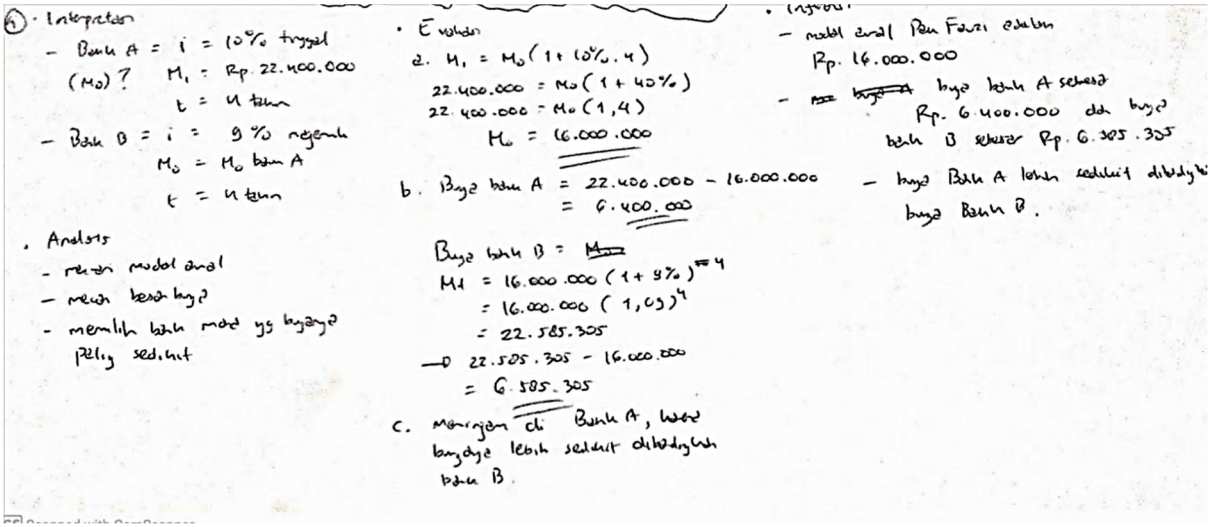

Figure 3. Answers of students with high AQ category (*Climbers)*

Based on Figure 3 above, it can be seen that all indicators of critical thinking ability are met by subject with high AQ. On indicator ″Interpretation", the student could write down the identification of a problem both known and asked clearly and correctly. On indicator "Analysis", the student could write down the concepts applied to solve a problem according to the steps to be used. On indicator "Evaluation", the student could write and explain in detail and correctly about the processes of solving a problem and perform calculations with the right results. On indicator "Inference″, it can be seen that the student wrote down the conclusions obtained in solving a problem equipped with logical reasons.

Based on the descriptions above, it can be seen examples of respondents showing students' mathematical critical thinking skills based on AQ. The levels are starting from low, medium, and high. The outline of the conclusions that can be drawn from the respondents' answers based on the level of AQ are presented in the following description.

3.3.1 Students with Low AQ

The results of the answers to the mathematical critical thinking ability test and the results of interviews conducted on the subjects of UC-13 and UC-18 presented information that critical thinking skills on indicators "Interpretation" implied that students are not able to write and explain the elements that are known and asked about a problem completely and clearly.

Indicator "Analysis" on the subject of UC-13 and UC-18 could bring up concepts or ideas that are used to solve a problem. In this indicator, the two subjects could mention the formula applied to solve the problem based on the image in a known problem.

Indicator "Evaluation" on subjects with low AQ presents the results of the subject's work could not answer questions related to evaluation indicators. In addition to the final wrong answer, the answer written by the subject is not clear. The results of interviews with the subject also mentioned the difficulties in solving this problem. The subject did not understand the steps in solving the problem.

Indicator "Inference" for subjects with low AQ is seen at the end of the work to solve the problem, the subject wrote a final conclusion based on the problem. At the time of the interview, the subject also confirmed the results with a conclusion statement according to the problem.

3.3.2 Students with Medium AQ

Indicator "Interpretation" on subjects with medium AQ, namely UC-2 and UC-16 can be seen from the work process of the subject wrote a brief identification of the problem. Based on the results of the interview, although the writing on the identification of the problem is brief, both subjects could explain the meaning of the question and explain the identification completely and clearly.

Indicator "Analysis" on the subject of UC-2 and UC-16 can be seen from the results of the work and the subject. The two subjects in this stage could write down and mentioned the concepts/ideas used to solve the problems during the interview.

Indicator "Evaluation" of AQ subjects is included in the low category because even though the subject were able to identify the problem, wrote down the concepts used to solve it, and explained the steps for doing it, the lack of UC-2 and UC-16 subjects is that there is still one missing process that can result in errors at this stage of evaluation. The UC-16 subject could state the correct final answer but there was still one wrong process in which the subject could not explain clearly the elements in operation.

Indicator "Inference" on the subject of UC-2 and UC-16 presents the process that the subject wrote the final conclusion so that it was clear in answering the questions. UC-2 and UC-16 subjects wrote briefly and clearly in accordance with the answer commands in the problem.

3.3.3 High AQ Students (UC-14 and UC-15)

Indicator ″Interpretation" on the subject of UC-14 and UC-15 is shown through the working process, namely by writing down things that are known and asked clearly, completely, and correctly. The results of interviews with both subjects can be concluded that the understanding of the problems to be worked on by the subject is very good so that the subject does not experience difficulties.

Indicator "Analysis" with a high AQ on the subject of UC-14 and UC-15 show the ability to analyze a problem to issue concepts or ideas that will be used to solve problems. An understanding of the identification of questions helps the subject clearly write down the processes to be carried out in a coherent and clear manner. Subject of UC-14 could write and also explain in interviews well and clearly. While in the work of the UC-15 subject, initially, there were errors in the results of the work on the answer sheet. However, during the interview, the UC-16 subject realized an error so that he could explain the correct concept that would be used to solve the problem.

Indicator "Evaluation" for subjects UC-14 and UC-15 indicate in the results of written work and interviews with both subjects. The working process on the UC-14 subject contains complete information, a coherent, clear, and correct completion process. Subject of UC-15 could also write the process completely but there were errors. The mistakes made are recognized and UC-15 subjects

can revise by reworking. This shows that the subject's understanding of a problem is very good where the elements needed can be found one by one according to a coherent step.

Indicator "Inference" for subjects UC-14 and UC-15 are shown in the results of the work and interviews with both subjects. The process of working shown by two subjects include writing a conclusion stating the final answer for solving the problem. The writing is done coherently and clearly. Both subjects could also provide additional reasons as the final answer in solving a problem.

In general, subjects with low AQ can meet the indicators "Analysis" and "Inference" while the indicator "Interpretation" and "Evaluation" are unfulfilled. Subjects with medium AQ can meet 3 indicators, namely: interpretation, analysis, and inference while the indicator evaluation unfulfilled. Subjects with high AQ can meet all indicators of critical thinking skills, namely: interpretation, analysis, evaluation, and inference. All the results of the analysis carried out on low, medium, and high AQ subjects based on the results of the subject's work and the results of collected interviews. The following is the mathematical critical thinking ability of students based on low, medium, and high AQ which is presented in table 5.

Table 5. Critical Thinking Ability Based on AQ

AQ	Critical Thinking Ability Indicators			
	Interpretation	***Analysis***	***Evaluation***	***Inference***
Low	Unfulfilled	Fulfilled	Unfulfilled	Fulfilled
Medium	Fulfilled	Fulfilled	Unfulfilled	Fulfilled
High	Fulfilled	Fulfilled	Fulfilled	Fulfilled

4. Conclusion

Each student has a different AQ and this affects students' mathematical critical thinking skills so teachers need to pay attention to students' AQ in learning. Students with low AQ can only meet 2 indicators, namely analysis and inference. Students with medium AQ can master 3 indicators, namely interpretation, analysis, and inference while students with high AQ can meet 4 indicators, namely interpretation, analysis, evaluation, and inference. Based on the results of these studies, teachers need to pay attention to students' AQ so that students can maximize their mathematical critical thinking skills.

5. Suggestions

The results of this study can be used as information material to conduct further research on the use of the SSCS learning model -assisted by Microsoft Teams with ethnomathematics variations in learning to improve students' mathematical critical thinking skills in terms of AQ.

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