



Critical Thinking Skill Seen from *Curiosity* on Independent Learning Assisted by Module

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Abstract

This research aims to describe critical thinking skill of students seen from *curiosity* on independent learning assisted by module. This *mix method* research used *sequential explanatory* design. The data collection was done through observation, test, and interview techniques. The subjects were seventh graders. The quantitative data was selected by *purposive sampling* technique. The qualitative data was based on the students' curiosity levels: high, moderate, and low. The findings showed that independent learning assisted by module was qualified. It was shown on planning stage of learning instrument validation result. It met validity categories. The promoting stage showed 77.2%. The evaluation stage was done through individual accomplishment test. It obtained $t_{\text{count}} = 6.34 > 1.69$. The classical accomplishment $z_{\text{count}} = 0.47 > 0.18$. The proportional difference test showed that $z_{\text{count}} = 2.88 > 0.112$. The N-gain test showed 97.3%, experiencing improvement. The variance test obtained $\text{sig} = 0.016 < 0.05$. The descriptions of the students' critical thinking skills seen from curiosities showed that they were varied. The high curiosity student reached high, moderate, and low critical thinking skill categories. The moderate curiosity students reached high, moderate, and low critical thinking skill categories. Meanwhile, the low curiosity students reached low critical thinking skill category.

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INTRODUCTION

Mathematics is an important discipline in educational world. It becomes a basis of a certain discipline correlated to other disciplines. Suherman *et al* (2001) states that mathematics is the queen or the mother of all science. It is the source of other sciences. Furthermore, it also greatly influences life.

Geometry is one of mathematics learning materials which is considered difficult as stated by Adophus (Krisdiana, 2013). One of said difficult materials by students is rectangular material. They had difficulties while facing an essay question. It was based on observation result of MTs Salafiyah Simbangkulon, shown by low daily test result on rectangular material, 54.2.

Thinking activity is needed in learning mathematics. It consists of two thinking skills: basic and high order thinking skills. Critical thinking skill is also included in high order thinking skills. As stated by Agoestanto (2017) that critical thinking skill is something used in daily life problem solving. 2013 curriculum elaborates that critical thinking skill is an important skill to have by students in learning mathematics. Palinusa (2013) stated critical thinking skill facilitated students to solve mathematics. It is in line with Styron (2014) stating that critical thinking is

a process of active and skillful intellectual disciplines to conceptualize, implement, analyze, synthesize, and evaluate the collected information or produced by observation, experience, reflection, reasoning, or communication as guideline of individuals' believed actions and beliefs.

Critical thinking skill components as stated by Watson and Glaser (2010) consists of: (1) *inference*, (2) *recognition of assumption*, (3) *deduction*, (4) *inter orientation*, and (5) *argument evaluation*. According to Ennis (Rizqiyana, 2016), there are 12 indicators of CTS summarized into 5 stages: (1) *basic clarification*, (2) *basic of decision*, (3) *inference*, (4) *advance clarification*, and (5) *supposition and integration*.

The advantages of critical thinking skill are: (1) critical thinking individuals think freely and independently, (2) they will not act without thinking, (3) they could state problems explicitly. Giancarlo and Facione (Tiruneh, 2014) showed that more comprehensive critical thinking perspective should cover disposition, which relies on an individual's tendency to use his critical thinking skill in solving faced problems and ideas to evaluate or make decisions.

Critical thinking indicators in this research adopting Watson and Glaser (2010) and Ennis (2016) are shown in Table 1.

Table 1. Critical Thinking Indicators

No	Critical Thinking Indicators	Sub Critical Thinking Indicators
1	Formulating questions	Identifying problems
2	Assumptions	Providing simple explanation related to the current existing fact
3	Observing	Using correct evidence
4	Interpreting information	Measuring the evidence based on the data
5	Analyzing arguments	Differing the strong and relevant arguments to weak and irrelevant arguments toward certain issues.

Based on the observation and interview result of the school's mathematics teachers. It was found that the critical thinking skill of the students were low. They tended to rely on the taught materials by the teacher so when they were given different question to what had been given, they could not work on it. Furthermore, the preliminary condition during learning showed uncertainty since they had low

motivation and only learned when they had assignment.

It is not only critical thinking aspect which is needed in learning mathematics. Affective skills, such as curiosity, is also needed since it represents ways of thinking, behaving, and having attitudes which motivate students to investigate something deeper from what they see, hear, and learn. It is supported by Regulation of Educational Minister, Number 21

(2016) that one of competencies to be achieved in learning mathematics for learners is - to be able to behave logically, critically, carefully, responsibly, responsively, not easily give up, curious, motivated in sustainable learning, confident, and interested in mathematics.

Curiosity is a character goal in 2013 curriculum learning which has several indicators: (1) asking to both teachers and friends about the learning material; (2) asking to something about certain occurring symptom; (3) asking to teachers about what is being heard from anywhere both from family and media; (4) asking about other reading sources instead of textbook about concerning materials to learn; (5) reading and discussing the new - occurring natural symptom; and (6) reading and discussing several natural events, social, economy, politics, and new technologies which are newly heard (National education minister, 2010). In this research, the used indicators were taken from Berlyne & Loewenstein: (1) *Epistemic curiosity* consisting of *epistemic - diversify* and *epistemic - specific*, (2) *perceptual curiosity* consisting of *perceptual diversity* and *perceptual - specific*.

Curiosity needs to be developed since it could be spirit of thinking in learning mathematics. It is strengthened by Zetriuslita *et al* (2017). They stated that critical thinking is correlated to curiosity since the existence of curiosity is initial stage used to investigate and find something from learning enthusiasm.

Heretofore, the learning fact shows that students rely on teachers and they are lack of learning motivation. Thus, when they were given different question to what they had learned or explained, they would have difficulties and could not do the questions. According to Bahri *et al* (2018), he stated that independent learning is learning activity which makes students active caused by intention or motivation to master a competence with purpose to solve problem.

Independent learning requires students to be active and independent during learning process as stated by Bandura (Sumarno, 2014). There are three stages to do in independent learning: (1) self-observing and monitoring, (2) comparing his position to certain standard, and (3) giving both positive and negative self-responses.

The use of independent learning module could improve students' curiosities because it requires them to learn in understanding material independently. They will surely learn the module and find other supportive sources. Furthermore, the use of module could reduce teacher's role in learning and it could make students more active during learning process through guidance. It is in line with Wawan and Teguh (Aris, 2017) that the use of multimedia are very supportive and important components in learning independently.

On independent learning assisted by module, students were led to learn the module independently or collectively. The learning had these following purposes: (1) students could independently learn by having very few teacher's assistance or guidance, (2) the teacher's role did not dominate or was not authorizer in learning, (3) it trained the students' honesties, (4) it accommodated various level and speed of learning, and (5) the learners could measure their capability toward current learned material (Setiawan *et al*, 2018).

Independent learning could be done in excellent classroom environment with individual or collective in natures. Independent learning assisted by the module was given a test to find out the students' weaknesses in the given learning material. Both task and test function to assist and control the students in understanding the material. Limited assistance is very needed to make the students' activities more focus and orderly (Putra, 2017). The assistance or guidance was done outside of classroom learning hours, both in the afternoon or days off with the teacher as facilitator for those experiencing difficulties. If the students faced difficulties, then they could ask on guiding and assisting activity. In this research, follow up actions were given to assist those experiencing difficulties in the given materials.

On this research, independent learning assisted by module discussed rectangular material. The module provision was done before the assisting and guiding activities were started. The students were led to learn independently, both individually and collectively in understanding rectangular material in the module. They were then working on the module's task. An assistance was needed for those experiencing difficulties.

The assistance was given within 5 meetings, promoted outside of learning school hours. It was promoted on holidays or in the afternoons. The assistance was given to those experiencing difficulties to ask and provide chance for students and groups to respond. After that, the students presented the discussion result about material and question on the module. The students from other groups responded and shared their opinions. In the end of the meeting, the teacher shared *posttest* questions.

The question problems are (1) how the independent learning quality assisted by the *module* in rectangular material to mathematics critical thinking of the seventh graders is; (2) how the mathematics critical thinking skill of the students seen from *curiosity* on independent learning assisted by module on rectangular material is.

The objectives of this research were: (1) finding out independent learning quality assisted by module on rectangular material to mathematics critical thinking skill of the students; and (2) describing critical thinking skill through independent learning on rectangular material seen from *curiosity*.

METHOD

This mix method research used *sequential explanatory* type by combining qualitative and quantitative researchers. Cresswell & Plano Clark (Cresswell, 2012) defines *mix method* is as procedure to collect, analyze, and combine both quantitative and qualitative methods into a research or series of research to understand the problem.

The research used 1 experimental group. This research was begun by finding a problem which was previously explained in background so several research problems could be obtained. The next step was implementing the already learned theories to solve problems and solve the hypothesis.

The data source was taken from the students through critical thinking skill test (CTST), *curiosity*, observational sheet of the students' curiosities, and critical thinking skill interview. The test result was used as the quantitative research data source while the qualitative research data sources were from CTST, the students' answer sheets, questionnaire

results, *curiosity* observational sheet, and mathematics critical thinking skill interview.

The quantitative data analysis was grouped into initial data analysis and final data analysis. Initial data analysis (requirement test) used normality test taken from critical thinking skill test with purpose to find out that the data was normal. Meanwhile, the final data was taken from final critical thinking skill test which the data was used to test the accomplishment. The accomplishment test was grouped into individual accomplishment test by using t-test and classical accomplishment test by using z test, proportional difference test, gain test, and influence test by using regression test. Meanwhile, the qualitative data analysis used three steps: data reduction, presentation, and conclusion.

There were 37 seventh graders of MTs Salafiyah Simbangkulon Buaran, Pekalongan, as the subjects. They were grouped into three *curiosity* levels: high, moderate, and low. Based on the *curiosity* questionnaire result and observation during assistance, it showed 6 students with high *curiosity*, 29 students with moderate *curiosity*, and 2 students with low *curiosity* on rectangular material.

FINDINGS AND DISCUSSION

The learning quality consisted of three stages: planning, promoting, and evaluating stages. Independent learning promoted in this research had met all the stages: (1) planning stage, the already arranged learning instrument was valid, (2) promoting stage, the learning process was categorized excellent and obtained positive responses from the students, and (3) evaluating stage, it had met effectiveness test.

The planning stage was done to prepare learning instrument. It was independent learning assistance guideline, module, critical thinking skill test, *curiosity* inventory, and *curiosity* interview and observation guidelines. The learning instruments were validated by expert - the lecturer of UNNES postgraduate school and educational practitioner, the teacher achiever in Pekalongan. The validations showed that the instruments met the validity criteria and they could be used. The validation result of the learning instruments could be seen on Table 2.

Table 2. Learning Instrument Validation Results

Learning Instrument	Average Score	Categories
Guideline of Independent Learning	4.25	Very Excellent
Module	4.20	Very Excellent
CTST Questions	4.18	Good
Curiosity Questionnaire	4.26	Very Excellent
Interview Guideline	4.30	Very Excellent
Curiosity Observation	4.10	Good

On promoting stage, it was obtained by learning process supervision observation sheet and student curiosity questionnaire. The observation data result of independent learning assistance showed that the percentage of assistance was 77.2%, it meant that independent learning assisted by the module had been categorized excellent. The student questionnaire data with 12 question items obtained maximum average score 4, the lowest average score 2.75, and average score 3.15. Thus, it could be concluded the responses of the students were excellent. Thus, it could be concluded that the students' responses on the learning assisted by module were positive.

On evaluating stage, normality and effectiveness test were done through accomplishment, gain, and influence tests. The normality test was purposed to find out the obtained data whether it was normally distributed or not. Based on the test, it was obtained $sig = 0.200 > 0.05$, meaning that $sig = 0.200 > 0.05$ was accepted or the critical thinking skill test data was from normal distribution.

Then, the effectiveness test, the first criterion was individual accomplishment test. It was a test of the students' critical thinking skill average assisted by module. It should be within actual minimum passing grade. The first criterion used t-test and the significant level showed 5%. It was obtained from $t_{count} = 6.34$ with $t_{table} = 1.69$, meaning that $t_{count} > t_{table}$. Thus, H_0 was denied so it could be concluded that the average of students' mathematics critical thinking skill of experimental group reached actual minimum passing

grade. Thus, it could be said that the requirement of the first effectiveness was met.

On the second criterion, mathematics critical thinking skill of the students on independent learning assisted by module met the classical learning accomplishment if it was higher than 75%. The students reached actual minimum passing grade, 60.00. To test the second criterion, it used classical accomplishment test or one - side proportional test. It resulted to $z_{count} = 0.47 > 0.18 = z_{table}$. Then, it could be concluded that the proportion of the students taught by independent learning assisted by module met the minimum actual passing grade, 60. It had reached 75%. Thus, it could be said that the requirement of the second effectiveness was met.

On the third criterion, the students' critical thinking skill test proportional test after intervened by independent learning assisted by module, was higher than those were not intervened by independent learning assisted by module. On this third effectiveness criterion, the proportional test was done by using z test and significant level 5%. It was obtained the value of $z\text{-count} = 2.88 = z \geq z_{0.5-\alpha} = 0,112$. It meant H_0 was denied so it could be concluded that proportion of the students' mathematics critical thinking skills after the intervention were better than before being intervened.

On the fourth criterion, N-gain test showed that the students' critical thinking skill improved after the intervention. From the test, it was obtained results as seen on Table 3.

Table 3. Recapitulation of *Gain* Index Results

<i>Gain</i> criteria	<i>Gain</i>	Students' Numbers
Digression	$-1,00 \leq g \leq 0,00$	1
Remains still	$g = 0,00$	0
Low	$0,00 < g < 0,30$	17
Moderate	$0,30 \leq g < 0,70$	18

High	$0,70 \leq g < 1,00$	1
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Based on the result of gain index, it was obtained that 36 students from 37 students had improvement. It meant 97.3% experienced improvement and only 1 from 37 students had digression. It meant 2.7% had digression.

The final criterion on effectiveness test was influence of curiosity to critical thinking skill. In this case, it was done by regression test. It obtained sig $0.016 < 0.05$. It meant H_0 was denied. It meant there was influence of curiosity to critical thinking skill of the students assisted by the module.

Based on the effectiveness data, the effectiveness criteria on evaluation stage had been met. The finding are in line with Umit Kopzhassarova *et al* (2016 that independent learning assisted by module was effective to improve the students' mathematics critical thinking skills.

Then, qualitative data analysis was purposed to describe the students' critical thinking skills seen from curiosity in independent learning assisted by module. There were 37 seventh graders of MTs Salafiyah Simbangkulon Buaran, Pekalongan, as the subjects. They were grouped into three curiosity levels: high, moderate, and low. Based on the questionnaire and observation during the assistance, it showed that there were 6 students with high curiosity, 29 with moderate curiosity, and 2 with low curiosity.

Critical thinking skill was described by curiosity levels: high, moderate, and low on five mathematics critical thinking skill process: formulating problems, creating assumption, observing, interpreting information, and analyzing arguments.

The findings showed that mathematics critical thinking skill description seen from curiosity were varied. It was shown by 6 students with high curiosity had 3 students with high critical thinking skills, 2 with moderate critical thinking skill, and only 1 with low critical thinking skill. From 29 students with moderate curiosity, 7 students had high critical thinking skill. 16 of them had moderate critical thinking skill. 6 students had low critical thinking skills. Meanwhile, 2 students with low curiosity reached low critical thinking skill category.

Due to the independent learning assisted by module, it resulted to various mathematics critical

thinking skill descriptions. Students with high curiosity, 3 of them met five mathematics critical thinking skill components: formulating problems, creating assumption, observing, interpreting information, and analyzing arguments. However, two of them only met formulating problem, creating assumption, observing, and interpreting information. Meanwhile, one of the students only met formulating problem.

Students with moderate curiosity also had various critical thinking skill. 7 students met five critical thinking components. 9 students did not meet creating assumption and analyzing arguments. 7 students did not meet observing component. 6 students only mastered formulating problem and observing components.

Students with low curiosity showed low critical thinking skill. From 2 students, they only could master formulating problem component.

Based on the explanation, students with low curiosity had low critical thinking skill than those with high curiosity. The findings are in line with Zetriuslita (2017) stating that curiosity of students influenced positively to critical thinking skills.

CONCLUSION

Based on the analysis and discussion, it could be concluded that independent learning assisted by module was effective in improving critical thinking skill and the students' curiosity plus their mathematics critical thinking skill and the students' curiosity descriptions. They were seen varied. Students with low curiosity would result low critical thinking skills. Then, the curiosity got higher, it would not always have high mathematics critical thinking skill and vice versa. It meant that independent learning assisted by module variously influenced the students' mathematics critical thinking skills.

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