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Mathematics Communication Skill Seen from *Self-Efficacy* of Junior High School Students on *7E Learning Cycle* with Ethnomathematics Nuances

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Abstract

This research aims to describe mathematics communication skill seen from *self-efficacy* on high, moderate, and low categories. It was done for VII graders of Public Junior High School 1 Takengon in academic year 2018/2019. This *mixed method* research used *sequential explanatory* strategy. It is a procedure to collect quantitative and qualitative data orderly. The findings showed that the model was effective to improve mathematics communication skill of the students. mathematics communication skill and *self-efficacy* of each category has different mastery indicators. The differences occurred because students had different developments. Therefore, learning should be undertaken based on their capabilities to understand and needed self-regulation of the students which should be supported by environment.

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INTRODUCTION

One of mathematics learning purposes as stated on fourth point of Education and Cultural Minister Regulation, Number 22 Year 2016 is - mathematics learning has purpose to allow learners having ability to communicate ideas by using symbols, tables, diagrams, or other media to explain certain situation or problem. Through learning mathematics, learners are expected to communicate their notions by using symbols, tables, diagrams or other media to explain a situation or a problem. In learning mathematics, either oral and written mathematics communications are important matters besides reasoning, proofing, mathematics representing, and mathematics problem solving (Putra, 2016).

Tiffany *et al.* (2017) stated that communication is an important factor in mathematics learning process both inside and outside of class. Communication plays important role in mathematics. There are many factors underlying low communication skill level. One of them is feeling afraid during learning mathematics. Thus, mathematics could be considered as difficult lesson. Greenes and Schulman (in paridjo & Waluya, 2017) stating that mathematics are: (a) central power for students in formulating concepts and strategies; (b) capital for students' success and solving problems with exploratory approach and mathematics investigation; (c) place for students to communicate with their peers to obtain information, share thoughts, and find, exchange, assess, and sharpen notions to ensure other people.

One of cognitive aspect is mathematics communication skill. The affective aspect is obtained through receiving, conducting, respecting, understanding, and implementing activities concerning to psychological behaviors. Meanwhile, the psychomotor aspect consists of activities done by students. *Self-efficacy* is an affective aspect element. Bandura (in Fajariah, Dwiyadati & Cahyono, 2018) explained that *self-efficacy* is a belief upon personal skill to regulate and carry out activity of program to be achieved. Therefore, it could be stated that belief of *self-efficacy* could influence an individual's behavior through its impacts on task decision to get involved in it, levels of efforts, and duration of diligence in difficult situation. According to Bandura (in Yuliatika, Rahmawati & Palupi, 2017), *self-efficacy* refers to perception about individual skill to organize and implement action to perform certain skill.

Self-efficacy skill is a skill to have by students. It is in line with the purpose of learning mathematics as stated in 2013 curriculum. It is to have respectful attitude of daily life mathematics usage. In this case, it means to have curiosity, attention, and interest to learn mathematics. It is also to have eager and confidence in solving problems.

In this research, the learning used to improve mathematics communication skill of the students is *7E Learning cycle* with Ethnomathematics nuances. According to Syannansky (in Rawa, Sutawidjaja & Sudirman, 2016), learning process within constructivist's perspective is active activity which allows students to construct their own knowledge, seek the meaning of their learning, and develop new ideas by using prior thinking frameworks. Baita & Sarac (2016) stated that one of innovative learning model in Turkey is *7E learning cycle* since it has high influence. Teachers should take into account this strategy into their teachings and to periodically adjust it to their own teaching styles. Djumhuriyah (in Purnamasari, Aryuna & Maryono, 2017) explained that *Learning Cycle* model centralizes on students as based on constructivism perspective which argues that knowledge is developed from students' prior knowledge. According to Trianto (in Lukito, Tatag & Siswono, 2018) , one of influential factors to weaken mathematics learning is the domination of conventional learning process which is dominated by teacher (*teacher centered*) and it does not provide access for learners to develop independently in term of their thinking process. Mathematics learning should centralize on students. The learning should involve teacher-student interaction, student-teacher interaction, and student - learning medium interaction. Thus, students could actively learn and construct their own knowledge (Pasaribu, 2017).

Khalimah *et al* (2019) stated that one of innovative learning could be done through cultural approach or called as ethnomathematics. Enthomathematics could be defined as specific ways conducted by certain group to commence mathematics activities. Perspective review on Indonesian anthropology consists of hundreds tribes,

such as Gayo, Aceh, Javanese, and many more. Each of the tribe has its own cultures, valuable characters, local quality and wisdom. One of Indonesian tribe is Gayo tribe, inhabiting Aceh plateau with the capital city, Takengon. Gayo tribe has many local cultural wisdom, such as dance, literature, decoration, and etc. Several decorations of the tribe are realized into Kerawang Gayo art, both in the form of bag, clothes, and etc. They have shapes as rectangles or triangles in a mathematics geometrical material. Thus, *7E learning cycle* with ethnomathematics nuances could improve mathematics communication skill and *self-efficacy* of the students during learning mathematics.

The problem formulations are (1) whether *7E learning cycle* model with ethnomathematics nuances will be effective on the students' mathematics communication skills and (2) how the description of the skill seen from *self-efficacy* of *7E learning cycle* model with ehtnomathematics nuances based on high, moderate, and low categories is.

METHOD

This is a *mixed method* research. Creswell (2016) stated that *mixed method* is a research approach involving both quantitative and qualitative data collections which are entailed by philosophical assumptions and theoretical framework. The research strategy is *sequential explanatory.* Creswell & Clark (2007) in Creswell (2016) states that *sequential explanatory* is a procedural strategy to collect quantitative and qualitative data orderly. *Sequential explanatory* is a procedure prioritizing quantitative data rather than qualitative data.

This research was conducted at Public JHS 1 Takengon, in academic year 2018/2019. The population consisted of seven VII grades. The samples were taken based on random sampling and resulted to VII-1 as experimental group and VII-2 as control group. The subjects consisted of six learners as mathematics communication skill subjects seen from *self-efficacy.*

The qualitative data collection techniques were test and questionnaire. The developed mathematics communication skill test was developed in the form of 6 essay questions. The questions were created by considering mathematics communication skill indicators and covered theoretical frameworks of mathematics communication skill assessment. The *self-efficacy* questionnaire consisted of seven indicators with 28 questions. The quantitative data analysis was done through normality and homogeneity tests to determine the hypothesis test. The hypothesis test used t-test and z-test. Meanwhile, the qualitative data analysis was done by documenting, interviewing, and observing on the selected subjects. The qualitative data analysis used Miles and Huberman (1984) as the references by following these stages: (1) data reduction, (2) data display, and (3) data conclusion.

FINDING AND DISCUSSION

The results of initial mathematics communication skill of the students resulted to Actual Accomplishment Standard as calculated by $BTA = \bar{X} + \frac{1}{4}\,SD$ with $\bar{X}$ has class average score and $SD$is the standard deviation (Sudjana, 2009). The data of *self-efficacy* questionnaire usage from ordinal scale needed to be converted into interval scale by using *successive internal method* (SIM) since the statistics test on hypothesis test required interval scale data (Sarwono, 2013). The result of Actual Accomplishment Standard of mathematics literacy is 78 with $\bar{X} = 76{,}31$ and $SD = 6{,}61$.

The effectiveness of mathematics communication skill in *7E learning cycle* with ethnomathematics nuances could be seen from: (1) the average of mathematics communication skill of *7E learning cycle* with ethnomathematics nuances reached mathematics communication Actual Accomplishment Standard; (2) the proportion of mathematics communication skill of the students on *7E learning cycle* with ethnomathematic nuances is minimally 75% from all actual accomplishment standard of the students' mathematics communication; (3) mathematics communication skill on 7E learning cycle with *7E* learning cycle was better than PBL. The effectiveness of mathematics communication skill of the students on *7E learning cycle* with ethnomathematics nuances had met the determined effective criteria by having the processed tested data on left party side, they are (1) the completeness of the experimental group's average score was $t_{hitung} \geq t_{tabel} = 8{,}87 \geq 1{,}68$, thus H_0 was accepted. It means that on significant level

95%, hypothesis stating that mathematics communication skill of the students was higher than 78. It could be accepted; (2) results of mathematics communication skill proportion showed $z_{hitung} \geq z_{tabel} = 2{,}18 \geq 1{,}64$, then H_0 was denied. It meant on significant level 95%, the hypothesis stated that the proportion of the students' mathematics communication skill on the learning was minimally 75% of all AAS of mathematics communication skill could be accepted; and (3) results of mathematics communication skill differences showed that $t_{hitung} \geq t_{tabel} = 3{,}82 \geq 1{,}67$, then H_0 was denied. It meant on significant level 95%, the hypothesis stated that mathematics communication skill of the students on the learning was better than PBL. It could be accepted.

It is in line with Syarifah & Firmansyah (2016) stating that *learning cycle* model was effective than direct learning in mathematics communication and *mathematics* belief. Sritresna (2017) stated that the students' mathematics communication skill from *7E learning cycle* model was better than those taught conventionally. It showed that *7E learning cycle* model could be used as a learning model to improve mathematics communication skill and *self-confidence* of the students in learning mathematics.

Mathematics communication skill of the students in the class by using *7E learning cycle* model with ethnomathematics nuances and the group taught by PBL had connection showing similar high classification. The differences existed on group taught by *7E learning cycle* model with ethnomathematics nuances was higher in terms of its correlation than group taught by PBL.

The qualitative analysis consisted of mathematics communication skill test in the form of answer sheet and *self-efficacy* questionnaire of the students based on high, moderate, and low categorizations. The categorizations were based on Azwar categorization (2016) by seeking the lowest and highest scores which would be ideal mean and standard deviation by following formula.

$$Ideal\ mean = \frac{1}{2} \times (\max score + \min score)$$

$$\text{Standard Deviation} = \frac{1}{6} \times (\max score - \min score)$$

Category of Mathematics Communication Skill (MCS) results and *self-efficacy* could be seen on Table 1.

Table 1. Categorization of Mathematics Communication Skills

Interval	Categories
$X \geq 78$	High
$66 < X < 78$	Moderate
$X \leq 66$	Low

Table 2. Categorization of *Self-efficacy*

Interval	Categories
$X \geq 71{,}65$	High
$57{,}02 < X < 71{,}65$	Moderate
$X \leq 57{,}02$	Low

Based on the data analysis of mathematics communication skill test, it was obtained that generally the students with high category could master all indicators of mathematics communication skill excellently. On indicator to express real object, situation, and daily life event into mathematics model (figures, tables, diagrams, graphs, and algebra expressions) the students could state the information accurately and explain them into figures properly although they had several mistakes. On indicator to explain mathematics ideas and models (diagram, table, figure, graph, and algebra expression) into common language was already excellent. It could be seen that they had been able to select appropriate method based on the already analyzed figures although they still had mistakes. On indicators of explaining and creating mathematics questions, indicators dealing with listening, discussion, and writing mathematics, indicators dealing with understanding of a written presentation and indicators dealing with creating conjecture, composing arguments, and formulating definition and generalizing were already excellent and had no mistakes. It is in line with Khoriyah (2016) that subjects with high score category of mathematics communication skill had been capable to communicate through explaining mathematics ideas by using figures. They were able to analyze figures and deliver explanation accurately. Rizqy, Suyitno & Sudarmin (2016) stated that mathematics

communication skill for high categorized students was seen from mathematics idea expression, visual form description, and notation and mathematics term usages.

In another hand, students with moderate mathematics communication skill had mastered several indicators. On indicator of explaining and creating question, and indicator dealing with creating conjecture, composing argument, formulating definition and generalizing, the students still committed many mistakes. It indicated they had not been able to master those two indicators properly. Meanwhile, dealing with other indicators, they had been able to master them. It is in line with Pujianto & Masrukan (2016) that subjects with moderate mathematics communication skill could express mathematics ideas, understand, interpret, and evaluate them. They were not capable of using mathematics terms, notations, and structures to present ideas, describe the connection to situation model. Lamonta, Tandiayuk & Paluhulawa (2016) stated that subjects with moderate skill reached two mathematics communication skill indicators. They were stating mathematics problems concerning to bar volume into figures and state a figure into mathematics ideas or problems concerning to bar volume. Then, they could solve it.

Learners with low mathematics communication skill category still had many weaknesses in mastering the indicators. Almost all indicators had not been mastered but only stating real objects, situation, and daily lifes into mathematics model forms (figures, tables, diagrams, graphs, and algebra expression), indicator of explaining ideas and mathematics models (figures, tables, diagrams, graphs, and algebra expression) into common language, and indicator to create conjecture, compose argument, formulate definition and generalization. It is in line with Hikmawati, Nurcahyono & Balkist (2019) stating that mathematics communication skill of low category student seemed to be dominant on two aspects: *written text* - consisted of explaining ideas, situations, and written mathematics relations, and *drawing* - consisted of stating ideas into visual and categorized formation in expressing ideas or notions into mathematics expression. Generally, the mastery of the indicators from high category students consisted of eight students. The moderate category consisted of 21 students. Meanwhile, the low category consisted of five students. They were all varied.

Learners with high *self-efficacy* generally had mastered all *self-efficacy* indicators. However, dealing with confidence indicator of their success, it was seen some of them were not so sure and feeling doubt to solve the mathematics problem. It is in line with Fajariah, Dwidayati & Cahyono (2017) explaining that high self-efficacy students seemed enthusiast to follow lesson and pay attention on teacher's explanation. They also listened their friends while their friends presenting and they were good behaved both at school and home, especially dealing with working on task. They noted the materials and prepared their equipments and materials. They would remember all information given to them. According to Hamdi & Abadi (2014), *self-efficacy* influenced learning achievement. Efficacy is primary principle of an action. An individual with efficacy would commit a certain action called *self-efficacy*. Efficacy would allow them solve certain problem which is known as *self-efficacy.*

The analysis of the students with moderate *self-efficacy* generally showed they were less capable in mastering confidence indicators of their success and indicators of being aware upon their own strength and weaknesses. According to Dimyati & Mudjiono (in Agustyaningrum & Suryatiini, 2016), the external factors cover teacher as coaches at school, and curriculum. Meanwhile, internal factors are such as attitude toward learning, learning motivation, learning concentration, storing learning outcome acquisition, recalling saved learning outcomes, ability to have achievement or to perform learning outcomes, confidences, intelligence, learning habits, and ideals.

Learners with low *self-efficacy* were lack in several indicators, such as solving problem, confidence to success, and interaction to other people. It is in line with Wasida & Hartono (2018) explaining that all students did not answer confidently in solving problems. However, they could work on the questions if they had more exercises, learn seriously, and did a lot of repetition. Some students were not confident in obtaining satisfying mathematics scores. It was due to the students tended to copy their friends' jobs if they could not

solve the questions. Thus, when they were asked to solve it alone, they would have difficulties in solving them. Novferma (2016) explained that low *self-efficacy* of students on mathematics is indicated by many of them do not want to try solving the questions. They tend to surrender when they face difficult tasks.

CONCLUSION

It could be concluded that 7E *learning cycle 7E* with ethnomathematics nuances was effective to improve the students' mathematics communication skills. The mathematics communication skill seen from *self-efficacy* of the students, on each category, had different mastery indicators. These differences occurred because they developed differently. Students with high *self-efficacy* would not always have high mathematics communication skill and vice versa. Therefore, meaningful learning process and self-regulation of the students which were supported by surrounding environment would provide excellent impacts on their mathematics communication skills and *self-efficacy*.

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