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Mathematics Literacy Skill Based On Self-Directed Learning On Meaningful Instructional Design Based Outdoor Learning

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Abstract

This research aims to describe mathematics literacy skills seen from *self-directed learning* of X graders. This *mixed method* research used sequential explanatory design. The subjects were selected based on each *self-directed learning* category. The category consisted of high, moderate, and poor by using *purposive sampling* to determine the sample. The findings showed that descriptive learning of mathematics literacy skill seen from *self-directed learning* of the students was varied based on their characteristics. It was shown by 9 students with high *self-directed learning* with 2 of them high category, 6 moderate category, and 1 poor category. From 24 moderate *self-directed learning* students, 2 of them were categorized high, 21 moderate, and 1 poor category. From 3 poor *self-directed* students, 1 of them was categorized high while the others were categorized poor.

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INTRODUCTION

Mathematics literacy skill is assumed as one of the most important component needed by students to solve PISA problem questions (Fathani, 2016). It is a knowledge to find out and implement mathematics in daily life (Ojose, 2011; Nurdianasari, Rochmad, & Hartono 2015; Nitasari, Suyitno, & Isnarto, 2018; Wahyuningsih & Waluya, 2017). According Salim & Prajono (2018); Nuurjanah, Hendriana & Fitrianna (2018) stated that literacy is capability of students to formulate, use and interpret within all different context. It implicitly says that teaching and learning mathematics literacy should not only focus on abstract mathematics (Machaba, 2018).

According to Wardono & Mariani (2017) ted that mathematics literacy skill motivated students to find and develop thinking ways in communicating mathematics ideas. Mathematics plays important roles in daily life and our professionality as individual and society member (Cahyono & Ludwig, 2017). According to Pohjolainen, S., Nykänen, O., Venho, J., & Kangas, J. (2018), the good mathematics competence is important in sciences, technology, and economy because mathematics is assumed as natural language while technology is important as well as methodology in economy and social sciences. However, the use of mathematics literacy skill at schools or societies have not shown its results.

Result of Programme for International Student Assessment (PISA) in 2015 stated that mathematics achievement of Indonesian learners was in rank 63 out of 70 countries, with score 386 from the average OECD score 490. Meanwhile, the achievement of Indonesian learners' reading was ranked 63 out of 70 countries, with average OECD score 496. It indicated the learning process had not been able to develop each individual's potencies to create golden reliable generation. Mathematics literacy skill was proposed by National Council of Teacher og Mathematic (NCTM) (2000) as a vision of mathematics education to be mathematics literate.

According to DBE (Machaba, 2018), mathematics literacy is a subject to develop learning competence and participants to contribute in 21st century. There are seven components of mathematics literacy: communication, mathematizing, representation, reasoning and argument, devising strategies for solving problems, using symbolic, and using mathematics tools (OECD, 2013). The mindset of students is trained thorugh literacy process, especially mathematics literacy which is formulated, applicated, and interpreted (Efriani, Putri, & Hapizah, 2019). According to Mulyono & Lestari (2016), mathematics literacy is an important skill to master by students because it facilitates them to understand and use mathematics in real life. To master the skill, students should master process component of each faced problem.

In the learning process, it is supported by students called as self-directed learning. According to Houle (Conradie, 2014), self-directed learning is a process which an individual or group tries to develop themselves by improving skill, knowledge, and providing their learning needs. It is in line with Gibbons (2002) stating that self-directed learning is an improvement of knowledge, skill, achievement, and personal development selected by students with their own efforts.

From the problem, it makes students to self-direct their learning in developing mathematics literacy skill. Self-directed learning is an effort to improve knowledge, skill, achievement, or personal development from their own efforts in any situation and anytime (Gibbons, 2002). It is aggred that in improving mathematics literacy skill in real life, it should not be structuralized based on the topics (Machaba, 2018). However, the roles of the teachers at school in improving the skill could be done by providing chance for them to develop, to practice in deciding, and to solve their own problems. By using suitable method for each material, it will have influence to their cognitive development. Constructivism learning approach could make learners more independent and create their own experience (Fandholi, Waluya, & Mulyono, 2015)

The good support of learning process is suitable learning method for each material. Meaningful instructional learning model is concentrated on meaningful learning and must be started by basic and detail content concept (Kember, 1991) by integrating it to outdoor learning. According to Deane &Harre; Gair: Stiehl & Parker (Robbins, 2015), outdoor learning is a unique learning done outside of classroom which provides

students chance to train their skill in real life. It is in line with (Cahyono, 2018) telling that mathematical outdoor is an educational process in outdoor place; learning is about the nature and is purposed for the better future of environment. It supports students' experiences in exploring knowledge wider and more fun. Outdoor learning is an alternative to get closer with the nature directly (Hastutiningsih, Prasetyo & Widiyaningrum, 2016).

The formulation of the reasearh is how mathematics literacy skill of the students seen from self-directed learning is. This research aims to analyze mathematics literacy skill of the students seen from self-directed learning.

METHOD

This mixed method research with sequential explanatory design had procedures started from data collection and quantitative data analysis in the first stage, followed by data collection and qualitative data analysis in the next stage (Cresswell, 2009). This research was done at SMK Negeri 2 Pati, Central Java. The sample consisted of 36 students with 6 subjects with each self-directed learning category consisted of 2 students taken by purposive sampling technique.

The data collection was done by test, inventory, interview, and observation. The test instrument was mathematics literacy skill test (TKLM) and inventory in the form of self-directed learning inventory. The quantitative data analysis was done by normality test, homogeneity test, and average of passing grade test, variance test (t-test) on nominalized N-gain data, and influence test. The qualitative data analysis was done by triangulation and source. Then, to get the valid data, the data was reduced, presented, and concluded.

RESULTS AND DISCUSSION

In the research stage, the learning outcome was measured quantitatively by testing their mathematics literacy skill and self-directed learning inventory. The test was done for both groups. The requirement test showed that the test results were homogeneous and normally distributed. The average of passing grade test showed $t_{count} = 7.418$ higher than $t_{(1-0,05;n)} = 2.037$. Thus, H_0 was denied. It showed that the average of mathematics literacy skill reached the actual standard limit (BLA = 60). Then, variance test of normalized gain data was done to find out improvement of mathematics literacy skill for both groups. It was gained t_{count} 2.054 with significant level $\alpha = 5\%$. The score of $t_{(1-0,05;n-1)}$ was 1.995. Since 2.054 > 1.995 then $t_{count} > t_{(1-0,05;n-1)}$. Thus, H_0 was denied. Thus, the average score of their mathematics literacy skill of experimental group was higher than control group.

Based on statistics test data of self-directed learning influence with mathematics literacy skill on meaningful instructional design based outdoor learning. It was gained regression equation $\hat{Y} = 46.387 + 0.408X$, meaning that each one score increase of self-directed learning, there would be improvement 0.408 of mathematics literacy skill. The test of linier regression test showed that there was positive influence of self-directed learning to mathematics literacy skill of the students although it was not dominant. Self-directed learning only influenced mathematics literacy skill 9.7% while the remaining percentage – 90.3% was influenced by other factors.

The findings of written test, interview, and observation would be analyzed to get related qualitative data to mathematics literacy skill seen from self-directed learing. The respondent inventory of self-directed learning consisted of 36 students of experimental group. The inventory result was divided into 3, they were high, moderate, and poor. From 36 students, there were 9 students categorized high, 24 categorized moderate, and 3 of them categorized poor.

Table 1. Categorization of the Students Seen from Self-Directed Learning

Criteria	Students' Numbers	Percentage
High Self-directed learning	9	25
Moderate Self-directed learning	24	66.67
Poor Self-directed learning	3	8.33
Total	36	100

The findings showed that meaningful instructional learning design based outdoor learning had better improvement and description of mathematics literacy skill seen from self-directed learning and it was varied. It was shown by Table 1. There are 9 students with high self-directed learning. From them, there were 2 categorized high, 6 moderate, and 1 poor. From 24 moderate self-directed learning students, there were 2 students categorized high, 21 moderate, and 1 poor. From 3 poor self-directed learning students, there were 1 high and 2 poor category students.

Based on the findings, the mathematics literacy skill of the students had variances of mathematics literacy skill achievement from each category. It was supported by Estell (2018) telling that self-directed learning is as explicit and transparent self-development for students to maintain and practice information literacy outside of classroom. It was also in line with standard of mathematics literacy skill – consisting of seven components on level 9 – 12 as formulated by NTCM (2000). It stated that students should be able to communicate their thoughts to other individuals both written and spoken. They learnt to be clear, ensure, and be accurate in using mathematics language. The students should be able to interpret mathematics ideas in various ways such as pictures, tables, graphs, symbols, and so on.

Students whose mathematics literacy skill with poor self-directed learning category could not achieve several components such as communication, reasoning and argument, and representation. It was in contrast to several principles and standars for 9 – 12 school mathematics levels as formulated by NCTM (2000). It stated that students should be able to think analytically to pay attention on pattern, structures, and orders of real world and mathematics situation plus to develop and express their knowledge about various problems. Besides that, Machaba (2018) stated that mathematics literacy skill of each individual should have sufficient understanding about various mathematics concepts and and should be able to find out how and when to use it.

Based on the findings, the mathematics literacy skill of experimental group was better. It was found on high self-directed learning category students. It was supported by Gibbons (2002) telling that high self-directed learning score had characteristics such as educators could identify their learning material need, make learning plan, and execute the plan. Meanwhile, poor self-directed learning students could not manage their learning need, learning strategy, and their dependency on their peers. It was supported by Kleden's statement (2016) telling that the improvement of mathematics learning of high self-directed learning category students.

It is supported by Kleden (2016) that there was improvement on students with high self-directed category. In another hand, the moderate self-directed learning, frequently experienced fluctuation during solving problem. There was a mistake in delivering reasoning and argument components.

It was supported by Gibbons (2002) telling that moderate self-directed students had successful characteristics in independent situation although they could not fully identify learning needs and implement learning plan. However, according to Guglielmino (in Guglielmino, 2008) told that self-directed learning is grouped into various situations, started by directed classroom by teacher so learning project could be designed and developed by themselves which would be developed as responses toward personal interest and needs or working place and was done collaboratively or independently.

CONCLUSION

Based on the analysis and discussion, it was gained description of mathematics literacy skill seen from self-directed learning of the students that it had various characteristics. It was shown that self-directed learning could not influence mathematics literacy skill. Therefore, the effective learning should focus on learning activity.

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