The Analysis of Mathematical Literacy in Terms of Learning Independence by Using *Treffinger* Learning through LMS-Assisted Dynamic Assessment

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Abstract
This study aims to describe mathematic literacy in 8th grade of State Junior High School 6 Semarang in *Treffinger* learning model by using dynamic assessment in terms of student's learning independence which is categorized into high, medium, and low. The source of data in qualitative data analysis is observation results, mathematic literacy test results, and interviews. It is selected six students namely 2 students in the high category, 2 students have medium category, and 2 students in the low category. The research shows that students with high learning independence have excellent result of mathematic literacy test, whereas they who have medium learning independence get has good result of mathematic literacy tests, and students with low learning independence are still lack mathematic literacy.

Keywords: Mathematic Literacy, *Treffinger*, Learning Independence, Dynamic Assessment, LMS

1.0 Introduction
Every man has the right to education, especially mathematic education. It has a fundamental role, therefore, it has been taught from primary school to college. Mathematic learning is related to some reality problems, it is called mathematic literacy. Kusumawardani, Wardono dan Kartono (2018) stated that it is used for implementing the basics of math in daily life.

According to the observation and interview results from some students in State Junior High School 6 Semarang, learning math still depends on the teacher. When the teacher gives a chance for asking, students do not take advantage of it. Moreover, they also state that sometimes they do not

learn the lesson material first before the class. Some of them also do not want to have a discussion with their friends regards to mathematic assignment. In sum, students' learning independence level of State Junior High School 6 Semarang is still low. It still needs students' learning awareness, so they will not depend continuously on the teacher.

Learning independence can also affect students' quality. Syahputra (2017) defines that the low students' learning independence will affect students' achievement, lack of responsibility, and dependence on others. In addition, a suitable learning model is still needed to enhance learning effectiveness. Therefore, in this study, the researcher uses the Trefingger learning method to increase students' learning awareness, they will be more active in learning mathematic. The teacher approach also plays a big role to increase students' understanding. In evaluation, the teacher uses Schoology as an alternative learning medium to deliver the lesson. Based on the explanation above, the researcher conducts the study about mathematic literacy in terms of learning independence by using *Treffinger* learning model through LMS-assisted dynamic assessment.

1.1 Research Problem

The research problem is about how the literacy mathematic description in the terms of learning independence by using *Treffinger* learning model through Learning Management System -assisted dynamic assessment.

1.2 The objective of the Study

The objective of this is study is to describe the mathematic literacy description in the terms of learning independence by using *Treffinger* learning model through Learning Management System - assisted dynamic assessment.

2. Review of Related Theories

This study reviews some theoretical studies namely (1) mathematic literacy, (2) learning independence, (3) *Treffinger* , (4) dynamic assessment, and (5) *LMS.*

2.1 Mathematic Literacy

According to Ojose (2011), mathematic literacy is students' basic knowledge such as understanding and applying mathematic discipline in their daily life. Moreover, Afriyani, Wardono dan Kartono (2018) defines that mathematic literacy is the ability to implement the mathematic concept, procedure, fact, and its tools which are used to measure individual ability. Integrating reading, writing, and speaking ability can lead students into more complex learning activities. On the other hand, based on Wardono dan Masjaya (2018), mathematic literacy means involving mastery of the writing system and its conventions. In addition, Madyararti (2019) highlights that it can be done by students by formulating mathematics problems, implementing them, and interpreting them in various contexts.

In PISA 2015, there are seven basic abilities used in mathematic process category, namely (1) Communication, in mathematic literacy involves an ability to communicate something by recognizing and understanding the mathematic problems. (2) Mathematization, it is used to convert a problem in the reality into mathematic form and vice versa. (3) Representation, it is an ability in presenting a mathematic problem in graphics, tables, diagrams, pictures, equations, formulas which can explain the problem. (4) Reasoning and argumentation, it is related to logical thinking that explores and connects the problem. This ability aims to conclude, check the data, and find a solution for the problems. (5) Designing a strategy to answer the mathematic problems, it is such an

important ability because it will help to finish the easiest problems until the hardest one. (6) Using symbolic language, operation, form, and technique includes understanding, interpreting, manipulating, the use of the symbolic expression in mathematic context, and the use of formal construction such as definition, rules, and formal system in mathematic literacy. (7) Using mathematic tools, it is an ability to use mathematic tools such as measuring tools, calculators, technology-based tools.

2.2 Learning Independence

Laksana (2019) defined that learning independence is a learning activity that does not depend on others. The learners have a will, initiative, and responsibility to cover up the problems independently. Kozma, *et al* in Sundayana (2019) stated that learning independence is a learning activity in which every student has their own ideas with or without help from others. It involves checking learning needs, formulate learning objectives, identifying learning sources, choosing and applying appropriate learning strategy, and evaluate the results. Moreover, according to Sumarni in Sumarmo (2016), learning independence has some indicators, namely: intrinsic learning initiative and motivation; (2) analyzing learning needs; (3) setting up learning objectives; (4) considering difficulty becomes a chance; (5) finding and using learning source; (6) choosing and applying appropriate learning strategy; (7) one's self-concept or self-efficacy.

Wijayanti (2020) stated that learning independence and mathematic literacy have positive effects on learning activity. It is 55,3%. Every learning independence has different effect in every mathematic literacy aspect.

2.3 *Treffinger* Learning Model

In this study, *Treffinger* Learning Model results effective effect because students' mathematic literacy test has increased. This study is as same as Rifa'i, Asep, dan Ira's (2020) study. It shows that the teacher can use *Treffinger* learning model as suitable teaching and learning strategy since it can improve students' thinking skills. For instance, when they discuss with their group, they will be more responsible and direct each other. In this session, the teacher has a role as a supervisor. The learning process in this study uses LMS namely Schoology. It is chosen because of the daring system. During the learning process, the researcher uses dynamic assessment to assess students' development in each meeting. In addition to this, according to Ndiung (2019), mathematic teachers are suggested to use *Treffinger* learning model since it has a significant effect on mathematic teaching-learning.

Moreover, Virlani (2019) highlighted that *Treffinger* learning method involves teacher to improve student's ability by asking some questions regarding to the lesson material, then they are asked to discuss the given problems, and try to find the solution. At the end of the lesson, the solution must be connected to real life. In contrast, Huda (2013) defined three steps in *Treffinger* learning method namely (a) Understanding Challenge, (b) Generating Ideas, (c) Preparing for Action.

2.4 Dynamic Assessment

According to Vygotsky in Poehner (2008), dynamic assessment is an assessment to measure a student's dynamic ability or understanding student's various abilities. In addition, Cho, Compton, and Josol (2020) dynamic assessment functions for measuring students' actualization in learning, later in the self-assessment, they will be able to assess their actualization ability. To sum up,

dynamic assessment is a method that focuses on picturing students' potential development (Daneshfar, 2018).

In running it, the researcher or examiner collaborates with the students in enhancing students' knowledge to a higher level. Afterward, she gives some motivations to the students such as guiding questions completed with their directions and explanations. Through this way, the researcher can understand students' ability for this moment and the future. Next, she analyses and asses students' development by using mediation between students and teacher or another one. The evaluation process does not only focus on students' performance through a single achievement test but also it is evaluated from coordination results with the teachers or their fellows. Thus, in the future, they do not depend on the teacher anymore to finish the problems in mathematic lesson.

2.5 *Learning Management System* (LMS)

According to Wiboow (2014) *Learning Management System* (LMS) is an application for an online teaching-learning program. Moreover, Fitriani (2020) added that it will be useful for bolstering and managing online learning activities in the college. This study uses LMS named Schoology to help the teacher delivering the lesson including the mathematic assignments. Rendra (2018) stated that Schoology is one of the free web-based LMS. The teaching and learning activity can conduct as same as a face-to-face learning activity. The use of LMS is effective since students' success is higher than students' failure (Listiawan (2016)). Schoology also has some features for facilitating the teaching-learning activity, so it can run well.

3. Methodology of Research

In this study, the researcher uses the qualitative research method for the primer data. According to Sugiyono (2017), population is the generalization consisting of an object or subject which has certain quality and characteristics. It is determined by the researcher then drawn the conclusions. The population of this study is all students grade VIII State Junior High School 6 Semarang 2021/2022. The sample is selected randomly by using the cluster random sampling technique. Grade VIIIC is the chosen one to apply *Treffinger* learning method by using LMS-assisted dynamic assessment. The technique of data collection for qualitative data is triangulation methodology.

According to Alfansyur (2020), triangulation is one of the ways to test the data validity from different sources. It aims to avoid double meaning when the researcher collects and analyzes the data. In sum, it is a merge of data collection technique and the source of the data. Qualitative data source comes from participative observation, mathematic literacy test, and deep interview.

In this study, data analysis is done continuously by giving some questions to the students. During the research, the researcher takes an important note. The first data analysis has been done before implementing the *Treffinger* method such as observing the school environment. The second data analysis is done during conducting the research. The last data analysis is done after implementing the learning method. When the researcher analyses the data, but the result has not met with the data credibility, she will collect the data again until it is credible.

4. Discussion

Based on the observation results, the researcher processes the obtained data and classifies it based on the categories which have been determined. The following are the results of the experimental class student independence learning questionnaire.

Table 3.1 Independence Learning Questionnaire Results

Category	**Range**	**Students**	**Percentage (%)**
High	85<N<120	10	31 %
Moderate	49<N<85	16	50 %
Low	N<49	6	19%
Total	-	32	100%

The researcher classifies the learning independence into high, moderate, and low based on the counted average scores by 67,063 and deviation standard by 18,26. Both learning independence average scores and standard deviation are summed up to find the range of independence learning with the high category. Meanwhile, to find the low category is based on the difference between the independence learning average scores with its devaition standard. Based on the calculatiob, it results 85<N<120 for high score range, 49<N<85 for moderate score range, and N<49 low score range. Then, the students are classified according to score range. Therea 10 students with high category by 31%, 16 students with moderate category by 50%, and 6 students with low category by 19%.

Based on the classification above, the researcher chooses 6 from 32 students with three categories, namely 2 students in the high category, 2 students in the moderate category, and the last 2 students in the low category. The 6 students which have been chosen within A-29 and A-12 codes for the high independence learning category, students with A-10 and A-21 codes categorized as moderate independence learning, and students with A-08 and A-09 are categorized as low independence learning. These are the following table based on the 3 categories of independence learning.

Table of Independence Learning Category

Category	**Subject**
High	**A-12** **A-29**
Moderate	**A-10** **A-21**
Low	**A-08** **A-09**

After analysing the questionnaire of the independence learning, the researcher analyzes its impact on the mathematics literacy test result. Mathematics literacy is described as the independence learning questionnaire. The analyzed mathematics literacy is adapted to seven

processes of mathematics literacy, namely *communication, mathematising, representation, reasoning and argument, divising strategies for solving problems, using symbolic, formal, and technical language and operation,* and *using mathematics tools.*

The students with the high independence learning category, namely A-12 and A-29 students have excellent results in mathematics literacy. Although the mathematics literacy results between A-12 and A-29 students are different, they have mastered the process of mathematics literacy well. A-12 and A-29 students are very good in *communication, mathematising, representation, reasoning and argument, divising strategies for solving problems.* Meanwhile mastering *using symbolic, formal, and technical language and operation,* and *using mathematics tools* has been categorized as good.

The students in the moderate independence learning category, namely A-10 and A-21 are having good results in mathematics literacy. A-10 and A-21 students master the process of mathematics literacy, namely *reasoning and argument, divising strategies for solving problems* excellently. On the other hand, *communication, mathematising, representation,* and *using mathematics tools* are mastered well. In *using symbolic, formal, and technical language and operation* students are in good enough in mastering those processes. The students in the moderate independence learning category still have lack process taking mathematics literacy. Students are still not careful in finishing the mathematics problems and still don't understand to use mathematics symbols, so it hinders or reduces the result of the mathematics literacy test.

The students with the low independence learning category have fewer results in mathematics literacy tests. The students within A-08 and A-09 codes are less mastering *communication, mathematising, representation, reasoning, and argument, using symbolic, formal, and technical language and operation,* dan *using mathematics tools.* However, A-08 and A-09 students can master *divising strategies for solving problems* matter in good ways. The students get some obstacles in the six processes of mathematics literacy because those students still cannot answer completely while solving the mathematics problems. The students still cannot convert the mathematics problems to mathematics forms or describe the existing problems. Based on the fact above, it leads to the lack of students' understanding and carefulness in solving the mathematics results.

Communication indicators, for the students which have the high independence learning in answering the question. They can write completely and clearly. They are also able answer correctly about the prior knowledge, the questioned problems, and they can draw a conclusion at the end of their answers. However, the students with moderate independence learning are still incomplete, unclear, or wrong in answering the literacy test. The students with low independence learning usually can not describe the prior knowledge, the questioned problems, or draw the conclusion at every end of answers.

Mathematizing indicators, students with high independence learning can convert the mathematics problem into mathematics forms. For the moderate independence learning, students are still incorrect in converting it into the mathematics form, but they can draw the mathematics problems' conclusion correctly. Those are different with the low independence learning students. They still find it difficult to convert the mathematics problems into mathematics forms, so in mathematizing indicators, the students have not mastered it yet.

Representation indicators, the high independence learning students, they can define the problem and describe it clearly according to the known mathematics problem. However, the moderate independence learning students sometimes can draw or describe the known mathematics

problem less clear but accurately. For the low independence learning category, students still cannot describe the existing problems.

In *reasoning and argument* indicators, students with high and moderate independence learning can explain the mathematics problems completely and accurately based on the ideas and reasons. However, the low independence learning students state their ideas and reasons for the mathematics problem in less complete and less accurate.

In *divising strategies for solving problems*, the high and moderate independence learning students can solve the mathematics problem according to the strategies which have been explained by the teachers when delivering the learning, by writing the formula and describing into steps in solving the problem. For the students with the low independence learning, they can write the formula but they cannot proceed to the solving steps from the mathematics problems.

In *using symbolic, formal, and technical language and operations* indicators, students with high independence learning are still less accurate in using the mathematics symbols but they can use the symbols correctly. The students which have the moderate independence learning can use the mathematics symbols correctly but in solving or using the mathematics symbols are still fewer. For the low independence learning category, students still cannot use or operate the mathematics symbols correctly.

For *using mathematical tools* indicators, the students with high and moderate independence learning have the ability to describe or to draw the problems into tables or objects configuration orderly. For the students with low independence learning category, in describing or thick drawing or objects configuration are still not in good order.

Based on the explanation above, it can be concluded that independence learning affects the mathematics literacy process. It meets to the study conducted by Ricky (2018), he found that the students with high independence learning have the better level in learning because they can understand, evaluate, and manage the learning time effectively and efficiently, so they can finsih their assignments well with high results as well. This is in line with the study conducted by Yanuarto (2020). He states that the students with high independence learning are very capable to solve mathematical problems in accordance with the seven components of mathematics literacy. However, the students with moderate learning independence are able to solve the problems which are related to mathematics literacy, and the low independence learning students have only a few components of mathematics literacy. Kholifah's (2020) research results that most students with high independence learning are not able to proceed in *reasoning and argument* process, the moderate independence learning students cannot proceed in *devising strategy for solving problems* process, and the students with low independence learning cannot proceed in *mathemarising* steps. In sum, the explanation above proves that independence learning affects the results of the mathematics literacy test.

5. Conclusions

Mathematic literacy in terms od learning independence has positive effect in learning process. It proves in the grade VIII state Junior High School 6 Semarang in academic year 2020/2021. The learning process runs well. The teacher has suitable teaching method, model, and strategy, so the students are enthusiast in learning.

Here are some conclusions regard to mathematic literacy in terms of learning independence

1) Mathematic literacy in terms of high learning independence
   The students with high level of learning independence has excellent mathematic literacy. They master five components of mathematic literacy namely *communication, mathematising, representation, reasoning and argument, divising strategiesfor solving problems.* For mastering *using symbolic, formal and technical language and operation,* dan *using mathematics tools* incuded to good category.
2) Mathematic literacy in terms of moderate learning independence
   The students with moderate level of learning independence has good mathematic literacy. It can be viewed from the way how they master mathematic literacy processes. They master *reasoning and argument, divising strategies for solving problems* excellently. However for *communication, mathematising, representation,* and *using mathematics tools* components, they master them well. For *using symbolic, formal and technical language and operation,* they are still in good enough category.
3) Mathematic literacy in terms of low learning independence
   The students with low level of learning independence are still lack of mathematic literacy
   They only master in *communication, mathematising, representation, reasoning and argument, using symbolic, formal and technical language and operation,* and *using mathematics tools* components in good enough way. On the other hand, in *divising strategies for solving problems* category, they can master it well.

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