Mathematical Literacy Seen from Learning Independency in *Blended Learning* with *Project Based Learning* Assisted by *Moodle*

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Article Info

Abstract

Mathematics literacy and learning independency have important roles for individuals' decision making to solve life problems. One of such efforts within the growth of 4.0 industrial revolution era is by applying technology in learning. Blended learning model with PjBL assisted by Moodle is a learning alternative by using technology and two learning methods: offline learning by using PjBL and online learning by Moodle. This research aimed to describe mathematics literacy seen from learning independency on Blended learning with PjBL assisted by Moodle. This mixed method research used explanatory sequential design. The population in this study was 10th grade of MAN 2 Kota Pekalongan. The quantitative data was selected by *purposeive* sampling. The subject categorization was based on learning independency: high, moderate, and low. The findings showed that Blended leanring with PjBL assisted by Moodle was effective in improving mathematics literacy and student learning independency. The description of the improvement seen from learning independency obtained various results as shown by high learning independency which reached high and moderate mathematics literacy skills. Moderate learning independency students reached high, moderate, and low mathematics literacy skills. Meanwhile, the low learning independency students reached moderate and low mathematics literacy skills.

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INTRODUCTION

Literacy is a skill to process information and to implement reading, writing, representing, and calculating techniques into various context with various media (Rosa & Orey, 2015). Based on PISA result in 2015, Indonesia was in 63rd rank out of 72 countries (OECD, 2016). It showed that student mathematics literacy was still low. Mathematics literacy is defineds as ability to formulate, apply, and interpret mathematics in various context, including reasoning skill mathematically by using concepts, procudures, fact, and meants to describe, explain, and predict phenomena or events (OECD, 2016). Besides that, mathematics literacy makes an individual to be able indeciding based on constructive – mathematics thinking pattern (Wardono, 2018).

Based on OECD (2017), mathematics literacy could be analyzed on three aspects: (1) process, covering communication, mathematizing, representing, reasoning and argument, devising strategies to solve problems, using symbols, using formal and technical language and operation and using mathematics tools; (2) content, covering change and relationship, space and shape, quantity, and uncertainty and data, and (3) context, covering personanlity, occupation, society, and science.

Learning independency is an affective factors to be master by students. Based on Regulation of Education and Cultural Minsitry Number 21, Year 2016 about Content Standard of Primary and High Education, it is clearly stated that dealing with students' skills, they are required to be independent in thinking, processing, and presenting. Learning independency is a designing process and careful self-monitoring toward cognitive and affective aspects of learning. Based on Macaskill and Taylor (2010), learning independency scale of students covers independence of learningand habitual study. Independence of learning is defined as process in which students obtaining knowledge and developing ability by their own efforts (Nagpal et al, 2013). Habitual Study is defined as habits which are used to learn (Lawrence, 2014). Adopting Mascaskill and Taylor (2010), the indicators used in this article are shown in Table 1.

Table 1. Learning Independency Indicators

Learning Independency Scales	Learning Independency Indicators
Independence of learning	Enjoying new experience Being open-minded to new methods. Loving challenging questions. Trying to solve alone. Enjoying discovery process. Being motivated to work in time. Being responsibility upon the obtained scores.
Study habits	Having good time management. Having good ability to manage time for daily activities. Managing times to effectively learn. Finding resons to not delay works. Working independently.

An effort which could be done by a teacher to improve such literacy and independency is by developing innovative learning. Dianawati (2018) stated that blended learning is an appropriate learning to reach the objective. One of the activity realization of the model is individualized learning. It makes students being independent in accessing information or learning materials online via internet (Hasubllah, 2014).

Blended learning with Project Based learning assisted by Moodle is a combination of two of them, offline and online learning assisted by Moodle. It makes the students not only learn in the classroom but also independently learn by using technology (internet), outside of classroom learning.

Modular Object Oriented Dynamic Learning Environment (Moodle) is an application which can change a learning medium into web form (Kartika et al, 2018). Moodle supports various activites in learning, such as material delivery, assessments (task and quiz), monitoring and communication/interaction. The learning syntaxs of blended learning with PjBL assisted by Moodle are (1) material delivery, (2) project determination, (3) designing solution to solve the project, (4) managing time/project schedule, (5) solving the project by teacher's monitoring and facilitation, (6) composing the report and presentation/publication of the project result assisted by Moodle, and (7) evaluating the process and project result.

This research aimed to (1) test the effectiveness of blended learning with PjBL assisted by Moodle in improving mathematics literacy and students' independency and (2) describe mathematics literacy skill of the students seen from learning independency during blended learning with PjBL assisted by Moodle.

METHOD

This mixed method research focused on data collection, analysis, mix of both quantitative and qualitative data in a research with sequential explanatory design (Cresswell, 2014). According to Clark in Subedi (2016), sequential explanatory at the first stage is done by collecting quantitative data. Then, it is continued by collecting qualitative data.

The research design used experimental (E) and control (K) groups as shown by qualitative design of this research in Figure 1.

| E | O_1 | X | O_2 |
| K | O_1 | Y | O_2 |

Remark
O_1 : Pretest of Mathematics Literacy Test (MLT).
X : Intervened by blended learning with PjBL assisted by Moodle.

Y : Intervened by Problem Based Learning (PBL)
O : Posttest of Mathematics Literacy Test (MLT).
Figure 1. Qualitative Design

The data source of this research was test score of the students' MLTs, questionnaire results, observation sheet of learning independency, and interview of mathematics literacy skill. The MLT result was used as primary quantitative research data while qualitative data was taken from the MLT answers of the students, questionnaire results, and observation sheet results of learning independency as well as mathematics literacy skill interview results. The quantitative data was tested by normality, homogeneity, classical accomplishment, proportional comparison, variance average test, and test of influence. The qualitative data was analyzed by data reduction, presentation, and conclusion.

The subjects consisted of 19 students of X Scince 1, Islamic Senior High School 2, Pekalongan Municipal, grouped into three categories based on learning independency levels: high, moderate, and low. Based on the questionnaire results and observation during learning, it showed that there were 4 high learning independency category students, 11 moderate learning independency category students, and 4 low learning independency category students.

FINDINGS AND DISCUSSION

There were two classes: X Science 2 as control group and X Science 1 as experimental group. The model implemented in control group was problem based learning. Meanwhile the experimental group was intervened by blended and PjBL assisted by Moodle. Before being intervened, there was a need of normality and homogeneity tests. Based on normality test, it was obtained sig = 0.200 > 0.05. It meant H_0 was accepted or the mathematics literacy test data had normal distribution. Then, it was tested

in term of homogeneity. The test was purposed to find out the existence of variance differences between two samples. Based on homogeneity test, it was obtained sig = 0.648 > 0.05 thusH_0 was accepted. It meant experimental group variance was equal to control group variance. Then, qualitative and quantitative data analysis were done.

The first criterion of mathematics literacy in blended and PjBL assisted by Moodle met classical learning accomplishment. In this research, learning was considered accomplished if more than 75% students reached minimum actual grade (BTA), 63.80. To test the first criterion, it was done by proportional test of one party. It resulted to z_{count} = 0.39736. Based on Z distribution table, it was obtained Z_{table} = 1.52 with significant level 0.05. Thus, $Z_{count} \geq z_{table}$thusH_o was denied. It meant the proportional accomplishment of the students intervened by Blended and Project based learning assisted by Moodle reached BTA, higher than 75%. It was concluded that the requirement of effectiveness was met.

The second criterion, mathematics literacy skill proportion of the students taught by blended and PjBL assisted by Moodle, was found higher than the control group students taught by PBL. In the second effectiveness criterion, it was tested by proportion variance difference test. It obtaines z_{count} = 2.07. Based on Z table, it was obtained that Z_{table} = 0.4898 with significant level 0.05. Thus, $Z_{count} \geq z_{tabel}$thenH_0 was denied. It meant mathematics literacy skill of the students taught by blended and PjBL learning assisted by Moodle was higher than those taught by PBL. Therefore, it could be said that the second effectiveness requirement was met.

On the third criterion, there was difference of the students' mathematics literacy averages on blended and PjBL learning assisted by model with higher average score than the students' mathematics literacy average taught by PBL. This third criterion was tested by t_{count}= 2.105. Based on t-distribution table, it was obtained t_{table} = 2.037 with significant score 0.05. Thus, $t_{count} \geq t_{table}$thenH_0 was denied. It meant mathematics literacy average of the students

taught by blended and PjBL assisted by Moodle obtained higher average score than those taught by PBL. Thus, it could be said that the third effectiveness requirement was met.

On the fourth criterion, there was positive influence of the students' learning independency to mathematics literacy found on blended and PjBL learning assisted by Moodle. This cretirion was tested by regression test assisted by SPSS 16 with significant score 5%. The sig score was obtained sig= 0,006. It meant sig < 5% so there was influence of the students' learning independency to mathematics literacy of the students taught by blended and PjBL learning assisted by Moodle.

Based on the explanation, it was obtain that (1) proportion of the students' accomplishment taught by blended and PjBL assisted by Moodle reached BTA with higher than 75%, (2) proportion of mathematics literacy of the students taught by blended and PjBL assisted by Moodle was higher than those taught by PBL, (3) the average of the students' mathematics literacy taught by blended and PjBL assisted by Moodle was higher than those taught by PBL model, and (4) there was influence of the students' learning independency to mathematics literacy of the experimental group students.

Thus, it could be concluded that blended and PjBL learning assisted by Moodle was effective to improve the students' mathematics literacy skills.

The mathematics literacy skill accomplishment cold not be separated from learning activities. Teachers, in this case, have important roles to select appropriate learning model. It is in line with Zaenuri et al (2017). He says that each teacher is demanded to innovate in selecting and developing learning model. Blended learning with PjBL assisted by Moodle done in this research provided students opportunity to learn independently and not to rely on time and space limitation. This learninc was not only involved face to face meeting but also independent learning done by the students. Students in blended learning group was better than typical group. It was effective and positively and significantly influenced learning (Muttaqin,

Marethi, & Syamsuri, 2016; ; Lin et al., 2017; Dziuban, Graham, Moskal, Norberg, & Sicilia, 2018; Dianawati, Kartono, & Wardono, 2018). Besides that, effective blended learning environment is needed in teaching and learning process (Kintu, Zhu, & Kagambe, 2017). Blended Learningcould also influence student mathematics learning independency (Yanto & Retnawati, 2018). Accordint to Wicaksana et al (2017), blended learning could trigger curiosity which influenced to mathematics literacy improvement.

Student learning independency also had significant influence, 77.3%, toward mathematics literacy skill of the students. Meanwhile, 22.7% were influenced by other factors. In PISA 2012 as stated by Pakpahan (2016), it concluded that personal identity, social – economy and cultural condition, computer ownership, and books were main factors influencing mathematics literacy achievement in Indonesia. The influential factors of mathematics literacy achievement are personal, interactional, and environmental factors (Mahdiansyah and Rahmawati, 2014).

The next stage, the data was analyzed qualitatively to describe mathematics literacy skill seen from the students' learning independency found in blended with PjBL learning assisted by Moodle. There were 19 subjects of X MIPA 1 of MAN 2 Kota Pekalongan, grouped into three learning independency categories: high, moderate, and low. Based on the questionnaire result and observation during learning, there were 4 high learning independency category students, 11 moderate category students, and 4 low category students.

Literacy skill is described based on learning independency categories: high, moderate, and low on seven process components of mathematics literacy, they are communicating, mathematizing, representing, reasoning and arguing, devising strategies to solve problems, using symbolic, formal, and technical language and operation, and using mathematics tools.

The findings showed that mathematics literacy skill description was seen from various student learning independencies. It was shown from 4 high category students, there were obtained 3 high and 1 moderate mathematics literacy skill category students. From 11 moderate category students, there were obtained 3 high, 7 moderate, and 1 low mathematics literacy skill students. From 4 students with low independency, there were obtained only 1 moderate and 3 low mathematics literacy skill students.

Due to blended learning with PjBL assisted by Moodle, there were various description of the students' mathematics literacy skills. The students with high independency could meet all seven mathematics literacy components: communicating, mathematising, representing,reasoning and arguing, devising strategies tosolve problems, using symbolic,formal and technical language and operation. However, one of them could not reach representing and using mathematics tool indicators. The moderate independency students showed various mathematics literacy skills: 3 of them met seven indicators but other 7 students were not able in using symbolic, technical, and mathematics operation accurately so they still had many mistakes in solving problems. They also had mistakes in presenting the figures in the forms of sketch which was not in line with the problem. Besides that, there was one of them with moderate independency had low mathematics literacy skills since he only met two indicators only: reasoning and arguing, and dvising strategies to solve problems.

Students with low independency showed different literacy skills. 3 of them could meet reasoning and arguing. Meanwhile one of them could met all 5 indicators communicating, mathematising,reasoning and arguing, devising strategies to solve problems, andusing mathematics tools. The problems faced by the students were they had not understood well so they were low in managing strategies to solve problems. They also had difficulty to draw the illustration based on the known information. It made their ability in using mathematics tools low. However, the students sufficiently were able to interpret the question and

appropriate statement to the problem although they still had difficulties which caused hindrances in solving problems.

This research was in line with various studies using Blended Learning in solving problem. Such studies were done in various educational levels and they showed that blended learning based problem solving could develop mathematics communication skill so students could express their mathematics ideas, understand mathematics problem solving expressed both oral and written (Riasari, 2018).

Students with low mathematics literacy needs habitualization in solving problems with various mathematics literacy questions. It is in line with Sugiman & Kusumah (2010) that to develop problem solving skill needs to use real and factual problems as the stimuli of learning. It is then used in mathematization process and mathematics form development. It is in line with PISA recommendation in Wardani & Rumiati (2011) that teacher should revise their learning process at schools, by referring to mathematics literacy indicators, by improving proportion of thinking, solving, argumenting, and communicating problems. Basically, learning independency had strong influence to students' learning outcome in which it determined learning quality. The independency could be shown by existence of problem solving skill.

CONCLUSION

Based on the analysis and discussion, it was obtained that blended learning with PjBL assisted by Moodle was effective in improving literacy skill and independency of the students and their mathematics literacy skill descriptions seen from the students' learning independency. Higher learning independency would not be always in line with an individual mathematics literacy skill and vice versa. It proved that blended learning with PjBL assisted by Moodle variously influenced the students' matehamtics literacy skills.

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