

## Mathematical Literacy Skills Reviewed From Mathematical Resilience in The Learning of Discovery Learning Assisted by Schoology

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### Abstract

This study has purpose to describe the quality of learning of Discovery Learning assisted by Schoology toward the mathematical literacy skills of students of grade X SMA Negeri 1 Blora and found the patterns of mathematical literacy skills that were analyzed based on the students' mathematical resilience. This study applied mixed method type of research with embedded concurrent embedded design. The subjects of this study were the students of grade X SMA Negeri 1 Blora. The result showed that. (1) the learning of Discovery Learning assisted with Schoology toward the mathematical literacy of students is considered good qualified. (2) found the patterns mathematical literacy skills such that (1) students with high mathematical resilience were able to master the five aspects of literacy skills, and master the two other aspects very well, (2) students with moderate mathematical resilience were able to master three aspects very well, and can master the four other aspects well, (3) students with low mathematical resilience, two aspects of literacy skills can be mastered well, average on one aspect of the literacy skills, and less well in mastering the other four aspects of literacy skills.

## INTRODUCTION

Paradigma learning in 21<sup>st</sup> century education, insisting on some capability. These capabilities include: the ability to think critically, the ability to connect to the science associated with the real world, the ability to communicate and collaborate and be able to follow the progress of information technology. It is contained in the lesson plan (RPP) curriculum of 2013 revised in 2017 that gave rise to the skills of the 21st century, HOTS, and the character strengthening education (PPK), and the school literacy education.

Fadholi, Waluya, & Mulyono (2015) emphasizes that teachers must prepare and develop a learning tool with a variety of approaches such as humanistic and constructivism, and the learning process, teachers are able to use multiple approaches of teaching, and teachers have the knowledge about mathematics literacy by giving the test of mathematical literacy skills to the students being taught. This is in accordance with Hidayah (2018) who revealed that the school literacy movement will give a reading literacy reinforcement and good impact for strengthening either mathematics or science literacy.

According to OECD (2016) mathematical literacy is defined as the individual's ability to formulate, problem solving, reasoning, use, interpret, and communicate mathematical ideas in a variety of situation. The ability of literacy include content domains (space and shape; change and linkages), domain process (communication, mathematising, representation, reasoning and argument, devising strategies for solving problems, using symbolic, formal and technical language and operations, and using mathematics tools) and domain context (personal, educational and occupational, social and science).

Wardono (2013) suggested that middle and high school mathematics teachers should try the innovative learning of mathematics and develop the PISA assessment to support achievement in the PISA assessment in the future. It also stressed by Rochmad & Masrukan (2016) that the success of learning is supported by the ability of teachers to use appropriate learning models, varied, good teaching and using good questions.

Waluya (2012) pointed out that according to a study at Harvard University, United States indicate a person's success comes not only from the knowledge and technical abilities (hard skills), but also the ability to manage themselves and others (soft skills) that are more supportive to achieve the succes. One of the soft skills which are crucial to be developed in the

learning of mathematics is the mathematical resilience.

Resilience according to Wilder & Lee (2008) as a positive adaptive attitude and fighting spirit of a person in learning mathematics. Dweck (2000) stated resilience load mathematically determined and persistent attitude in the face of adversity, collaborative learning with peers, skilled at speaking to the understanding of mathematics and master the mathematical learning theory. Furthermore, Hutaaruk & Priatna (2017) suggested that the resilience associated with affective abilities of students in facing of obstacles and negative conditions in the learning process, so that the negative conditions can support them.

Learning mathematics is often done more to focus on the results of the solutions that are routine, speed in counting, memorizing formulas, and exercises to prepare for the exam. The learning will cause anxiety and fear in the students towards mathematics. This is consistent with that expressed by Kath (2015) that there are several factors that make students anxious on the mathematics that emphasize students memorize formulas, which are too high workload, training opportunities and learning in a variety of issues that still less conducted. Furthermore, mathematics still hard felt by the students, and therefore students should have a positive attitude in mathematics adaptive to continue learning despite the obstacles and difficulties. Therefore, the resilience of mathematical of students need to be develop in the learning of mathematics.

Hafiz (2017) states that learning mathematics by using Discovery Learning can develop the resilience of mathematics. In line with this statement, Zanthly (2018) states that there is a positive relationship between the resilience of mathematical significantly with the academic ability of college students. Moreover, Tokada, Herman, & Suhendra (2017) states that learning mathematics by using Discovery learning mathematics can develop literacy skills significantly.

The model of Discovery Learning is learning that requires the learner to build his/ her own knowledge of the trial effort, and then conclude. With Discovery Learning, students can develop concepts based on direct experience and are actively involved in building knowledge. Bruner suggested that students learn through active participation by using concepts and principles to gain knowledge. With this

model of Discovery Learning, students can ask questions and discuss in more active condition. This is in line with the characteristics of mathematical resilience that includes perseverance in facing of adversity, working together, have the necessary language skills to express mathematical understanding.

According to Purwaningrum (2016) learning by using Discovery Learning requires a lot of time so that the teacher must be able to manage their time well. Furthermore, based on Permendikbud, number 22 2016 teachers are required to take advantage of information and communication technology to improve efficiency and effectiveness in the learning. Wardono, Waluya, Kartono, Mulyono, and Mariani (2017) asserts that Schoology is a fun media that according to the times, and students learn not limited on classroom space and time.

In this study, the learning applied was Discovery Learning assisted with Schoology, with the steps of Discovery Learning by integrating literacy problems of mathematics tools and in its learning in. The problems of this study were (1) How is the quality of learning through learning model of Discovery Learning assisted with Schoology toward the mathematical literacy skills of students of grade X SMA N 1 Blora in the academic year of 2017/ 2018. (2) How is the literacy skills reviewed from the mathematical resilience of students of grade X SMA N 1 Blora in the academic year of 2017/ 2018 in the learning model of Discovery Learning assisted with Schoology.

In line with those problems, the objectives of this study were (1) to describe the quality of learning by using Discovery Learning assisted with Schoology toward the mathematical literacy skills of students of grade X SMA N 1 Blora in the academic year of 2017/ 2018. (2) to find out the pattern of mathematical literacy skills reviewed from the resilience of mathematical of students of grade X SMA N 1 Blora in the academic year of 2017/ 2018. The quality of learning in this study covered three stages, namely lesson planning, implementation of learning, and assessment of learning outcomes.

## METHOD

The type of this study was mixed method type with concurrent embedded design, with the research design of quasi experiment. This study began with the

observation in the field and then collecting quantitative and qualitative data for further analysis and interpretation of data. The experiment was conducted in SMA Negeri 1 Blora with the study population of students of grade X in the academic year of 2017/ 2018. The sample taken for this study were 36 students for the class with the learning of Discovery learning assisted with Schoology, as well as 35 students for the class with only Discovery Learning.

The research data were obtained from the result of questionnaire of mathematical resilience of, the result of mathematics literacy skills test (TKLM), interviews on mathematical literacy skills, learning the observation sheet of the learning implementation and the questionnaire of students responses. The result of TKLM was taken as quantitative research data source, and the source of data for qualitative research were the observation sheet of students TKLM, the results of questionnaires of mathematical resilience and interviews result on mathematical resilience. The quantitative data was tested by using normality test, homogeneity, completeness test of proportion, an average of completeness of test, the average comparative test, and comparisons of proportions. Whereas, the qualitative data analysis was performed with data validation, manufacture of transcript of verbal data, data reduction, data presentation, and data verification.

## RESULTS AND DISCUSSION

In the planning stage of learning, averaged a score of validation of the learning tools is 4.475 and the instruments was 4.6. The following table 1 shows the details scores of the validation of learning tools and instruments.

**Table 1.** The Results of Validation of Learning

Learning Media	Average Score	Category
Syllabus	4.6	Very Good
RPP	4.15	Good
LKS	4.65	Very Good
Teaching materials	4.5	Very Good

**Table 2.** The Result of Validation of Instruments

Research Instruments	The average scores	Category
Mathematical Resilience Questionnaire	4.75	Very good
TKLM items	4.58	Very good
Observation Sheet	4.5	Very good
The implementation of learning	4.5	Very good
Student Response Questionnaire	4.67	Very good

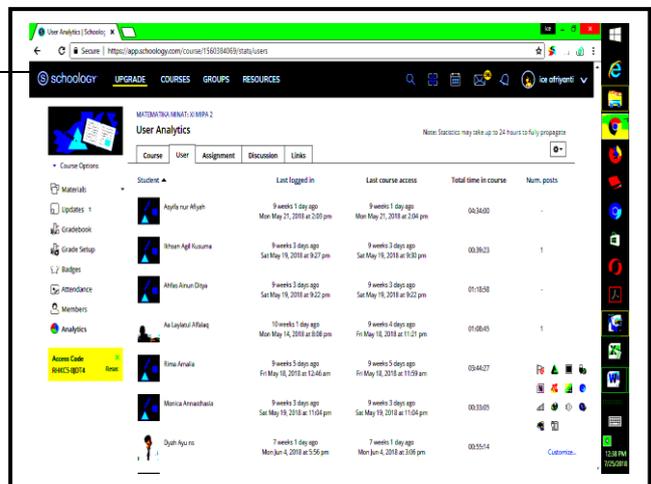
From the above results, it can be said that the device is well categorized and the research instruments is in the excellent category, and therefore, it can be concluded that the devices and the research instruments were feasible to be use for this study.

Based on the mathematical resilience questionnaire, obtained the percentage of students with high mathematical resilience of 19.4%. Students with moderate mathematical resilience has a percentage of 44.4%. Meanwhile, students with low resilience of mathematical has a percentage of 36.1%.

During the implementation phase of learning, the quality of learning was measured by using the observation sheet of learning implementation and giving the students with the questionnaire of students responses. From the observations that have been conducted, obtained an average score of learning implementation of 4,2 or 84,5%, so that the learning carried out in this study was in the excellent category. Based on the analysis of student response data, obtained the average score 72.39%, therefore, it can be said that the students assess the learning held is 72.39% or good category.

In the learning process Discovery Learning assisted Schoology, teachers facilitate students to solve the problem by discussing with the group. Gurumemberikan problems that allow students to find their own concepts learned. Each kelompokdiberikan worksheets that contain problems containing mathematical literacy and provide step LKS answer by writing the information known, asked, concepts or formulas used and

penyelesaiannya. Hal step is intended that the students are trained and accustomed to when working on the math soalliterasi After finishing the discussion, several groups presented worksheets that have been done in front of the class. Later, another group of questions or give a response when there is no question. Teachers guide students during the presentation. Then, the teacher together students take the conclusions into actual concept. Teachers do affirmation and strengthening or justify such concepts no keliru. Pada end, teachers give students assignments in Schoology dan sent directly Schoology duties. The following Figure 1 which display Schoology used in learning.

**Figure 1.** Screenshots Schoology

When the discussions learning of students with the very top category showed resilience diligent and persistent attitude in the face of difficulties or barriers to learning mathematics, confident or confident, work hard, do not easily give up the face of problems, failures and uncertainty. This is indicated that at the time of mutual discussion groups LKS work. Students show curiosity, reflect, examine, utilize a variety of resources, a willingness to try to find the source of their own learning through ICT, the internet, or books before asking a friend or teacher. Students try to bring new ideas and find creative solutions to the challenge to solve a mathematical problem at the time of homework given. In addition, students want to socialize and discuss with the neighborhood or friends to find another solution with the help of Schoology.

Students with moderate resilience showed a desire to socialize, it is easy to give assistance, discussions with peers, and to adapt to their

environment. Students using their failure experience to build self-motivation.

Students with lower resilience tend to be weaker in controlling themselves and face problems in learning. Students avoid any perceived difficult task. When faced with a difficulty in expressing mathematical problems and step completion, students were not encouraged to ask friends who understand or teacher. Students do not dare to ask when in the classroom or outside the classroom. Students belonging to this group only copy tasks. Students were afraid to ask and answer questions during a presentation in class. Students were very visible lack of confidence and resilience of the current mathematical learning in the classroom which was very weak.

At the stage of learning outcomes assessment, obtained that result TKLM normal distribution and homogeneous. Test the proportion of one party (the right side)  $z_{obtain}$  value was 1.92. Because  $1.92 > 1.64$  then  $z_{obtain} > z_{(0.5-\alpha)}$ , meaning rejected. Thus, the proportion of students in the class who acquire learning materials by using the learning model of Discovery Learning assisted with schoology has reached more than 75% completeness. Test average of one party based on the calculation shows that the value of  $t_{obtain} = 1.87 \geq 1.69$  then  $H_0$  is rejected. It means that the average math student literacy classes taught by the learning model of Discovery Learning assisted with Schoology over 70. The average difference test of the calculation showed  $t_{obtain} = 5.99 > t_{table} = 1.69$ . Therefore,  $H_0$  is rejected. It means that the average mathematics literacy class of students who received the material by using Discovery Learning model assisted with Schoology is more than the average of mathematics literacy skills of students in the learning model of Discovery Learning. The test of equality of two proportions of the parties based on the calculation showed the value of  $z_{obtain}$  is 3.49. The value  $z_{(0.5-\alpha)}$  is 1.64. Since,  $3.49 > 1.64$  then  $H_0$  is rejected. It means that the proportion of the class students gain mastery of learning materials by using Discovery Learning model assisted with Schoology less than or equal to the proportion of the class students gain mastery of learning materials by using learning model of Discovery Learning.

In the aspect of communication, students with mathematical resilience on high category were extremely able to write information that they known and asked, write the concepts used to solve problems, and write steps to resolve completely and correctly. Then, giving conclusions to correctly. Thus, it can be concluded that students with mathematical resilience of high catehory have the ability Communication aspects very well.

Diketahui: mistal AB = 1.6m EC = 75m  
Ditanyakan: ED = ? (panjang kapal)

Konsep matematika: aturan pythagoras  
Ean. depan  
samping

Langkah penyelesaian:	Panjang ED :
* Aturan pythagoras siku siku $\Delta AEC$	EC - DC
karis : $\frac{AC}{EC}$	+ 285,875 - 132,675
EC = $\frac{76,6}{\tan 30}$	= 153,2 m
* Aturan pythagoras siku siku $\Delta EDC$	
tan 30 = $\frac{AC}{DC}$	
DC = $\frac{76,6}{\tan 30}$	
DC = 132,675	

Jadi panjang kapal FR1 Badgu 84) adalah 153,2 m

Figure 2. Examples of Student Work Top Mathematical Resilience Communication Aspect

The results of this study showed that students with high mathematical resilience can express information that they known, the question asked, concepts and steps to resolve the problem properly, right, and complete. Students with medium resilience of mathematical also has a very good response. However, communication capabilities for students with lower mathematical resilience have less good in communication, the students only can write information that they known and questioned, but not yet able able to communicate concepts and

appropriate steps to resolve the problems presented, the idea is not appropriate with the given material.

In mathematical aspect, students with high mathematical resilience was very good in mentioning the information that they known and asked correctly and very complete, and create mathematical form of the case filed correctly and accurately. Students with moderate mathematical resilience also have been able to transform problems into mathematical form correctly, as well as defining the right answer.

$$\frac{a}{\sin LA} = \frac{b}{\sin LB}$$

$$\frac{a}{\sin 50^\circ} = \frac{4,59}{\sin 43^\circ}$$

$$a = \frac{4,59 \times \sin 50^\circ}{\sin 43^\circ}$$

$$a = 5,16 \text{ m}$$

**Figure 3.** The Examples of Student Work on Moderate Resilience of Mathematical on The Aspects of Mathematical

These results indicated that students can make a mathematical shape of the case filed by them correctly. However, it less than perfect because it does not include information completely. Students with lower resilience can master the aspect of mathematical well, able to create a mathematical model, but there was not proper and was not yet able to complete task well.

**Langkah penyelesaian:**

$$AC^2 = 300^2 + 400^2$$

$$AC^2 = 900 + 1600$$

$$AC^2 = 2500$$

$$AC = 500$$

**Simpulan:** Panjang AC 500 km

**Figure 4.** The Examples of Student of Moderate Mathematical Resilience on Mathematical Aspects of Reasoning and Argument

In the aspect of reasoning and argument, students with top mathematical resilience able to resolve the problem by writing the draft is complete

and correct, and then make conclusions based on the reasons given.

From the results of this work indicated that students with moderate mathematical resilience were able to solve the problems accompanied with a conclusion and give reasons but there were fewer errors. Thus, the conclusion is not clear. Students with low mathematical resilience adverse and not able to control aspects of reasoning and argument. Students did not write down the answers and conclusions.

In the aspect of devising strategies for solving problems, students with high mathematical resilience consider in the excellent category were able to write steps to resolve and determine a strategy in advance using the concept correctly and completely. Students with moderate mathematical resilience were good in writing the steps to resolve problems but lacking of coherent. Students' strategies with moderate mathematical resilience were also able to write down the correct steps to resolve problems but there were incorrect calculations and strategies used to resolve the problems was less clear.

**Langkah penyelesaian:**  $\cos L = \frac{300^2 + 400^2 - 300^2}{2 \cdot 300 \cdot 400}$

$$\cos L = \frac{900 + 1600 - 900}{2 \cdot 300 \cdot 400}$$

$$\cos L = \frac{600}{240000}$$

$$\cos L = \frac{1}{400}$$

$$L = 48^\circ$$

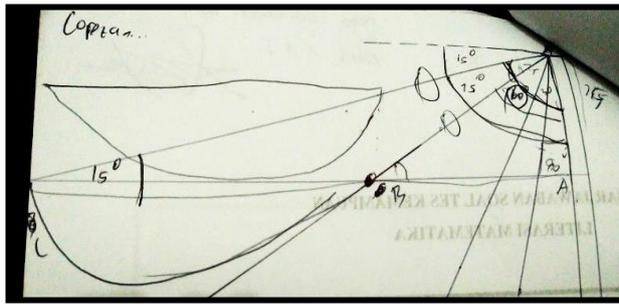
daerah:  $90 + 40 + 48 = 178^\circ$

**Simpulan:** Jadi daerahnya  $178^\circ$

**Figure 5.** The Examples of Student Work of Lower Mathematical Resilience on Mathematical Aspects of using Strategies for Solving Problems

The results of student work above showed that the students were able to make concept. However, students were still not able to interpret them in clearly.

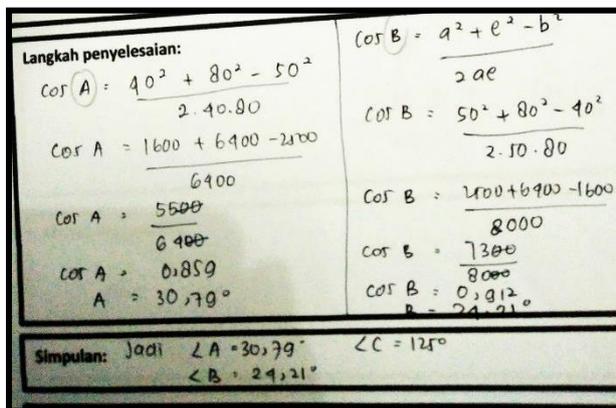
In the aspect of representation, student with high mathematical resilience capable restate the problem by creating an image and interpret it very well. Students with moderate mathematical resilience also capable to present problems of images very well. However, there was a bit of a mistake on the pictures. However, the mistake was not fatal. The result of the images presented have not seen clearly. Therefore, images can lead to the interpretation that is inconsistent with that given on the matter.



**Figure 6.** The Examples of Student Work of Moderate Mathematical Resilience on Mathematical Aspects of Representation

These results indicated that students with low mathematical resilience were able to do task according to the case presented in terms of determining the angle of deviation. Meanwhile, students with low mathematical resilience cannot master the aspects of representation, because the students were poor and not able to make the representation of the problem in the picture.

In the aspect of using symbolic, formal and technical language and operations, students with the high and moderate mathematical resilience were able to use the symbol, formal and technical language and operations to formulate, solve or interpret problem well or correctly.

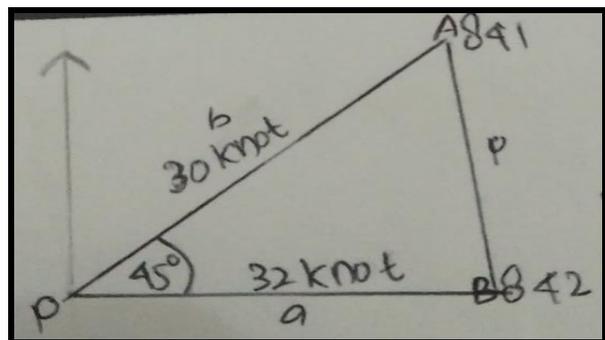


**Figure 7.** The Sample Results of Students Work with High Mathematical Resilience of Aspects of Using Symbolic, Formal Language And Technical Operation

The results of the above work showed that students were able to solve the problem using symbols and operasi. Akan However, the students do a bit of writing mistakes. There was a great symbol with consistent writing. Then angle, the students do

not understand the principle of division performed by striking of division. Operation part of the numerator and denominator. Students with lower mathematical resilience were also less well and have not been able to control aspects of using symbolic, formal and technical language and operations, as there were a lot of mistakes in the use of symbols, as well as less consistent in the use of symbols, which are used less operation in accordance with problems

In the aspect of using mathematics tools, student with the high and moderate mathematical resilience can use mathematical tools such as a ruler, protractor well, although the scale was less precise and tidy.



**Figure 8.** The Sample Results of Student Work with High Mathematical Resilience of Mathematical Aspects of Using Tools

These results indicate that students can use mathematical tools to draw the direction and magnitude of the angle with the concept of the majors three numbers (JTA) with a ruler, a protractor, and tidy although not describe the scale used. Whereas, students with low mathematical resilience have sufficient ability in using mathematical tools such as a ruler, a protractor, since there were illustrations that do not fit the description on the image, less neat, and not show a real picture.

**CONCLUSION**

The result showed that: (1) the learning of Discovery Learning assisted with Schoology toward the mathematical literacy of students is considered good qualified. (2) found the patterns mathematical literacy skills such that (1) students with high mathematical resilience were able to master the five aspects of literacy skills, and master the two other aspects very well, (2) students with moderate mathematical resilience were able to master three aspects very well, and can master the four other aspects well, (3) students with low mathematical

resilience, two aspects of literacy skills can be mastered well, average on one aspect of the literacy skills, and less well in mastering the other four aspects of literacy skills.

The mathematical resilience of the students contributes to the ability of mathematical literacy. Differences in resilience levels of students become important especially when facing difficulties in solving mathematical problems involving the ability of mathematical literacy. Therefore, teachers must cultivate and improve students' mathematical resilience in mathematics learning.

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