



## Mathematical Literacy Ability Viewed by Students' Mathematical Habits of Mind Using Quick on the Draw Model With SPUR Approach

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### Abstract

This study aims was describing students' mathematical literacy abilities based on mathematical habits of mind after being given Quick on the Draw learning with the SPUR approach. This research was a qualitative research. Subject of the research were students of class VII SMP Negeri 5 Borong. The results of the study show that (1) Quick on the Draw model with quality SPUR approach in improving students' mathematical literacy skills (2) Students with high mathematical habits of mind had excellent mathematical literacy skills, namely students were very capable of mastering the components of communication, mathematics, reasoning and argument, as well as formulating and solving problems. Students with mathematical habits of mind were showing good mathematical literacy skills. Students were able to master the components of communication, mathematics, and formulate and solve problems. Meanwhile, those that had not been mastering well are representation, reasoning and arguments, and the use of symbols, formal language, techniques, and operations. Students with low mathematical habits of mind show that literacy skills were still not good. Students only master the communication component well enough. Meanwhile, the other components had not been mastering properly.

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## INTRODUCTION

Quality human resources are the main foundation so that Indonesia can carry out development and be able to compete with other nations. In order to make this happen, efforts are needed in various aspects of life, one of which is in the field of education. Education has an important role in producing quality humans to be able to compete globally in the development of science and technology. The established education curriculum includes mathematics subjects that must be taught to students.

Mathematics can not only be used to achieve educational goals but can also shape students' personalities and develop certain skills. Mathematics is a mindset, a pattern of organizing logical proofs, mathematics is a language that is a language that uses carefully defined, clear and accurate terms, represented by symbols. Mathematics is knowledge of organized structure, axioms, properties, art or mathematics can also be called deductive science (Siregar & Marsigit, 2015). In line with this opinion, (Wardono, Mariani, & Candra, 2015) stated that mathematics proficiency is considered very useful for students to take part in learning at a higher level or in overcoming problems in their daily lives. Mathematics is studied and developed to equip students with logical, analytical, systematic, critical and creative thinking skills. That is the reason for the importance of mathematics to be studied. But so far, learning mathematics has not been able to make students proficient in mathematics.

Until now, mathematics is a subject that is considered difficult by most students. This results in students being less interested in taking part in learning in the classroom and the emergence of a sense of quickly boredom which makes it difficult for students to understand mathematical concepts. In understanding mathematical concepts, the ability to make generalizations and abstractions is quite high. This is what causes students' mastery of mathematical concepts to be weak and often misunderstood.

One of the abilities that students need to have in learning mathematics is mathematical literacy skills. Mathematical literacy in mathematics learning is a standard that must be mastered by students in

order to develop and improve the competence of students' mathematical skills. The ability of individuals to communicate and explain phenomena faced with mathematical concepts is prioritized in mathematical literacy.

In addition, our findings are in line with previous research that mathematics skills are very important for every individual to master, one of which is mathematical literacy skills. Mathematical literacy skills can help someone apply mathematics to solve problems in everyday life (Aminah et al, 2019). This shows that the results of this study also confirm some of the results of previous studies which reveal the importance of mathematical literacy skills for our lives.

Mathematical literacy itself is defined by the OECD (Wardono, 2015) as a person's ability to formulate, apply and interpret mathematics in various contexts, including the ability to reason mathematically and use concepts, procedures, and facts to describe, explain or predict phenomena / events. In line with this opinion, (Stecey and Tuner, 2015) defines literacy in the context of mathematics as the power to use mathematical thinking in solving everyday problems to be better prepared to face life's challenges. Mathematical thinking is meant to include problem-solving mindset, logical reasoning, communicating and explaining. This mindset is developed based on concepts, procedures, and mathematical facts that are relevant to the problem at hand.

Before being introduced through PISA, the term mathematical literacy was coined by NCTM (National Council of Teachers Mathematics). There are five competencies in learning mathematics, namely: mathematical problem solving, mathematical communication, mathematical reasoning, mathematical connection, and mathematical representation. The ability that includes the five competencies is mathematical literacy ability.

In addition, according to the OECD (Wardono et al, 2018) mathematical literacy skills consist of seven components that are used in the mathematics assessment process in PISA: (1) communication, (2) mathematizing, (3) representation, (4) reasoning and argument, ( 5) designing strategies for solving problems, (6) using symbolic, formal, and technical

language, and operations, and (7) using mathematical tools.

However, based on the results of the PISA study in 2003, in the field of mathematics, Indonesia is ranked 38 out of 41 countries with an average score of 360. In 2006 the mean score of students rose to 391, ranking 50th out of 57 countries. In 2009 Indonesia was ranked 61 out of 65 countries with the average dropping to 371 while the average international score was 496. In 2012, Indonesia was in the second lowest rank, only ahead of Peru with a score of 375, which was ranked 62 out of 63 countries that took the test. Meanwhile, in 2015 Indonesia got a score of 386 with an average score of 490, which is ranked 64 out of 72 countries (Gurria, 2016). This shows that Indonesian students still have abilities below the average of OECD countries or it can be said that Indonesian students' mathematical literacy skills are still low.

Several findings reinforce these results. Among them are the findings of Wardono (2014), the ability of Indonesian students to solve problems that require analytical skills, reasoning, communicate effectively, and solve problems, then interpret solutions in various situations is still low. In accordance with these findings, Mahdiansyah & Rahmawati (2014) found that the achievement of mathematical literacy of the study sample students was still low, even though the questions had been adjusted to the Indonesian context. In addition, there are also findings show that students' mathematical literacy skills in two-dimensional geometry are still low and lacking, this is because the teacher has never asked questions about mathematical literacy equivalent to PISA (Fadholi et al, 2015). These findings also corroborate the previous findings which show that the mathematics literacy skills of students with low math abilities only reach level 2 and students with high math abilities only reach level 3 (Asmara et al, 2017).

The findings of Wijaya, Panhuizen, Doorman, & Robitzsch (2014) suggest that most of them still experience difficulties in the early stages of solving context-based mathematical tasks, namely understanding real problems and turning them into mathematical problems. The results of Stacey's (2011) study show that 76.7% of Indonesian students are below level 2. Students with level 2 abilities are able to use basic algorithms and recognize mathematical

contexts that only require direct inference. Thus, Indonesian students are considered unable to apply basic algorithms or interpret the results of mathematical calculations in the context of the problems at hand.

These results indicate that Indonesian students still experience difficulties in learning mathematics. One important aspect of studying mathematics that students in our country still find difficult is in mathematical literacy. The problem of literacy is one of the problems that must receive special attention by all of us.

Mathematics learning does not only develop cognitive aspects, especially those related to mathematical literacy skills, but also affective aspects, because in the learning process teachers are also required to continue to develop the values of life. This means that in students the development of affective aspects (attitudes) is an important aspect that must be formed in students.

In classroom learning, one of the affective aspects that is important for students to have in learning mathematics is mathematical habits of mind. Mathematical habits of mind become the basis for students in learning, because in the learning process students will be faced with problems to solve. According to Cuoco (Nuurjannah, et al. 2018), mathematical habits of mind can motivate students to make connections or linkages between mathematical ideas. Therefore, students must have good thinking habits in order to be able to respond to any problems that arise in learning so that they can solve problems as expected.

Based on the description above, in order to find out what problems are related to mathematical literacy in terms of students' mathematical habits of mind, researchers have conducted a preliminary study at SMP Negeri 5 Borong. Interviews with class VII mathematics teachers at SMP Negeri 5 Borong were also conducted to obtain secondary data on preliminary research. The results of interviews with a class VII mathematics teacher at the school indicated that some students often had difficulty understanding problems and making mathematical modeling, especially in story problems. The results of interviews with students also showed that students felt less interested in story questions that often used long sentences. This results in students being less careful in

reading the questions given and difficulties in understanding the problem. In addition, students also have difficulty in determining problem-solving strategies and linking various information in a problem with the knowledge they have previously had to solve the problem.

Learning using a problem-based learning (PBL) model with a scientific approach that is commonly applied in SMP Negeri 5 Borong requires students to learn through the process of solving problems in groups consisting of 4 to 5 members and sharing the results of the discussion with other students. According to the seventh grade mathematics subject teacher, the facts that occur in class, namely learning activities in the form of many discussions, allow not all students to be actively involved in problem-solving discussions. Sometimes only a few students in a group discuss and try to solve a problem and the rest discuss other things. In addition, the management of time spent in discussion activities is still not optimal. This is what causes students to be weak in solving problems.

The results of observations on mathematics learning in grade VII at SMP Negeri 5 Borong show that many students are less enthusiastic in welcoming the questions given by the teacher, do not try to explore mathematical ideas they have, have not been able to take advantage of old experiences to form new knowledge and have not active in asking questions and answering questions given by the teacher individually and in discussions. This shows that students' mathematical habits of mind are still low.

The research results of Nuurjannah, Hendriana, & Fitriana (2018) show that there is a significant relationship between mathematical habits of mind on the mathematical literacy abilities of junior high school students in West Bandung Regency, with the influence of mathematical habits of mind on students' mathematical literacy abilities by 39.8% and the rest is influenced by other factors that were not measured in this study. Having high mathematical habits of mind in students will provide a good increase in mathematical literacy skills.

In line with this research, the results of Malasari's (2019) study also show that habits of mind have a positive effect on students' mathematical literacy skills in solving flat-sided space problems. The amount of contribution was 43.5% while 56.7%

was contributed by other factors that were not measured in this study.

From the results of these studies, we can see that mathematical habits of mind have an influence on students' mathematical literacy abilities. Where in this case, students who have high mathematical habits of mind will also have high mathematical literacy skills.

One of the problematic mathematics subject matter is integer material in grade VII. Integers have long been introduced to mathematical concepts. Integer material can be used to solve many problems that occur in everyday life. One of the dominant factors that causes less optimal understanding of the concept of integer material, namely students are confused in solving the questions presented in the form of story questions, students' insufficient understanding of the operations of addition, subtraction, multiplication, and division, and students are still confused in determine the appropriate solution steps to solve a given mathematical problem.

With regard to the foregoing, the teacher as the person in charge of Teaching and Learning Activities (KBM) must be able to choose learning models and learning media that can create a pleasant learning atmosphere and be able to motivate students in learning so that students become active in solving problems. Madyaratri et al.(2020) revealed that one of the efforts to improve math skills, especially in improving literacy skills, is through innovative mathematics learning. Innovation requires collaborative activities of teachers and students to create learning that can develop students' mathematical literacy skills. The solution to solving this problem is to apply a learning model that can train students' mathematical literacy skills.

Seeing the difficulties of students in learning mathematics, researchers are challenged to find solutions to help students who have difficulty learning mathematics by using the quick on the draw model with the SPUR (Skill, Properties, Uses, and Representation) approach.

The Quick on the draw model was introduced by Paul Ginnis who wants students to work cooperatively in small groups with the aim of being the first group to complete a set of questions. Quick on the draw is a learning that prioritizes student activity and cooperation in finding, answering and

reporting information from various sources in a game atmosphere that leads to group racing through teamwork activities and speed (Lestiyaningsih, 2013).

In addition, our findings are in line with previous research conducted by Maimunah & Nasution (2018) that there is an effect of quick on the draw activities in cooperative learning settings on learning outcomes. This shows that the results of this study also strengthen the results of previous studies regarding the benefits of implementing the quick on the draw model in mathematics learning.

The learning process using the quick on the draw model leads students to find out, not be told. In addition, it can provide space for students to be more active during the learning process. It is hoped that this will also strengthen the process of students' mathematical literacy skills. Based on these reasons, learning using the quick on the draw model needs to be done.

The SPUR approach is an approach consisting of Skills, Properties, Uses and Representation. Based on Kaur & Yoong (2011) this skill or ability is the lowest level, where students are only measured by looking at students' counting abilities. Then, in the Properties level, we can see the students' ability to understand the use of properties in solving the problems presented. At the Uses level, it looks at how students solve the problem if the problem is presented in another form, namely in the form of problems that are often encountered in the real world or in their daily lives. Whereas at the last level, student representation is expected to be able to present a problem that is presented in the form of pictures, charts or others.

The research results of Riyandiarto, Zaenuri, & Hidayah show that 1) In the implementation of the learning model Discovery Learning Project Based Learning, and Problem Based Learning it is known that the dimensions of mathematical understanding of Properties and Representations are the dimensions with the highest achievement, while the dimensions of Skills and Uses have the lowest achievement. , 2) The error of the majority of students in the three tests with the SPUR approach occurs in the direct object of mathematics in the form of skills and facts, 3) From an ethnicity point of view, there is a significant difference in achievement in one of the dimensions of understanding which is quite significant, namely that

Chinese ethnic students are better at solving problems in the dimension of understanding Skills compared to Javanese students.

The SPUR approach can help teachers to target their classroom activities to these aspects of content that students have not mastered so that students can develop a strong and balanced understanding of mathematics. Teachers can determine whether they focus their teaching on only a few dimensions so that teaching requires modification to incorporate other important aspects of mathematics (Bleiler & Thompson, in Kaur & Yoong, 2011). Through this approach, it is hoped that students' mathematical literacy skills can improve.

Learning mathematics using the quick on the draw model with the SPUR approach in mathematical literacy activities trains students to become accustomed to mathematical literacy and increases students' enthusiasm for learning mathematics. In addition, when learning takes place students are also trained to develop self-concepts in completing assignments properly. This effort is carried out as a habituation step in the psychomotor and affective aspects of students.

## METHOD

This research is a descriptive study with a qualitative approach. This research was conducted at SMP Negeri 5 Borong class VII in the 2020/2021 academic year with class VII B research subjects who were treated using the Quick on the Draw learning model with the SPUR approach on integer material. The selection of research subjects was based on the results of the mathematical habits of mind questionnaire scores so that 6 research subjects were obtained consisting of two students with high mathematical habits of mind, two students with moderate mathematical habits of mind, and two students with low mathematical habits of mind as the selected research subjects for an interview.

The research data was collected directly by the researcher using assistive instruments in the form of mathematical literacy test questions, learning tools, questionnaires and interview guidelines. Data collection techniques used in this study were written tests, interviews, observation, and documentation.

Data analysis was carried out from the time before food was carried out to analysis during the field. Analysis before in the field was carried out by validating learning tools and research instruments. While the analysis while in the field is the process of analyzing data on mathematical literacy skills using the Quick on the Draw model with the SPUR approach.

To account for the credibility in this study, the researcher conducted a triangulation. The triangulation used in this research is the triangulation of techniques and sources, which is to compare and examine the degree of confidence of information obtained through the results of tests of mathematical literacy skills, mathematical habits of mind questionnaires, and interviews from various sources. Data analysis in this study used the Miles and Huberman Model which includes: (1) data reduction, (2) data presentation (display data), (3) drawing conclusions / verification.

## RESULTS AND DISCUSSIONS

Before the learning process using the Quick on the Draw learning model with the SPUR approach is applied in the classroom, students are first asked to fill out a mathematical habits of mind questionnaire. Students who filled out the questionnaire were class VII B students of SMP Negeri 5 Borong in the 2020/2021 school year. Students are grouped into 3 levels of mathematical habits of mind, namely students with high mathematical habits of mind, students with medium mathematical habits of mind, and students with low mathematical habits of mind. Of the 20 students who filled out the mathematical habits of mind questionnaire, there were 2 students with high mathematical habits of mind, 15 students with moderate mathematical habits of mind, and 3 students with low mathematical habits of mind.

After filling out the mathematical habits of mind questionnaire and having obtained scores for all students in class VIIB, the researchers then prepared learning tools consisting of syllabus, lesson plans, teaching materials, worksheets, and preparing interview guidelines. Then, the teacher carries out learning activities using the Quick on the Draw model with the SPUR approach until the assessment

stage. At the assessment stage, the teacher provides a Mathematical Literacy Ability Test (TKLM).

Based on the results of the analysis of observations using the observation sheet on the implementation of the quality of learning, it was found that the average score of learning implementation was generally very good. The first meeting was in the good category. In the second meeting it was in very good category and in the third meeting it was in very good category.

This study measures students' mathematical habits of mind using a questionnaire. The mathematical habits of mind questionnaire consists of 24 statements. Each statement consists of 5 different answer choices with different weight scores. The five answers given are strongly agree, agree, doubt, disagree, and strongly disagree. A summary of students' grouping based on mathematical habits of mind can be seen in table 1.

**Table 1.** Results of Student Grouping Based on Mathematical Habits of Mind

Mathematical Habits of Mind Category	Number of Students	Percentage
High	2	10(%)
Moderate	15	75(%)
Low	3	15(%)
Total	20	100(%)

Table 1 above shows that the category most achieved is the mathematical habits of mind category, with a percentage of 75% reaching 15 students. Meanwhile, there were only 2 students and 3 students with high and low mathematical habits of mind categories, respectively, with a percentage of 10% and 15%. This grouping aims to find the subject to be selected to represent each category. The selected subjects will be examined for their mathematical literacy abilities related to the mathematical habits of mind category. The following is presented in Table 2 which contains a list of research subjects consisting of six students to analyze literacy abilities in terms of students' mathematical habits of mind.

**Table 2.** List of Research Subjects

Category	Subject	Subject Code
High	SE-09	T1
	SE-01	T2
Moderate	SE-02	S1
	SE-03	S2
Low	SE-18	R1
	SE-13	R2

Based on Table 2 above, it appears that the research subjects in this study were SE-09 and SE-01 students as research subjects with high mathematical habits of mind, SE-02 and SE-03 students as research subjects with moderate mathematical habits of mind, and SE-18 and SE-13 students as research subjects with mathematical habits of low mind. Furthermore, each subject of this study described their mathematical literacy skills.

In general, students who belong to the high mathematical habits of mind group have excellent mathematical literacy skills. Students with high mathematical habits of mind can master the four components of mathematical literacy very well, namely the components of communication, mathematics, reasoning and argument, formulating and solving problems. Meanwhile, the three components of mathematical literacy are controlled by several insignificant deficiencies, namely the components of representation and use of symbols, formal language, techniques, and operations, and using mathematics tools. In addition, based on observations on facial expressions, hand movements, leg movements, head movements, and voice tones of students who have high mathematical literacy skills and mathematical habits of mind during the interview, it was found that the two students had calm facial expressions, hand movements that were show flexibility in explaining the answer systematically, sitting upright, not moving the legs during the interview, nodding his head with a sure sign of agreement when given input and suggestions by the researcher, and conveying the answer in a loud voice along with a clear intonation at the speed of speaking normal. This shows that students who have mathematical literacy skills and high mathematical habits of mind tend to communicate clearly and precisely, are able to reflect the correct answers to

mathematical problems, and dare to be responsible for everything they do.

As for the group of students who have moderate mathematical habits of mind, in general, they show good mathematical literacy skills. Of the seven components measured, three components are well controlled, namely the communication component, mathematizing, and formulating and solving problems. There are four components that have not been mastered well enough, namely representation, reasoning and arguments and the use of symbols, formal language, techniques, and operations, and using mathematics tools. Some of these components have not been well mastered because students are not used to doing problem representation activities, are still not used to conveying reasons for problem solving steps, and do not fully understand symbols and counting operations correctly, and are not used to using mathematics tools in solving problems by showing the results of images that are not suitable for example using a ruler. Addition, based on the results of observations on facial expressions, hand movements, leg movements, head movements, and voice tones of students who had mathematical literacy skills and mathematical habits of mind while during the interview, it was found that the two students had fairly calm facial expressions but gazes. eyes sometimes do not focus on the researcher, occasionally scratching their head when in doubt about the answer to be conveyed, sitting upright, occasionally moving their legs during the interview, nodding their head in a sure sign of agreement when given input and suggestions by the researcher, and conveying the answer is in a loud voice along with a clear intonation, but sometimes speak quietly when students are hesitant in answering the questions given. This shows that students are quite good at conveying their knowledge but still look a little nervous and hesitant when delivering some answers to the questions given.

Students in the low mathematical habits of mind group show that mathematical literacy skills are still not good. Of the seven components of mathematical literacy, only one component is carried out quite well, namely communication. The problem that is still often encountered is related to the above components because students with low mathematical habits of mind are not able to communicate

important information contained in questions into concise and precise sentences. The other six components, namely mathematics, representation, reasoning and arguments, formulating and solving problems, and using symbols, formal language, techniques, and operations, and using mathematics tools are considered weak. Students are not persistent in working on the questions so that there are several unresolved questions. Students are not careful in interpreting problems and are not careful in performing arithmetic operations. In addition, students lack confidence in communicating ideas and opinions both verbally and in the problem solving process.

Based on the results of observations on facial expressions, hand movements, leg movements, head movements, and voice tones of students who had low mathematical literacy skills and mathematical habits of mind during the interview, it was found that the two students had tense facial expressions and did not dare to look directly at them. The eyes of the researcher, often scratching their heads, often moving and pressing their hands to make a sound when delivering answers, sitting bent, often moving their feet during the interview, sometimes nodding their heads when given input and suggestions by researchers but sometimes just silent, as well as conveying the answer in a submerged tone of voice along with a sometimes unclear intonation. This shows that students already have difficulty conveying everything they know. It seems that students look nervous and afraid to give answers during the interview activity.

Although students' mathematical literacy skills with low mathematical habits of mind have increased compared to their initial abilities, they have not shown good literacy skills. In general, students with high mathematical habits of mind show their ability to solve any problems related to mathematical literacy very well. Students with moderate mathematical habits of mind are able to solve every problem but sometimes the results are not accurate, while students with low mathematical habits of mind tend to have difficulty in formulating the steps to solve problems and also have difficulty in solving problems correctly.

This is as stated by Nuurjannah, Hendriana, & Fitrianna (2018) which state that having high

mathematical habits of mind in students will provide an increase in good mathematical literacy skills and vice versa. This result is also consistent with the research of Purwasih, Sari, & Agustina (2018), Malasari, Herma, & Jufri (2019) that mathematical habits of mind have a positive effect on students' mathematical literacy skills.

The explanation above shows that there are differences in students' mastery of mathematical literacy abilities between students in the high mathematical habits of mind category and moderate and low mathematical habits of mind category students. Students who have high mathematical habits of mind tend to have higher mathematical literacy skills than students with lower mathematical habits of mind. This supports the findings of Qadarsih (2017) that mathematical habits of mind affect mastery of mathematical concepts. This finding is also in accordance with Safitri's (2017) opinion which states that students' mathematical habits of mind affect student learning outcomes.

Students with low mathematical habits of mind also need habituation in solving problems with various mathematical literacy problems. Teachers need to improve the learning process in schools as an indicator of mathematical literacy with the portion of reasoning, solving problems, arguing, and communicating.

Apart from that, it requires more intensive attention, guidance and direction from mathematics teachers for students with low mathematical habits of mind. So that students are motivated to learn mathematics regularly and are able to have a positive attitude towards mathematics, especially a positive attitude towards math problems that exist in everyday life that involve social interaction with all circles.

## CONCLUSION

Based on the results of the study, it was concluded that the Quick on the Draw learning model was effective in learning mathematics, especially in integer material. Students belonging to the high mathematical habits of mind group are very capable of mastering the components of communication, mathematics, reasoning and argument, as well as formulating and solving problems. Students who have moderate mathematical

habits of mind are able to master the components of communication, mathematics, and formulate and solve problems. Meanwhile, students who have low mathematical habits of mind show that literacy skills are still not good, namely students are only able to master the communication component quite well. Based on the results of this study, it is suggested that teachers apply the Quick on the Draw learning model with the SPUR approach in learning mathematics in class. In addition, to improve students' mathematical literacy skills, teachers need to pay attention to students' mathematical habits of mind tendencies.

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