Interaction between Students and Mathematical Contents in Learning Mathematics

Interaction in mathematics learning activities is needed. One of them is students’ interactions towards math content. This study underlines the importance of teachers to develop interactions in mathematics learning. This study aims to explore students’ interactions towards math content that can help students to comprehend mathematics. This research is a qualitative research with a phenomenological approach. This research was conducted to 29 eighth graders of SMPN 2 Tumijajar. The results of this study are the interactions between students and mathematics content in learning that help students understand mathematics, a) student interactions towards mathematics content by taking notes, b) paying attention to mathematics, c) reading mathematics, d) working on math problems. Teachers are expected to pay more attention to interactions between students and math content to improve student understanding. Teachers are expected to pay more attention to interactions between students and math content to improve student understanding. The next researcher must delve deeper into each of the impacts of these interactions.

Keywords: Interaction, students, mathematics content

Introduction

The interaction between students and mathematical content involves students and mathematical content. Students are subjects in learning and mathematics content as learning objects. The mathematical content referred to in this study are all stimuli encountered during the learning process. Thus, mathematical content includes knowledge of mathematics subject matter that students must learn, activities with mathematics content and everything about the instruction of existing subject matter knowledge including teaching activities and input from teachers and peers in teaching (McLaughlin et al., 2007).

Student engagement towards content is students’ cognitive interaction to challenging subject matter knowledge (material content knowledge) through activities that must construct the mental processing necessary for learning (occasion for processing) and that students are capable (physiological readiness) and willing (motivation) to perform (McLaughlin et al., 2007). The interaction between students and math content involves students and the math content itself. Students are subjects in learning and mathematics content is as learning object. Mathematical content includes knowledge of mathematics subject matter that students must learn, activities with math content and
everything about the instruction of existing subject matter knowledge including
teaching activities and input from teachers and peers in teaching (Koçak et al.,
2009).

Content offers knowledge and activities that help students interact to
subject matter successfully. It also offers stimuli from teachers, fellow students,
instructional activities, and instructional settings that influence students’
motivation and other aspects of students' readiness to interact successfully to
subject matter knowledge. Engagement, within the framework of student-
content engagement, refers to forms of cognitive interaction between students
and instructional content (McLaughlin et al., 2007).

Participation can be attending school or discussions, comparing new
information to previous insights, and practicing a bunch of facts. In this
condition, instructional content is a lecture or discussion, new information, or a
collection of facts; the engagement describes how students and instructional
content interact. Engagement describes the aspects of instructional content with
which students interact and how, in cognitive terms, those interactions occur.
The term of student-content engagement defines three categories in which all
influences on learning can be ranked; Students, instructional content, and two
both engagement (McLaughlin et al., 2007).

The interaction between students and class content involves each student’s
implicit or explicit estimation of the relevance of the content to them. In
general, the more students perceive class content to be personally relevant to
them, the more possibility they engage to it. A study noted that there are three
ways classroom content may be relevant to students: relevance to someone's
current interests, relevance to someone's future goals, and relevance to
someone's identity or sense (Corso et al., 2013).

The interaction between students and learning content need to be applied
well in learning. Unfortunately, in reality there is still learning that does not pay
attention to the form of interaction between students and content. Teachers do
not pay much attention to the importance of interaction between student-
learning content and tend to focus only on teacher-student and student-student
interactions. Even though based on the theory previously explained, the
interaction between students and mathematics content also has a lot of
relationship to students' understanding about learning material.

The interaction between student-learning content has a lot of relevance to
students. This relevance has many benefits for students’ knowledge
development in learning. The interaction between students and learning content
needs to be explored, what kind of interactions need to be developed in
learning, especially in mathematics learning. Thus, educators can apply these
interactions in their learning activities.

The interaction between students and mathematics content is an interaction
that occurs when they learn mathematics. It occurs in one direction, more in the
form of mathematics students’ attitudes or actions. The actions are taken by
students towards mathematics when they learn. This study seeks to explore
interactions between students and mathematics content that help students to comprehend mathematics.

**Method**

This study aims to explore and investigate the interactions that occur in mathematics learning. Interaction in the learning process is between students and mathematics content in understanding mathematics. Mathematics comprehension in learning process can be seen in students’ work results and learning evaluation. Interactions in learning that help students understand mathematics were explored through observation, interviews, and documentation. The interaction that occurs as an experience experienced by students was observed in detail and strengthened through interviews and documentation. Furthermore, these experiences were interpreted as forms of interaction in understanding mathematics.

This is a qualitative study applying the phenomenological method. The analysis used in this study is used phenomenologi data analysis from (Moustakas, 1994); (Nurdin, Ismail & Hartati, 2019): 1) Consider each statement with respect to significance for description of the experience, 2) Record all relevant statements, 3) List each nonrepetitive, nonoverlapping statement, 4) Relate and cluster the invariant meaning units into themes, 5) Synthesize the invariant meaning units and themes into a description of the textures of the experience, 6) Reflect on your own textural description, 7) Construct a textural-structural description of the meanings and essences of your experience.

The validity of the data in this study consists of credibility or internal validity with the triangulation method. Data triangulation was done by collecting then combining, cross-checking the data that had been obtained through observation, interview, and documentation techniques. Transferability or external validity, and dependability or reliability, dependability is done by conducting an audit of the entire research process that has been carried out.

**Results and discussion**

The data of this research were obtained through observation, interviews and documentation. After analyzing data, this study found out the interactions of students towards mathematics content. Those interactions involve students and the math content itself. Students are subjects in learning and mathematics content is as learning object. The mathematics contents in this study are all stimuli encountered during the learning process. The content offers mathematical knowledge and activities that help students interact with subject matter (McLaughlin et al., 2007).
Student interaction to math content is students’ activities on math material in order to understand mathematics. Those activities were observed by researchers during observations in mathematics class. In this study, the researcher observed, recorded and selected the activities carried out by students. Furthermore, the researchers confirmed the findings to the previous theory or research.

Taking Mathematics Notes

Based on the results of previous studies, it can be seen that taking notes can help students understand mathematics. Taking notes is important as students’ process in learning mathematics. This activity can also improve students' math performance. Although learning prioritizes discussion activities, presentations, and observations, note-taking activities still need to be considered in learning mathematics because of many benefits obtained from these activities. Teachers are expected to always remind students to take notes so that they can be used for learning after learning in class is over. Teachers are also expected to guide students in making notes.

Taking notes is the practice of recording information taken from other sources. By taking notes, the writer records the main information. Taking notes plays an important role in learning and cognitive (Mosleh et al., 2013). Recording in a cognitive image, cognitive learning is a learning style that stems from the concept that people learn by paying attention to what others do, learn by using their reason, intuition, and perceptions, learn to acquire knowledge from listening, watching, touching, or experiencing (Mosleh et al., 2013).

Research conducted by Haydon (Haydon et al., 2011) shows that using guided notes has a positive effect on student outcomes. Furthermore, another research (Biria, 2010) concluded that taking notes positively affects students’ academic achievement, there is a strong bond between note-taking strategies and cognition and / or metacognition, note-taking positively affects students’ academic achievement, notes is effective for students’ learning.

Crawford (Mosleh et al., 2013) said that students who took notes showed a positive impact on their test performance. In addition, other studies such as Di Vesta and Gray, Fisher and Harris, Kenneth A Kiewra, Kiewra (Mosleh et al., 2013) confirm Crawford's findings that taking notes helps students to remember recorded information and to perform well on exams relating to that information. They determined that the notes could be used later for study or for other review tasks as external memory enhancers. Note-taking can serve as an external storage function because it builds a repository of information for later review and additional cognitive processing (Mosleh et al., 2013). In addition, taking notes during reading material requires less cognitive effort than taking notes during learning.

Note-taking has many benefits, however, in taking notes students need teacher’s assistance so it can be well organized and have a positive impact on student performance. Research shows that instructors can help students...
improve their note-taking skills (Cardetti et al., 2010). Research states that note-taking with instructions can have a positive effect on learning process (Wetzels et al., 2011). Good notes are the important goals for students (Titsworth, 2004), so that students can take advantage of these notes.

Taking notes is important to do, the importance of taking notes are as follow (Mosleh et al., 2013): a) Taking notes helps to record information and documents, b) Taking notes supports efficient processing and understanding of information, c) Taking notes makes students more focus and improves concentration, d) Taking notes helps students think, e) Taking notes organizes information, f) Taking notes helps students memorize and remember, g) Taking notes improves learning and students’ achievement.

Research conducted by (Dündar, 2015) states that making mathematics notes is important in terms of form and process. In another hand, a study by Swenson (Swenson, 2018) aims to show how to implement note-taking strategies to improve students’ performance. The results showed that the note-taking strategy improved students’ performance appraisals in mathematics learning. Many students stated that they liked the way notes were organized.

Paying Attention to Mathematics

One of the interactions that students make towards math content is paying attention to math material. In the research class, it was seen that students paid attention to the material presented by the teacher. Students paid attention to the material, paying attention to the discussion of examples of math problems and paying attention to math assignments. But there were also some students who did not pay attention because they looked around the class.

Paying attention to mathematics is the first step which students take in learning mathematics. This is a students’ activity when learning mathematics. Attention is a form of student’s interest in something. Starting from an interest, students began to pay attention and then began to study mathematics. Paying attention to mathematics needs to be emphasized to students. If students do not pay attention to mathematics during learning, it will cause difficulties for students in understanding mathematics.

When students give their attention on a certain stimulus, they are more easily aware of the goals to be achieved, and aware of what they are paying attention to. Attention makes students easier to choose and learn information (Cicekci & Sadik, 2019). Therefore, attention is emphasized as a mechanism to initiate learning (Ainley & Luntley, 2007; Chen & Huang, 2014; Cicekci & Sadik, 2019).

The research conducted by (Gunesch, 2015) suggests to study about attention specifically in mathematics learning. The study concluded that attention affects students' understanding of mathematics learning. Structured attention is very important for what can be considered, and what can be learned. Attention at all times is structured according to the degree and degree.
The effect of attention during learning on student understanding was strong, especially when learning mathematics. The teacher’s attention had an important role in learning activities. Based on the theory, it is revealed that it is impossible to learn information processing without attention. Social learning theory states that humans can learn through direct observation and experience. According to Sternberg (2006) conscious attention is processing a small amount of information from a large amount of information available. According to the American Heritage Dictionary, information can be said to be knowledge obtained from learning, experience, or teaching. Information is obtained from sensing, memory and other cognitive processes. The process of paying attention helps to efficiently use limited mental resources which helps to accelerate reactions toward certain stimuli. Humans’ limited mental resources to process a stimulus need assistance to get reflexes faster. Directing specific information will accelerate the mental stimulation process (Muktar, 2016).

**Reading Mathematics**

Reading is a form of student’s interaction to mathematics. Reading is the interaction between the reader and the text. Aquino states that the reader constructs the meaning of the text by guessing and predicting the next text based on the reader’s previous knowledge of the text and the world (Imam, 2016). Students read material in printed books, in notebooks and presentations written by the teacher on the blackboard. Reading is one of the students' efforts to understand the content being discussed.

In the research class, students were seen reading when the teacher asked them to read. The teacher always invited students to read the material to be studied in advance. The teacher asked students to read so that they had an overview of the material to be discussed. Because students' prior knowledge is essential in learning process, the teacher also reminded the students to read again after the discussion was finished.

Reading text is a crucial skill in the modern world (reading internet material, literature, textbooks, etc.). However, it is possible that many students cannot read mathematics textbooks to understand (Berger, 2019). Reading is an important skill, unfortunately in reading mathematics, students have many difficulties. This happens because mathematics consists of many symbols and signs that are difficult to understand.

Reading skills are needed to understand mathematical texts (Imam, 2016). Reading in mathematics learning can have a more radical impact, as it can contribute to the redefinition of what it is to understand and study mathematics (Borasi & Siegel, 1990). Applying reading and writing mathematics as a task gives students many advantages. Reading and writing in mathematics classes will have more concrete understanding of concepts and be able to study alternative situations (Bosse & Faulconer, 2008).
In addition, reading provides opportunities for students to practice extracting mathematical content from a work (Caputo et al., 2015). Mathematics is full of signs and symbols; therefore, students have to read a lot of mathematics to understand them. Research conducted by Österholm (Österholm, 2006) concluded that there is a need for a more explicit teaching of reading comprehension for texts including symbols. A study also states that students have difficulty understanding mathematics. So, the researcher suggested a special reading strategy that could help students understand mathematics (Shepherd et al., 2009).

Mathematics is the language of order, and reading mathematics requires one to pay attention to several principles that guide how reading must be performed if accurate interpretation, understanding, and communication are to be produced (Adams, 2003). In understanding mathematics reading skills are needed by students. Through reading students can understand and interpret mathematics.

Students develop goals for communicating mathematically through words, symbols, and numbers. Teaching that helps students see mathematics as a tool for solving problems, participating in recreation and other fun activities, and understanding the world as seen by students is instruction that motivates students to read mathematics (Adams, 2003).

Reading mathematics is someone’s attempt to apply mathematics. The words, symbols, and numbers that give discipline to attitude, framework, and power are the same as words, symbols, and numbers that students must use to communicate ideas, perform procedures, explain processes, and solve problems. Therefore, someone who knows mathematics is a mathematician, and a mathematician is a math reader (Adams, 2003).

Through reading students know the vocabulary in mathematics. Monroe and Orme as quoted by Miller and many educators stated that the key component in understanding Mathematics is learning vocabulary, without understanding the vocabulary that is used routinely in teaching mathematics, textbooks, and word problems, students become disabled in their efforts to learn mathematics (Imam, 2016). Once the importance of reading and understanding mathematics, researchers state that students become disabled, which means that students will have difficulty understanding mathematics. This happens because mathematics consists of many vocabulary symbols if students do not read then they will not understand mathematical symbols and in the end, they will not understand mathematics as a whole.

Many studies believe that students learn mathematics through reading mathematics. Students learn mathematics more effectively and deeply when reading and writing is directed towards learning mathematics (Bosse &
Faulconer, 2008). Reading and writing are integral activities in the learning process as well as learning mathematics. When students write, students must first read the material to be written. Reading is a form of basic student activity in understanding mathematics.

More deeply, researchers argue that reading is an active process of meaning making in which readers use their knowledge of language and the world to construct and negotiate interpretations of texts (Dewitz & Dewitz, 2003; McNamara, 2004). The idea of reading shifted from simply moving the eye across pages of written symbols and translating these symbols into spoken words, to the idea of reading as a way of thinking and learning (Draper, 2002). Seeing the importance of reading, researchers consider reading as a person's way of thinking and learning.

Mathematics is the language in which people communicate, solve problems, and create works of art and art tools. It is a language of words, numbers and symbols that are sometimes interrelated and interdependent and sometimes unrelated and autonomous (Adams, 2003). The words, terminology and vocabulary used in mathematics are key factors in the communication process with mathematics. The National Council for Mathematics Teachers argues that knowing mathematics is doing mathematics (1989). In other words, knowing mathematics means being able to apply mathematics. Doing math requires reading math. The words, symbols, and numbers that give discipline to its sub-attitudes, framework, and power are the same words, symbols, and numbers students should use to communicate ideas, perform procedures, explain processes, and solve problems. Therefore, someone who knows mathematics is a mathematician, and a mathematician is a reader (Adams, 2003).

The interaction of students to math content in the form of reading mathematics is very important. Teachers should invite students to read mathematics such as reading words, numbers, and symbols so they can reveal messages from and about mathematics. Reading is like a trifle, but if it’s explored more, it can provide numerous benefits. Teachers are expected to pay more attention to the reading process of students in order to know whether the student is really reading and gaining understanding or just reading without understanding.

**Working on Problems as Mathematics Task**

The next interaction is working on math problems. In learning mathematics, it cannot be separated from the activity of working on problems. Most of the activities in learning mathematics are working on problems, solving math problems and discussing them. This activity is carried out in order to train students to solve math problems. The more often students work on questions, the more students understand and are familiar with mathematics. The questions were given in the form of individual assignments, group assignments and homework.
The results showed that students were often invited to practice doing the questions by the teacher. The teacher gives an example first, then they discuss about the answer, after that teacher asks students to work on the questions in groups. After this session is over and the result has been discussed, the teacher gives individual questions. Then the teacher gave some questions as homework as a students’ learning instrument at home. If all materials have been discussed, the teacher would provide a test. Students showed quite satisfying results. Students who diligently work on problems while learning mathematics get satisfactory results.

The researcher perceived the interaction between students and mathematics content in the form of working on math problems to be an interaction that helps students understand mathematics. Working on math problems can train and strengthen students' understanding of the material. Research conducted by (Ildikó & Tibor, 2013) discusses the use of interactive math tasks in teaching mathematics. The study concluded that practicing task is beneficial for students and its effectiveness in education. Hiebert & Wearne (Watson & Mason, 2007) said that what students learn is largely determined by the tasks given to them. This statement shows that managing assignments in learning provides great benefits for students to understand the lesson.

Mathematics assignments have important benefits in learning. According to research conducted by (Clarke et al., 2014), it is said that mathematics assignments are chosen by teachers to realize learning objectives. Problems and tasks bring many advantages into teaching mathematics, which contribute to increasing student success (Clarke et al., 2014). Research conducted by (Ildikó & Tibor, 2013) states that math assignments provide many advantages in increasing students’ achievement. Thus, if students work on math tasks more often, they will gain better understanding of mathematics. Because the more often they do math assignments, the more students understand mathematics. Students will find it easy to solve problems because they are used to doing math problems.

Understanding the meaning of math assignments delivered by the National Council of Teachers of Mathematics, mathematics assignments are the core of learning mathematics. Giving mathematics assignments is an exercise to improve students' understanding and abilities in mathematics. The more often students do math assignments, the more skilled their abilities will be and they will be more experienced. Students' interactions toward mathematics are mediated by artifacts, such as math assignments (Rezat & Sträßer, 2012). The function of mathematics assignments as a tool to facilitate students’ learning leads us to further recognition that the use of instruments, tasks, fundamentally affect the nature of the activity being facilitated, namely student learning (Clarke et al., 2014). Based on this statement, it is known that mathematics assignments are instruments to facilitate students’ learning. Mathematics assignments facilitate students’ interaction to mathematics. Providing math assignments has implications for students’ activities in learning mathematics. By the existence of mathematics assignments, students are active in learning
mathematics. They try to do it, look for the right way to solve problems and convey their ideas.

The interaction between students and mathematics content in the form of doing math problems or assignments is an interaction that helps students understand mathematics. This interaction is considered as an interaction that can help students understand mathematics and train students' skills in solving math problems.

**Conclusion**

This research aims to explore information about interactions in mathematics learning. The interactions that were explored were interactions between students and mathematics content. Research attempts to explore interactions between students and mathematics content that can help students understand mathematics through observation, interviews, and documentation. Based on the results of research and discussion, this study concludes that there are interactions between students and math content that can help them to understand mathematics, namely, a) taking notes on mathematics, b) paying attention to mathematics, c) reading mathematics, d) working on math problems. Those interactions are activities that we often hear about in learning. Researchers hope that mathematics educators will pay more attention to them. Those interactions seem normal, but they are so beneficial for students. Educators can apply appropriate strategies in learning and still pay attention to interactions between students and mathematics content.

Teachers are expected to pay more attention to interactions between students and math content to improve student understanding. Teachers are expected to pay more attention to interactions between students and math content to improve student understanding. The next researcher must delve deeper into every impact of the interaction between students and mathematics content on students' understanding of mathematics.

**References**


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McLaughlin, M., McGrath, D. J., Burian-Fitzgerald, M. A., Lanahan, L., Scotchmer,


