

The Interaction of Students in Mathematical Problem Solving with Group Discussion Activities

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This study aims to identify and describe the types of interactions that arise in learning when students solve math problems through group discussion activities; whether each student in the group participates actively or not; whether the interaction occurred in the learning quality or not. A descriptive method with a qualitative approach was used in this research. The results of this research were: there were three types of interactions that appeared in the high group, i.e., S – S, S – G, and S – M; Two types of communications arising in the medium group, i.e., S – G and S – M; the types of interactions that appeared in the low groups are S – S and S – M. As a whole, not all students actively participated in learning activities taking place at the time, in the high group there was one student who was not active, in the medium and low group each had four inactive students. The quality of the interactions that occurred when students completed math problems in a group discussion activity was still not qualified. In other words, the interaction that occurred during learning and when solving the problem in group discussion activities was an everyday interaction.

Key words: *Mathematics, Problem Solving, Learning*

Introduction

The curriculum in Indonesia is very demanding; the students need to be active, creative and innovative and can trigger students to be able to construct his knowledge. Several studies have emphasised the importance of an active role in the learning process (Kauchak and Eggen, 2009; Jacobsen et al., 2009). Eggen and Kauchak research results show that students who are actively involved in learning helps improve understanding and motivation to learn (Kauchak and Eggen, 2009). The active involvement of students in education offers an excellent opportunity to develop and construct and knowledge so that students will deepen their understanding, which will ultimately improve the quality of the students themselves. Jacobsen, Eggen & Kauchak state that the most appropriate learning approach and methods so that students are actively involved are to use student-centered learning (Jacobsen et al., 2009). By applying the technique of student-centered education, students are challenged to develop critical thinking and actively participate both in education and in solving problems. For students to be involved actively in learning, it is important for teachers to make a condition of proper interaction processes in the interaction between man and man, as well as the interaction between humans and non-humans. Interaction between students, the interaction between students and the subject matter, and student interaction with teachers is crucial in learning activities (Bishop, 1985; Clement, 1991; Jaworski, 1992).

In addition to the active role of students in learning, another factor not less important is the interaction. The interaction becomes important to consider, primarily by teachers, because it deals with the process of the students in constructing the concept through a given problem. Several studies emphasise the importance of interaction in the learning process of mathematics (Yackel et al., 1991; Alerby, 2003; Baharullah, 2016). According to Yackel Cobb, the interaction of mathematics learning in the classroom is very important, because the class can be view as a social context in understanding mathematics in a way constructed and negotiated. It's mean that students must give the widest opportunity to construct their knowledge . Alerby revealed that the students identify the relationship with the teacher is the most crucial part of their school experience. Such links can help to shape the personality of students to optimize their potential. Englehart states that the interaction between teachers and students is one of three important factors in the learning process. How a teacher interacts with his students is defined as an essential outcome for education. While Baharullah (2016) states that the mathematics class is a means by which teachers and students mutually build an interactive social environment with the aim of improving the learning process (Baharullah, 2016).

The general situation in the process of learning mathematics is how and what interactions occur in the school environment. The interaction of teachers and students is the most important activity in the whole learning process in school. Interactions that occur in the

school environment or educational interaction is the interaction conducted by teachers, students and the environment in the learning process. Interaction is an important concept in the learning environment because it will make the environment more interactive. Reviewing from a pedagogical point of view, interaction identifies as a complex relationship between at least two people with behavioural effects that affect (Tenorth and Tippelt, 2007). The term interaction in this study identifies a relationship or mutual communication in solving mathematical problems.

The importance of communication in learning mathematics as an interaction became the focus of the National Council of Teachers of Mathematics (NCTM, 1985); that connection is one of three conditions necessary to achieve a useful learning objective. In the process of the teaching and learning of mathematics, there are several types of interactions that occur, such as:

- (1) (Gilbert & Moore, 1997) argue that there are three kinds of communications, i.e., students – content (happens when students reflect on the content and ask questions relating to the material for analysis, synthesis, and evaluation); student – instructor (refers to interactions where students and instructors exchange views, the instructor has the objective of stimulating students' interest, clarifying questions, guiding, motivating and discussing with students); and students – students (refers to the interaction among students).
- (2) (Hanna, Glowacki-Dudka, & Conceigao-Runlee, 2002) distinguish interaction into two types, i.e., human interaction (consisting of student-teacher interaction, student-student interaction, expert students or community – member community interaction); and non-human interaction (interaction between students – media, student – content, and students – the environment).
- (3) (Liang & Bonk, 2009) distinguishes interaction into five types, namely learner – content; learners – learners; learner – instructors; learners – himself; and learners – interface (Liang and Bonk, 2009).
- (4) (Leikin & Zaslavsky, 1997) suggest there are five types of interaction in the learning process of mathematics, namely: the interaction of student-student; student – subject matter; student – teacher; student – the subject matter – the student; and student – subject matter – teacher (Leikin and Zaslavsky, 1997).
- (5) (Stanley, 2017) distinguishes interaction into five types, i.e. student to student; student to teacher; students into the community; students to the material; and students to technology (Stanley, 2017).
- (6) (Setianingsih, 2017) states there are three kinds of interactions, i.e., vertical interaction, horizontal interaction, and simultaneous interaction (Setianingsih, 2017).
- (7) (Djamarah, 2014) says there are three patterns of communication between teachers and students in the educational interaction process, namely communication as action (interaction between teachers to students, one way); communication as an interaction, meaning no

feedback or feedback for teachers and no student interaction (interaction teacher - student - teacher), feedback for teachers, students learn from each other (interaction teacher - student - student); communication as a transaction or communication in many directions (interaction teacher - student, student - teacher and student - student) (Djamarah, 2014).

The problem of the interactions that occur in learning activities and learning math is mostly that they are not capable of increasing effective interactions related to mathematical problems given. This opinion is strengthened by the statement that most interactions related to mathematics are not enough to improve interactions related to the student's assignments (Mulryan, 1992). To facilitate the students interactions in constructing knowledge requires the existence of a learning method that can trigger the student to interact with the environment. The learning method that can facilitate the students to be able to interact is student-centered learning, placing more attention on students' involvement and social interaction. The implications of student-centered learning methods of students, with the guidance of teachers, means that students have more responsibility in constructing their knowledge (McCombs and Miller, 2007; Lewis and Reinders, 2007; Odundo and Gunga, 2013). Student-centered learning methods assume positive implications. In addition to inviting students' activities in the learning process, it also effectively encourages mastery of subject matter and improves a positive attitude to science (Sajjad, 2011).

The learning method developed by this constructivist group is rooted in pedagogy that puts the students as the subject of learning and the teacher as the facilitator. Student-centered learning methods that are often used include cooperative learning, group discussion, and problem-based learning. The learning method used in this research was the group discussion learning method or group discussion because this is very effective in developing student creativity. The results of the research Sajjad (2011) shows that group discussions are effective because the concepts become clear after discussion, develop creativity among the students, and each student gets the opportunity to put his ideas together to solve problems, among students (Sajjad, 2011). Group discussions allow students to develop the personality of the student as an active subject in the study, involve them in social interaction, introducing the students' knowledge as a mode of action in a social environment, and can facilitate student interaction, because this method is student-centred so that it will encourage students to be active in solving problems. Group discussions need to improve as one form of activities that support life skills related to the general capability that everyone has to have, since life skills at the elementary level is more focused on developing students' ability to socialise, interact socially and develop other life skills. Teachers give opportunities to high, medium, and low ability groups to interact in expressing opinions and information or arrange a variety of alternative mathematical problem-solving. Therefore, the purpose of this study is to identify and describe the types of interactions that arise in learning when students solve math



problems through group discussion activities; whether each student in the group participates actively or not; whether the interaction that occurs contributes to the learning quality or not.

Experimental method

This study used a descriptive method with a qualitative approach, i.e. a process based on the research methodology of the social phenomena to investigate. This study intended to find out the types of interactions that arose, describe the activeness of students and describe the quality of student interaction in mathematical problem solving. This research was conducted at the Islamic elementary school of Surya Buana, Malang with grade IV-B. Observations were made of three groups, i.e. high, medium and low group abilities. Formation of groups was based on the value of student report cards and math teacher recommendations. Data collection was in the form of direct observation, interviews with students, and video recordings. The data analysis techniques in the study follow the Moleong model i.e. drafting unit, namely information related to this type of interaction; categorisation, i.e. the grouping of units that have been arranged includes the type of interaction between students and students or student and teacher; and data interpretation, including drawing conclusions about the types of interactions in group discussion activities based on the analysis of the data that has been collected.

Results and discussion

The results were obtained by observing three types of interactions for high groups i.e. students – students, students – teachers, and students – material; two types of interactions for the medium group, i.e. students – teachers, and students – material; two types of interactions for low groups, i.e. students – students and students – material. In observations on the whole, for the high group, of 6 students only one person who did not participate actively during the learning process. A group of five friends held a very active discussion and exchanged opinions with a fellow friends group and with the teacher.

Figure 1. The interaction of high group students when completing a math problem in group discussion



For medium groups, there were two students who played an active role when completing a mathematics problem. Four friends in the group were more likely to pay attention to the process of discussion between the two friends with the teacher without any desire to join the discussion.

Figure 2. Interaction of students group with medium abilities when completing a math problem in group discussion



For the low group, there were only two from six students who actively participated when solving the problem, the rest only focused on looking at the question without being able to

solve it. The quality of interaction that occurs when students solve math problems in group discussion activities was still very low.

Figure 3. Interaction of students group with low abilities when completing a math problem in group discussion



This research was conducted in SD Islam Surya Buana Malang City. The subject of research was the students of grade IV-B which amounted to 30 students. The students were then grouped into five categories of homogeneous groups consisting of two groups with high ability, one group with medium ability, and two groups with low ability, each group consisted of 6 students. Determination of the subject of this study was based on a value report on students and teacher recommendations from mathematical subjects. Based on the results of the first observation that was carried out on Wednesday, March 21, 2018, interaction began after the teacher finished explaining the material. In the 36th minute, the teacher distributed three essay forms to each group. Interaction in the high group occurred in the 38th minute, almost all of whom actively participated in the form of discussions with teachers to ask questions and ask for explanations related to problems they considered less clear or difficult, except for T6, he only focused on responding. The discussion lasted for three minutes, and in the 41st-minute students began to focus on the problem until all the problems were successfully resolved. In the 55th minute, the teacher asked one of the students, T6 to answer the given problem, and T6 was able to give the answer correctly.

For the groups, interactions started to happen in 41 minutes, but there were only two students, S2 and S6, who actively asked as well as discussing with teachers with regard to the responses. The discussion lasted for five minutes, and 46 minutes already not happen again the discussion. S2 and S6 focused on the problem, while the other students in the group

just listened to the discussion between S2, S6 and the teachers, and only saw the results of the answers from S2 and S6 without any attempt to ask how the process of the answers were obtained. The low ability group remained totally invisible to the interaction, they did not ask the teacher questions, they also did not discuss questions with the fellow group members. All students in the low group were busy staring at the given problem without being able to finish well.

The second observation was carried out on Friday, March 23, 2018. After the teacher had finished explaining the material unit of length of the first lesson, one hour, in the 37th minute the teachers back allot of 4 pieces reserved to the respective groups. Almost the same as the first day of observation, the high group remained in active discussions with teachers, students participated and began to discuss. T6 discussed the problem given with the teacher. But the discussion on this second observation was shorter when compared with the discussion at the first observation. This time the majority of the group were more focused on working on the question of who was giving a response, though no one has finished working .

The same thing happened with the moderate group, each student within the group was focused on solving the problem of giving a response. In the 42nd minute from the time a problem was given, S2 finished working on the question and handed the answer directly to the teacher. The teacher checked the results , and S2 had answered all questions correctly . Not long after that, students from a group of high ability handed the answers to the teacher to check their veracity.

For the low group, in the 35th minute, there were two students, namely R4 and R5 who were mutually discussing the questions given by the teacher. They discussed how to get the answers from the questions. By the time they experienced difficulties or deadlocks, they immediately stopped the discussion and did not attempt to continue or ask for help to find a solution.

The third observation took place on Monday, March 26, 2018, and interactions began to appear in the 25th minute when the teacher finished explaining the material. As in previous observations, the teacher returned to give the problem, and this time the matter of the story required as much as 2 questions with the material unit length. At minute 27, all students who were in the high group, in addition to interacting with the teacher, asked questions that they did not understand, they also interacted with fellow students in the group to discuss cooperation to solve problems. Almost all students in high groups seem more confident in solving comparative problems with other groups.

For some groups there were no visible interactions. If the previous observations revealed that the interaction between these students and teachers and students with the material was less than the maximum, on the last day of this observation that interaction did not happen. In other

words there was a decline in group interaction. When the teacher gave problems to the students in the group, they came together as if in discussions to solve the problems, but the video recordings showed that only one student, S2 worked on the problems. When S2 was out of the classroom for, the students who were members of the group suddenly stopped activities to solve the problems. They made absolutely no effort to resume resolving the given problem. A few minutes later the student S2 returned, and the group's friends seemed excited and exclaimed this person should quickly return to the group. Indirectly, it can be said that S2 was considered the most dependable student by group members.

As with the interactions that occurred in the low group, the participants on the first day and the second did not look at their interactions, on the third day observation it seemed the students' interaction with students and students with the material was not optimal. The interaction occurred only between the two students encoded R2 and R3. Both of these students appeared to discuss trying to resolve questions given by the teacher, while the other students in the group just quietly watched without contributing to give an opinion; those actually read a book of stories like comics.

When the time given to students to work on the problems had been exhausted, the teacher then asked each group about the answer to the problem they had been working on. The first group chosen was the group with the medium ability, with the correct answer, followed by a response from the group. Low group members revealed answers that were less appropriate.

The types of interactions described were the types that generally occur and are used in learning. While the type of interaction that researchers wanted, which appeared during observations, was the type of student interaction with the material, the other two types of interaction did not occur. During the observation, there was no interaction between the students and the community, because the teacher did not provide direction, as well as the opportunity for the students in other groups to express or give opinions about the answers of other students.

Overall, student activity during the learning process was unsatisfactory. The inability of students to participate actively in the class affected the low quality of interaction that occurred. This could be seen in one of them from the weight of the questions posed by students to the teacher, including not containing the words 'what, how, when, where and why', the absence of comments from other groups when there were students who answered the teacher's questions, whether it was a refutation and additional answers.



Conclusion

It was concluded that: (1) the type of interactions that occur in grade IV-B was a type of interaction that commonly occurred in the process of teaching and learning, namely for the high group there were three kinds of interactions, i.e. the interaction between students and students, students with teachers and students with the material; for groups there were only two types of interaction: the interaction between students and teachers, and the interaction between students and materials; and for the low, the interactions that occurred were the interaction between students and students and students with the material. (2) the high group nearly all participated actively in solving mathematical problems through group discussion activities; for student groups just two of the six students were active, as well as the low group. (3) the quality of the interactions that occurred when students complete math problems in a group discussion activity was still not qualified. In other words, the interactions that occurred during the learning or when solving problems in a group discussion activity and through common interactions in general.

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