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Short Communication

The Effects of Peer Interaction towards Mathematical Understanding during Learning Activities among Elementary Students

Noor Aida Affida Abdul Rahman and Mohd Faizal Nizam Lee Abdullah*

Department of Mathematics, Faculty of Science and Mathematics, Universiti Pendidikan Sultan Idris, 35900 Tanjong Malim, Perak, Malaysia
*Corresponding author: faizalee@fsmt.upsi.edu.my

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ABSTRACT

This study investigated the effect of peer interaction on mathematical understanding during learning activities among primary school students. This study gives an overview of how peer interaction impacts student understanding of mathematics. It enlightens educators and learners on the importance of communication in the teaching and learning process, especially in mathematics. The objectives of this study are to investigate students' peer interaction during learning activities and to study the effects of their interaction on their understanding of mathematics while completing their mathematics group tasks. This study employed the qualitative approach. Four Year 5 students, aged between 10 and 11 years old, have been selected through purposive sampling as respondents. The data collected were the recorded videos of the mathematics lessons on the selected subtopics. Based on the findings, peer interaction among the respondents significantly affects their understanding. The communication among the respondents also indicated that peer interaction or group discussion is an effective tool for enhancing their mathematical understanding.

Keywords: peer interaction, mathematical communication, mathematical understanding

1. INTRODUCTION

Learning mathematics traditionally focused on the teacher-centered approach where most of the time, teachers will provide input and students must receive and memorise the knowledge. Nowadays, there are more student-centered approaches proposed by scholars, especially in Mathematics. Scholars believe that by implementing more student-centered approaches, students are given opportunities to learn independently and are able to fully utilise it for the enhancement of their learning skills and understanding. A study by Aytac and Kula (2020) showed that students' creative thinking skills are positively affected when student-centered approaches and methods are applied in the lessons. Parallel to this, peer communication or interaction among the learners during the learning activities assists them in building up their knowledge of mathematics and makes them understand better. Peer interaction or communication promotes the process of sharing ideas, hearing and incorporating other's ideas, consolidating their thinking by putting their ideas into words, and building their in-depth understanding of key concepts (Francisco, 2013). An effective peer discussion in learning activities, according to Davidson and Worsham (1992) as cited by Rowe and Bicknell (2004)

requires individual responsibility and accountability, organised cooperation, and common learning tasks or goals for peer interaction. Francisco (2013) has also cited Weber et al. (2008) suggesting that the discussion also invites students or learners to be explicit in the way they make their new claims from the established facts and the standards they use in defining the acceptance of an argument. This study was conducted to study the effect of peer interaction or discussion on mathematical understanding during learning activities among elementary students. The objectives of this study are to investigate students' peer interaction during learning activities and to study the effects of their interaction on their understanding of mathematics while completing their mathematic group tasks.

2. METHODOLOGY

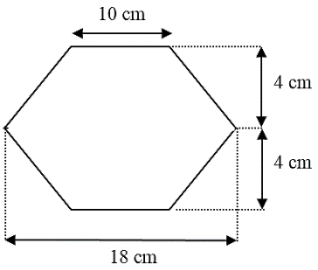
This study employed the qualitative approach by combining the Communication Study Framework of Sfard and Kieren (2001) and The Pirie-Kieren Theory (1992, 1994). The respondents of this study were selected using purposive sampling as it is believed that this type of sampling enables the representation of the study's objective. There were 4 selected students at the elementary level from a school. The data collection involved video recording, field notes from the researcher, and samples of the activities done by the respondents. The data gathered was analysed using the Communication Analysis Framework (Sfard and Kieren, 2001) and Theory of Mathematical Understanding Development (Pirie and Kieren, 1992). The selected respondents and parents were consulted regarding their consent to be involved in this study. They were guaranteed with the confidentiality of their demographic background, and they were given the freedom to withdraw from the study at any time they wanted to.

The video recordings were conducted for 3 months. There were 5 recordings involving the primary 5 respondents during the teaching and learning process of Mathematics subjects. For this study, the recordings were conducted on a specific day for the duration of 1 hour. During the recording of the session, two units of smartphones were used as a tool of recording. Based on the data from the recorded video, selected respondents were identified and were acknowledged further by the classroom teacher. The teacher was asked to give opinions to each of the selected respondents inclusive of their attitudes, perceptions, and abilities in the mathematics subject. The respondents as well were given the opportunity to write their opinions about mathematics subjects and their friends in the group.

The data was furthered analysed using the Pirie-Kieren Theory (1992, 1994) where the data was compared to 8 loops of understanding. To study the students' mathematical understanding, questioning techniques were employed, in which students were given mathematical questions to be solved and during the activities, students' dialogues were recorded and analysed. In this study as well, the researcher has implemented Analytical Model by Powell (2003) while analysing all recorded videos. By implementing this model, the researcher has gone through 7 phases of analysis including watching, explaining, identifying critical situations, mapping, coding, summarising, and developing a narrative.

3. RESULTS AND DISCUSSION

The topic of Measurement and Geometry from the mathematics syllabus was selected as per the teacher's daily lesson plan. The lesson started with the induction set by the teacher, explaining the daily issues related to the topic and students were asked to name the keywords for the addition problem solving. After several recaps of the keywords in daily mathematical problems, students were instructed to form groups and they were given mathematical problems to be solved within the group.



Question 1: Calculate the area value of the of the figure below

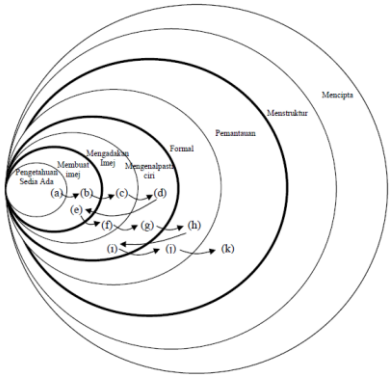


Figure 1. Afief's Mathematical Understanding Mapping

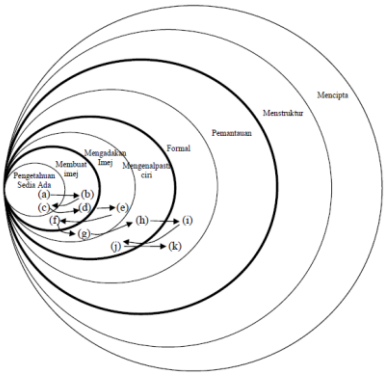


Figure 2. Damia's Mathematical Understanding Mapping

The respondents of this study managed to solve Question 1. During the discussion and interaction among the respondents, while solving the calculation of the area for the figure, respondents indicated active interaction especially when helping their peers to understand the question and the concept to calculate the area needed. The active interaction among the respondents portrayed their level of understanding of the mathematical concept of the topic. Effective communication and interaction among the peers have influenced their understanding based on several statements during the discussion that proven effective communication indeed has a significant impact on the development of students' mathematical understanding.

Based on Figure 1, it is clearly seen that in the pre-knowledge loop (a), Afief started by reading the question and observing the figure. After that, he moved to the second loop (b), creating the image by dividing the hexagon into several two-dimensional forms. Then, he started to form the image by putting labels based on the geometric side of the third loop (c). Once completed that section, he identified the two-dimensional form of the fourth loop (d). He returned to the second loop (e), when his friend asked about his work. He then moved again to the third loop (f) to get the other geometric side that he needed. He moved to the identifying loop (g) again with the assistance from Wan. Then he moved to the formal loop (h) to write the calculation for the triangle area, but he moved back to identifying loop (i) where he could not find the answer for the triangle area. With assistance from Damia, he went back to the formal loop (f) and he managed to answer the question. After he managed to solve the calculation, he moved to the observation loop (k) by helping his friend to write the calculation and get the total measurement of the figure. From this diagram and the process described, it is clear that peer interaction during the activity helped the respondent to enhance his understanding of the mathematical topic. When the respondent faced problems in solving certain issues, the peers helped by explaining and showing the calculation of the concept. At the end of the process, the respondent managed to solve the calculation for the question.

Based on Figure 2, Damia started at the pre-knowledge loop (a) where she read the question. Then she tried to create the image (b) for the second loop before she asked Afief for confirmation. She moved back to pre-knowledge loop (c) to find the similarities that could be

used to solve the question, and she started creating the image (d) at the second loop and forming the image at the third loop (e), but she missed the geometric side and made her move back to creating the image loop (f) and discussed with her friend. After the discussion, she moved again to forming an image loop (g) by looking at her friend's answer. Then she moved to the identifying level (h) and helped her friends by giving more information needed. She then moved to the formal loop (i) by looking at her friend's answer, but then she moved back to the identifying loop when her answer was different from her friend's. After that, she moved back to the formal loop (k) and managed to solve the question. From these figures, respondents' understanding became more concrete as they discussed with each other during the learning activities. Based on the findings, communication, discussion, and reasoning help respondents in finding the answer to the question. During the activity, they were able to open their minds to new things even though it was tough to solve it. Yet, by using and adapting their pre-knowledge, the issues or questions were resolved.

In summary, for this topic, respondents managed to solve the question. Since the question has its key concept understood by the respondents based on their pre-knowledge such as perimeter, the development of understanding of the term perimeter did not happen. Overall, it is suggested that the question did not really help in creating students' mathematical understanding as the communication only occurred for finding the unknown geometric sides.

4. CONCLUSION

Peer interaction has its own significant effect on the understanding of the knowledge during the learning process. By having peer interaction, discussion, and communication, learners can equip themselves with more knowledge and skills in learning as during the discussion, they are exposed to critical thinking, reasoning, and other skills that help them enhance their understanding of the topic learned. As stated by Tandililing (2012), cited by Sa'diyah et al. (2019), one of the important factors that impact the success of learning is the teacher's and student's communication ability while interacting. As well as in teaching and learning, the success of it is measured by the active participation of learners in learning activities. Sa'diyah et al. (2019) proposed that communication is crucial in the learning process including mathematics learning as it is a tool for measuring a student's understanding of what they have learned. Macit (2013) as cited by Karali and Aydemir (2018), has stated that peer interaction during cooperative learning is beneficial in terms of academic, social, and psychological aspects as students develop more positive attitudes towards mathematics, increasing success, sharing, and interacting, self-confidence and motivations, and development of awareness of responsibilities. Cobb and Yackel (1996), as cited by Francisco (2013), proposed a sociocultural perspective on learning that emphasises the interaction among learners or participants where they argued that learning occurs in and through social interactions. The interactions include sharing ideas and thoughts, arguing, reasoning, and suggesting solutions.

In the learning process, most scholars agree and believe that communication is the key to better teaching and learning, especially in mathematics. It is a tool to measure and determine the level of understanding of the topics or knowledge learned. Interaction or communication among peers during the learning process provides a more negotiable and conducive learning environment as learners have opportunities to exchange ideas and thoughts, and have less anxiety about making mistakes or being afraid to give opinions. By having peer interaction, learners enhance their communication and thinking skills better and this leads to better learning experiences which will enhance better understanding and personal development.

Declaration of Interest
The authors hereby declare that there is no conflict of interest.

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