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Does discussion have effect on students' responses?

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Abstract

Peer instruction teaching method has become an efficient learning strategy at all education grades. Peer teaching method developed by Eric Mazur can be defined as a technique in which participants actively participate in the education process by discussing in a peer group and helping each other in the group during the lesson. The aim of the present research was to investigate the effect of discussion in peer instruction techniques during the lecture. The application was carried out five weeks with 30 students in the first-course education mathematics students in an introduction to mathematical analysis lesson at Suleyman Demirel University in Kazakhstan. Concept test questions were asked to students during the lecture. We analyzed the answers of 32 multiple-choice conceptual different questions. We measured the data by using a t-test ($p=.000$). The results showed the discussion has a significant influence on the change of students' responses from inaccurate to accurate answers as previous studies.

Keywords: Peer instruction, active learning method, discussion.

Introduction

Mazur (1997) developed peer instruction method based on his experiences and practices in physics courses taught by him at Harvard University. Peer teaching is a teaching method in which students think about conceptual questions and contribute to their learning by discussing them with each other, while the teacher gives the key concepts and guides the lesson more.

Mazur (1997) states that in the Physics Department of Harvard University, where traditionally the course is taught by explaining and solving questions, students are unable to answer physics questions on a conceptual level, even if they solve mathematical questions. Likewise, it has been emphasized that even if the students successfully learn algebraic problem solving, the traditional teaching method does not have enough benefit for the students to understand the basic concepts of physics (Crouch and Mazur, 2001).

DiCarlo and Rao, (2000) reported that the effect of the peer instruction method depends on knowledge transmission from students with the correct responses and the accurate cause to their neighbors during discussions.

The peer discussion is the most well-known attribute of the PI model, and most of this review is given to reporting on learning Achievements observed after students' discussions. (Smith et al., 2009), (Porter et al., 2011b), (Bruck and Towns, 2009), (Lasry et al. 2009), (Brooks and Koretsky, 2011), (Willoughby et al., 2011), (Kaymak et al., 2019), (Tullis and Goldstone, 2020), (Morgan & Wakefield, 2012), (Giuliodori, Lujan, & DiCarlo, 2006) in their research they stated that after discussion, students ' wrong answers changed drastically to right answers.

Ten years of experience and results (Crouch and Mazur, 2000) is the most extensive research on this subject, and the findings suggest that the debate is positive for students and has the most impact when the correct answers are between 35-70% at the end of the first answers.

Implementation of Peer Instruction

First of all, reading papers are given on the subject to be covered in the course and reading exams are given before starting the course. This allows students to have some preliminary information about the subject before entering the class. The preliminary information created in

this way will form the basis for the topics to be covered in detail in the course. In addition, in this method, students' fear of being embarrassed towards their peers is a factor in increasing their motivation. (Tokgöz, 2007).

Students are divided into groups of two or three. It is a method of course processing that focuses on key concepts rather than processing all of the course notes in detail, giving emphasis to conceptual teaching. One course hour is divided into four mini-courses, each lasting approximately 15 minutes. Approximately 7 to 10 minutes of this period is used for the processing of concepts, while the remaining 5 to 8 minutes are used to direct pre-prepared concept questions and to evaluate the answers given by the students to test the level of understanding of the concept (Mazur, 1997).

- * Questions will be asked (approximately 1 minute)
- * Students are given time to solve the concept test (approximately 1-2 minute)
- * Students form their individual answers.
- * Students try to convince their peers in their group (about 1-2 minutes)
- * Students form the common answer they agree on as a group.
- * Students give feedback to the teacher by removing the option they agree on from the answer cards in which their options are written.
- * Students' answers are quickly evaluated by the teacher. If the correct answer rate is well below 35%, the teacher will rework the concept, and if it is about 70% or more, the teacher will come to the conclusion that the concept is understood and the new concept will pass. In this way, the teacher has the opportunity to receive feedback from all students in crowded classrooms at the same time and to dominate the classroom (Mazur, 1997).

An example application

Determine the correct expressions. (There may be more than one correct answer)

A- If $\lim_{x \rightarrow a} f(x)$ exists, then f is differentiable at a .

B-. If f is differentiable at a , then $\lim_{x \rightarrow a} f(x) = f(a)$

C- If $\lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a}$ exists, then f is differentiable at a .

D- If f is continuous at a , then f is differentiable at a

- A- Only B
- B- B and C
- C- A and C
- D- C and D
- E- Only A

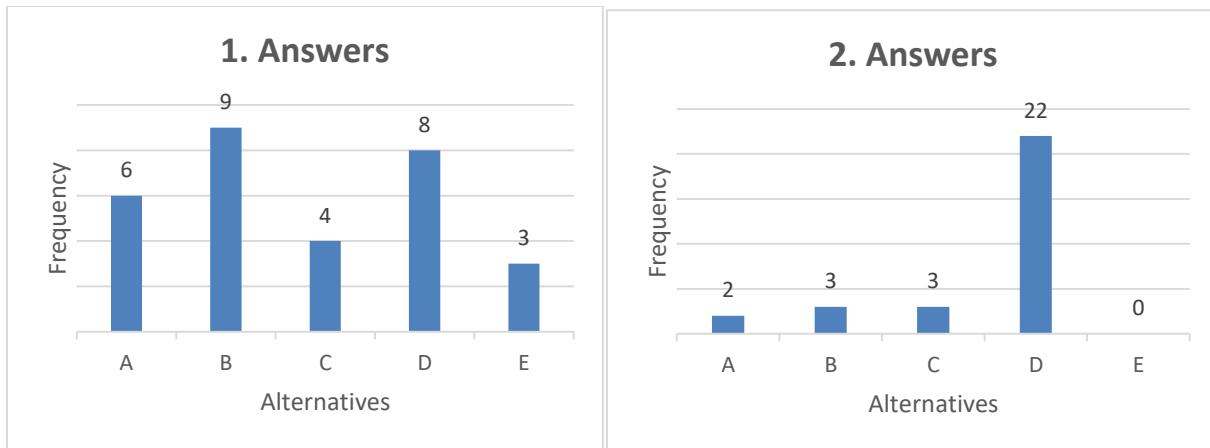


Figure 1: A graph for students' first and second responses. The correct answer is B.

Purpose of the Study

The aim of the present research is to examine if the discussion changes students' responses to the concept test during the class in peer instruction.

Research Question

- 1. Does discussion change students' responses?

Methodology

Participants

The participants in this study were 30 students in the education mathematics course.

Materials

Multiple-choice questions developed by the author related to the proceeding lesson content. Questions were proposed to check students' conceptual comprehension, rather than real learning.

Procedure

Introduction to mathematics analysis is 3 lessons of 50 minutes per week. The implementation of the peer instruction was carried out as defined by Mazur (1997). At the beginning of the lesson, the teacher gives 15-20 minutes of mini-lecture and then passing to the concept test. In the second part of the lesson given a question to class after minute students give the first response to the given question. Instructor reflect on the board the responses and analyze them, if correct answers between 35-70% instructor gives 2 minutes to discuss students their reasons with peers. If the answers are less than 35%, the topic is not understood and the short lecture repeated, if the answers are more than 70%, the other question will be passed. After 2 minutes of discussion, students give answers again. Finally, the instructor explains the solution.

Results

Table 1: Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Before-discuss correct	16.625	32	3.32876	.58845
After-discuss correct	26.625	32	1.49731	.26469

The mean of the correct responses before discussion was 16.625 while the mean of the responses after discussion was 26.625 (See Table 1). This result indicates a significant difference on behalf of the after discussion. The statistically significance was checked by paired sample t test (Table 2).

Table 2: Paired Samples Test

t	df	Sig. (2-tailed)
-22.052	31	.000

The t test results show that discussion has an effect on students' responses ($t(31) = -22.052$, $p = 0.000$).

Discussion

This research examined the effect of the discussion on first-course education mathematics students. The application was carried out on the introduction to mathematical analysis. In our study, we showed that in every question we asked, after the discussion, there was an increase in the second answers compared to the first answers in the correct answers. In our study, we asked 32 different multiple choice concept tests. In the second answers of the participants, we observed that they turned towards the correct answers compared to the first answers. As shown in the previous researches, the answers of the students increased from the wrong answer to the correct answer. The reason for this, students can successfully convey the accurate solution to their classmates, because they interact with each other positively to find the correct solution. This showed us that discussion is an effective tool of peer teaching and that it has a positive effect on correcting students' answers in the discussion. The result would support previous work in this field. (Brooks and Koretsky, 2011; Bruck and Towns, 2009; Giuliadori, Lujan, & DiCarlo, 2006; Kaymak et al., 2019; Lasry et al. 2009; Morgan & Wakefield, 2012; Porter et al., 2011b; Smith et al., 2009; Tullis and Goldstone, 2020 Willoughby, 2011).

Conclusion

In summary, we determined that the discussion change the students' responses during the concept test process in the lecture. We found a significant increase in students' correct response, similar to the study examined by Crouch and Mazur (2001), they observed that the correct answers to the concept test increased after discussion during the class.

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