# The Effect of Peer Instruction Method in Programming Education to Student's Attitudes towards Course and Programming Self-Efficacy

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**Abstract**
*In this research, the effect of using the peer instruction method in programming teaching on the secondary school student's attitudes towards information technologies and software course and their perception of programming self-efficacy comparing to traditional teaching methods are examined. In the study, the "mixed method," in which qualitative and quantitative research approaches were utilized together, was used. In the quantitative part of the research, the pretest-posttest control group and semi-experimental research model was used. In the research, a qualitative research design was also used to describe the different opinions and thoughts of the students about peer instruction method more detailed and in-depth. To this end, semi-structured interviews were conducted with 12 volunteered students from the experimental group. The study group of the research consisted of 72 sixth grade students studying in a secondary school in Turkey. In the study, it was observed that students stated opinions such as "increasing interest in lessons" and "making lessons more fun." However, it was observed that this situation did not reflect statistically on the results. According to the research findings, it can be said that the peer instruction method increases students' perceptions of programming self-efficacy more than the traditional teaching method. Student views such as "the subjects are reinforced" and "the skill of expression is increased" support this situation. The students who participated in the peer instruction method stated that the process contributed to their own and their friends' communication and that they would be pleased with the use of this method in other courses.*

**Keywords: Peer instruction method, Programming education, Programming self-efficacy, Attitudes towards course, Secondary school students and Mixed methods**

## Introduction

In the information age we are in, individuals are expected not only to be just passive users of computers and technologies originated by computers but also to be able to produce their technologies. It is thought that teaching computer programming or coding is important in this context. The programming teaching carried out for middle school students with block-based visual programming tools, and different teaching methods are studied thoroughly (Dinçer, 2018; Vatansever, 2018; Yıldırım, 2017; Shim, Kwon & Lee, 2017; Alrubaye, 2017; Kaucic & Asic, 2011; Peppler & Kafai, 2007). Especially in programming teaching, it can be seen that collaborative teaching methods are tried, and positive results are obtained (Caceffo, Gama & Azevedo, 2018; Porter, Bailey-Lee & Simon, 2013).

1. This study is a part of the first author's master thesis.

The peer instruction method allows the student, who does not understand any concept after the course and therefore cannot reach the correct answers in comprehension test questions, to talk and discuss with a student whose level of understanding is ahead of him. In this way, a significant contribution is made to the success of the student who gets help from the peer (Crouch & Mazur, 2001). It can be seen that peer instruction is applied in different ways and different disciplines according to the active learning model (Deshpande, Lee & Ahmed, 2019; Zhang, Ding & Mazur, 2017; Zingaro, 2014; Lasry, Mazur & Watkins, 2008; Golde, Koeske & Mc Creary, 2006; Cortright, Collins & DiCarlo, 2005).

There are many studies examining the effect of the tools used in programming teaching on the students' self-efficacy perceptions and attitudes in the literature. It can be seen that different results are obtained in researches (Tsai, 2019; Theodoropoulos et al. 2018; Gezgin & Adnan, 2016; Yağcı, 2016; Özyurt & Özyurt, 2015)

The overall purpose of this study is to investigate the effect of peer instruction method on students' attitude towards the course and programming self-efficacy in programming teaching. In line with this general aim, the following questions were tried to be answered:

1. What is the effect of the peer instruction method in programming teaching on the attitudes of students towards the Information Technologies and Software course compared to the traditional teaching method?
2. What is the effect of peer instruction method on programming self-efficacy perceptions when compared to traditional teaching methods in programming teaching?
3. What are the student views regarding the peer instruction method used in programming teaching?

## Method

In the research, "mixed method," in which qualitative and quantitative research approaches are applied together, was used. In this research design, quantitative and qualitative data collection processes are run at close times to each other. The data obtained are integrated after separate analyzes (Fetters, Curry & Creswell, 2013). In the quantitative part of the research, the pretest-posttest control group and semi-experimental research model were used. The courses related to programming teaching were taught by the peer teaching method in the experimental group and traditional teaching in the control group. In the study, semi-structured interviews were conducted with 12 volunteered students from the experimental group students.

### Study Group

The study group of the research consists of 72 (33 female, 39 male) sixth-grade students studying at a secondary school in Turkey. The study is to test how independent variables (traditional teaching method and peer instruction method) affect dependent variables (attitude towards information technologies course, programming self-efficacy). The study groups are randomly selected as two classes for the experimental group, two classes for the control group.

### Collection of Data

In the study, semi-structured interview form developed by the researcher, Attitude Scale for Information Technologies Course (Işık & Rıza, 2011) and Programming Self-Efficacy Scale (Kukul, Gökçearslan & Günbatar, 2017) were used.

The attitude scale for the Information Technologies course is composed of 34 items in the 3-point Likert type, taking into account the class levels of the students. Likert options of the scale were determined as agree, undecided, this agreement. It was scored as "disagree-1", "undecided-2," and "agree-3" Course (Işık and Rıza, 2011).

The Programming Self-efficacy Scale is composed of 31 one-dimensional items arranged in a 5-point Likert type. There are no inverse items on the scale. Likert options of the scale are determined as strongly agree, agree, undecided, disagree, strongly disagree. It was rated as "Strongly Agree-5", "Agree-4", "Undecided-3", "Disagree-2", "Strongly Disagree-1". (Kukul et al., 2017).

The semi-structured interview form was created by the researcher and presented to the opinion of a specialist faculty member and two teachers. It was finalized by making necessary arrangements in line with the suggestions. It consists of 4 key questions

and related probe questions. All of the interviews were recorded digitally with the approval of the participant students and their parents.

## Findings

In this section, firstly, the findings obtained from the statistical analysis of the quantitative data collected for the solution of the sub-problems of the research and their interpretation are included. Then, the interpretation of the results gained from the analysis of the qualitative data collected for the in-depth examination of research problem is included.

### Comparison of Information Technologies Course Attitude Scale Post-test Scores of Control and Experimental Groups

Independent sample t-test was carried out to determine whether there is a difference between the post-test "Attitude Scale for Information Technologies Course (IT)" scores of the experimental group in which peer education was used and the post-test "Attitude Scale for Information Technology Course" scores used by traditional education. Analysis results are given in Table 1.

**Table 1: Comparison of Attitude Scale for IT Course Posttest Scores**

| Group | n | $\overline{X}$ | SD | df | t | P |
|---|---|---|---|---|---|---|
| Control | 36 | 78.42 | 15.69 | 70 | .21 | .83 |
| Experimental | 36 | 79.17 | 14.45 | | | |

As a result of the post-test analysis between experimental and control groups, it can be said that the attitudes of the groups towards the Information Technologies course did not show a statistically significant distinction ($t_{(70)}$=.21; p>.05).

### Comparison of Programming Self-Efficacy Scale Post-test Scores Between Groups

Independent sample t-test was performed to determine whether there was a difference between the post-test Programming Self-Efficacy Scale scores of the experimental group that used peer instruction and the post-test Programming Self-Efficacy Scale scores of the control group that used traditional instruction. Analysis results are given in Table 2.

**Table 2: Comparison of Programming Self-Efficacy Scale Posttest Scores**

| Group | n | $\overline{X}$ | SD | df | t | P |
|---|---|---|---|---|---|---|
| Control | 36 | 108.03 | 17.24 | 70 | 2.86 | .01 |
| Experimental | 36 | 120.14 | 18.70 | | | |

According to the results of the post-test analysis between the experimental and control groups, there was a significant difference between the groups in the context of programming self-efficacy in favor of the experimental group ($t_{(70)}$=2.86; p<.05). It can be said that the post-test programming self-efficacy levels of the experimental group are higher than the post-test programming self-efficacy levels of the control group.

### Findings from Semi-Structured Interviews

Within the scope of the research, semi-structured interviews were conducted with 12 volunteer students from the experimental group students to whom the peer instruction method was applied. The data obtained from interviews were formed within the conceptual framework, and themes were coded.

### General views of students about Peer Instruction method in IT Course

Within the scope of the research, it was tried to determine the general thoughts of the students about the peer instruction method applied in programming teaching. The answers given by students in this context are analyzed, and the most frequently expressed opinions are themed & shown in Table 3.

**Table 3: General Views of Students on Peer Teaching Method in IT Course**

| Themes | Related Views | f |
|---|---|---|
| Learning Status | I reinforced my learning (4) | 8 |
| | I understood better (4) | |
| Course Process | The courses were fun (8) | 22 |
| | The courses were listened interestedly (2) | |
| | The interest to the course increased (10) | |
| | I got bored during the course (2) | |
| Social Relations | Friendship strengthened (8) | 11 |
| | Group discussions were useful (3) | |

When Table 3 is examined, the most frequently stated opinion of the students is related to the effect of the peer instruction method on the course process. In this context, it can be seen that the students expressed their opinions intensely as the lessons were fun, and their interest in the lesson increased:

"Some friends in the back row did not use to participate in the lesson. Thanks to this, everyone started to participate lesson… " (S1)

**Students' Views on the Superiority of Peer Instruction Method**

Within the scope of the research, it was tried to reveal the opinions of the students about the advantages of the peer instruction method compared to the traditional method. The expressions stated by the students in this regard are themed and shown in Table 4.

**Table 4: Students' Views on the Superiority of Peer Instruction Method**

| Themes | Related Views | f |
|---|---|---|
| Attitude Towards the Course | It increased in-class participation (4)<br>The courses were fun (8)<br>My friend was interested, willing (7) | 19 |
| Learning Process | It increased the comprehensibility of the course (12) | 12 |
| Friendship Relations | Our solidarity increased (6)<br>Our communication got stronger (3) | 9 |

As can be understood from Table 4, the answers given by students regarding the question of the advantages of the peer instruction method are under the theme of "Attitude Towards the Course." In this context, it can be seen that the students frequently expressed that they had more fun in the classroom environment, and their group friends' interest in the course increased in this process:

"… We learned better things with this; we had more fun. It became better." (S3)

**Students' Views on the Limitations of the Peer Instruction Method**

Within the scope of the research, the opinions of the students about the limitations of the peer instruction method compared to the traditional method were tried to be revealed. The opinions expressed by the students on this subject are shown in Table 5 by theme.

**Table 5: Students' Views on the Limitations of the Peer Instruction Method**

| Themes | Related Views | f |
|---|---|---|
| Presentation of the Course | Presentation time of the course was short (5) | 5 |
| Practice | I had difficulty in answering questions on my own.<br>Test questions were difficult (2)<br>Answering time was short<br>I felt nervous about what kind of questions would be asked<br>I felt afraid of making mistake (5) | 10 |
| Social Aspect | I didn't know my groupmate well<br>My groupmate had difficulty in solving questions (3)<br>My groupmate got bored with the activity (5) | 9 |

As can be understood from Table 5, it is seen that the students expressed opinions about the practice of peer instruction method mostly. In this context, students frequently expressed that they feared to answer the questions incorrectly, especially in the comprehension tests applied after the presentation of the lessons:

"There was a bit of fear of doing it all wrong." (S2)

**Student Views about Using Peer Instruction Method in Different Courses**

Within the scope of the research, when the students were asked whether they wanted a peer instruction method to be applied by other teachers in different courses, all of 12 students interviewed stated that they would:

"Teacher, it changes from lesson to lesson. For example, I would like to have this in maths, social studies, sir, in science, in such courses, four main courses, sir. " (S1)

**Results, Discussion and Suggestions**

In this study, no significant change occurred in students' attitudes towards the lesson. When the studies in the related literature investigating the effect of peer instruction method on attitude are examined, it is seen that the result of the peer instruction method

has a positive effect as well as the result that it does not have a significant effect on attitude.

In the studies of Eryilmaz (2004) and Şekercioğlu (2011), in which they searched for the peer instruction method on attitudes of students towards physics courses, it is stated that the method did not have a significant effect on the attitude. Similar results can be seen in studies in which Sencar-Tokgöz (2007) investigated peer instruction method on attitudes of primary school 6th-grade students towards science lesson, Özcan (2017) investigated the attitudes of peer instruction method towards chemistry lesson and Yavuz (2014) conducted on rational numbers.

It was observed that the method created a significant difference in the attitudes of students in Zhang et al. (2017) 's studies in which peer instruction on the attitudes of university students towards the introduction to physics course was investigated and Akay (2011)'s study on the effect of peer primary school students' attitudes towards mathematics lesson. Also, in their different studies, Lasry et al. (2008), Porter et al. (2013), Deshpande et al. (2019) searched the effect of peer instruction on students' tendency to quit the lesson than traditional instruction method. The common result of these studies is that, independently of academic achievement, students developed positive attitudes towards the course, and drop-out rates are thus significantly reduced. In the analysis of student interviews, regarding the course process, it can be thought that there was a positive change in the attitudes of the students towards the lesson from the frequently expressed views such as "lessons were fun," "interest in the lesson increased," in-class "participation increased," "focus on the lesson increased." However, this did not reflect statistical data significantly.

As a result of this work, it can be said that the peer instruction method in programming teaching has a positive effect on students' self-efficacy perceptions of programming compared to traditional teaching. When the literature related to programming teaching is examined, a limited number of studies have been found in which the effect of peer instruction method on programming self-efficacy perception has been investigated. A study with similar features with this study was carried out by Zingaro (2014). At the end of the research, there was no significant difference between the traditional instruction and peer instruction method in the academic achievement of the students. In contrast, there was a significant difference in favor of the peer instruction method between the programming self-efficacy perception levels.

When the findings obtained from the interviews with the students are examined, the opinions supporting the conclusion that the peer instruction method in programming teaching increases the perception of programming self-efficacy are frequently seen. In this context, frequently repeated views such as "the comprehensibility of the course increased," "It reinforced the topic, "my understanding of the topics increased," and "Expressing myself got easier "makes it possible to make this comment. In other words, it would not be wrong to say that the students' self-efficacy perceptions about programming increased, who stated that they understood the subject better, reinforced what they learned, and developed the ability to transfer what they learned to others.

In the study, while the study group students were divided into peer groups, the heterogeneous structure in which the male and female students would be together could not be created. In the light of the experiences gained during the research process and the findings obtained as a result of the research, it is important to practice the peer instruction method with different age and grade levels, as mentioned heterogeneous male-female groups in the teaching of programming and compare with the findings of this study.

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