



## PROBLEM SOLVING, CREATIVITY AND CONSTRUCTIVIST-BASED TEACHING PRACTICE OF PRESERVICE MATHEMATICS TEACHERS

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### Abstract

The purpose of the present sequential explanatory mixed method design study is to examine the connection of constructivist-based teaching practice between creativity and problem solving skills of preservice mathematics teachers (PMT). Also, thoughts of the participants about these relationships were examined through the semi-structured interviews. Totally 120 PMT participated who enrolled in an undergraduate program of elementary teacher education in eastern part of Turkey. The data were collected through three stages. In the first stage, all participants designed their micro-teachings and implemented. In the second stage, PMT were conducted the scales related to problem solving and creativity. In the last stage, ten participants were selected randomly and interviewed. The result of the present study showed that, constructivist-based teaching practice levels of PMT was statistically significantly correlated with problem solving in negative way and creativity ability in positive way. Moreover, findings based on semi-structured interviews confirmed these results.

**Key words:** Problem solving, creativity, constructivist-based teaching practice.

### INTRODUCTION

Teachers are the fundamental part and the basic determiner of the education since they are responsible for shaping the students life styles, their attitudes, their beliefs and development of creativity (Ataünal, 2000) and problem solving ability. Moreover, it is clear that teachers have direct effect on the mathematics success of the students (Presley & Gong, 2005). In this respect, it can be claimed that teacher education programs are important because these programs train preservice teachers for their future profession (Imbimbo & Silvernail, 1999). These programs design these courses considering the lists of Ministry of National Education (MNE) and Higher Education Council (HEC) explaining necessary abilities and values to be a teacher. When the preservice teachers become teachers after graduating teacher education programs, they are expected to apply all the things that they have learned in the programs. Preservice teachers are also educated during teacher education programs with respect to the philosophy of constructivism. The teachers are expected to learn the main properties of constructivist approach and how to implement their lessons with respect to this approach effectively.

The teachers can meet challenge situations in the classrooms to cope. For example, novice teachers can have many problems in the classrooms. The process of the transition from preservice teacher to inservice teacher can be difficult for novice teachers since they may not have sufficient experience about theoretical knowledge related to being a teacher (Lindgren, 2005). When they design their lessons in the classrooms, they can meet a harsh reality of everyday teaching (Lundeen, 2004) which Veenman (1984) identifies as the "reality shock" (p. 143). These problems may include to motivate students, to provide student equity, and to assess students' work (Thomas & Kiley, 1994). The classrooms as a part of teachers' life include various problems to cope in their everyday lives since the environment has the complex and dynamic nature (D'Zurilla & Goldfried, 1971). D'Zurilla and Goldfried (1971) explained that problem solving is a behavioral process in which people coping with any challenge select the most effective response among alternative responses. Problem solving is a kind of activity which is conscious, rational and effortful. The ability of people dealing with the challenge situation can be defined as problem solving ability and the level of this ability may vary from person to person (D'Zurilla & Goldfried, 1971). Moreover, one of the aims of our education system is to educate students having problem solving ability to educate qualified citizens accommodating the society effectively.



Creativity is ability that the teachers should have. While dealing with challenge situations, problems, teachers should provide creative solution strategies and have the ability of creativity. The teachers can solve the problems with the help of the ability of creativity. Roberts (2003) defined creativity as forming new information benefiting from available information. This forming new information can happen in process. In this process, people use actively previous knowledge, ability, habits, knowledge related to theory and practice (Bartzer, 2001). Moreover, creative thinking is a dynamic process including mental activities happening in subconscious while they are aware of the happenings. Moreover, the teachers are important factors to discover the creativity ability of the students. In addition, problem solving and creativity is directly connected abilities. This connection can be exemplified four steps of creativity identified by Guilford; identifying the problem, forming various beneficial information, assessing this information and forming a schema including beneficial solution strategies (Cropley, 2001).

In this respect, it is important to determine PMT's levels of the abilities of problem solving and creativity and also the connection of these abilities related to their constructivist-based teaching practices. Therefore, the purpose of the present study is to answer the following questions;

1. What are the levels of PMT's constructivist-based teaching practices and their abilities of problem solving and creativity?
2. What are the connections of constructivist-based teaching practice with the abilities of problem solving and creativity?
3. What are the thoughts of PMT about the connection of constructivist-based teaching practice with the abilities of problem solving and creativity?

## METHOD

### Participants

Sample of the study included of 120 PMT, enrolled in the programs of elementary mathematics education and secondary mathematics education in a university in eastern part of Turkey. Of 120 participants, 65 were female students and 55 were male students. All of the participating universities were public institutions.

### Instruments

There are three instruments used in the present study. The first instrument is Reformed Teaching Observation Protocol (RTOP). It was used to evaluate PMT's constructivist-based teaching practices. It is composed of 25 items with three subcategories: lesson design and implementation, content and classroom culture. The translation and validation study of the instrument was made by Topcu and Temiz (2012). The items are scored with the help of 5-point Likert scale. For each item; a score of "1" is rated when the behavior related to the item was not observed and a score of "5" is used when the behavior based on the item was very descriptive (Sawada et al., 2000). The second one is Problem-Solving Appraisal. The Problem Solving Inventory (PSI) (Heppner, 1988; Heppner & Petersen, 1982) is a measure of self-perceived problem-solving ability with 35 items. It is a 6-point Likert scale scored from strongly agree (1) to strongly disagree (6). High scores on the PSI can be explained that there are low level of perception of effective problem-solving ability, problem-solving style, and personal control, of the scorers. The instrument was developed by Heppner and Petersen (1982) and Validity and reliability studies were done by them. Also, the instrument was translated into Turkish and reliability and validity studies of this new form were made by Sahin, Sahin and Heppner (1993). Satisfactory values were found for both forms of the instrument. The last one is the instrument of "How creative are you?" developed by Raudsepp (1979). It includes 27 items with only one sub-factor and it can be scored in a 5-point Likert scale. The highest that can be obtained from the instrument is 135 and the lowest score is 27. The instrument was translated into Turkish by Gulel (2006). The satisfactory values of reliability and validity were found for both forms. After conducting of the quantitative instruments was finished, semi-structured interviews were conducted with randomly selected ten PMT.

### Data Collection and Analysis

Data collection period was carried out during the term of 2011 and 2012. PMT designed their micro-teachings and implemented their lesson plans. The lessons were videotaped while they were implementing their lessons.

The researcher scored the micro-teachings with the help of RTOP by watching the videos. After the implementations of the lesson plans finished, ten PMT were selected to be interviewed and the participants were conducted semi-structured interviews. Moreover, descriptive statistics were used for the sake of the determination of the levels of PMT's constructivist-based teaching practices and abilities of problem solving and creativity. In order to determine the connection PMT's constructivist-based teaching practices with the abilities of problem solving and creativity by using Pearson multiplication of moments correlation quotient analysis. The goal of the interviews was to gain deep information about the connection of constructivist-based teaching practices with problem solving and creativity. The semi-structured took maximum of 1 hour long. Interviews were audio taped, transcribed, and then analyzed in a qualitative manner. Codes and themes were determined. Then, reliability and validity of the codes and themes were determined by peer debriefing and using rich and thick descriptions and direct quotations.

## RESULTS AND DISCUSSION

It was found that there were the correlations between PMT's constructivist-based teaching practices and abilities of problem solving and creativity. First, constructivist-based teaching practice of PMT was significantly correlated with their problem solving ability ( $r = - 0.585$ ,  $p < .01$ ) in negative way. It can be said that this relationship is at medium level. Second, constructivist-based teaching practice of PMT was significantly correlated with their creativity ability ( $r = 0.733$ ,  $p < .01$ ) in positive way and with high level. Last, problem solving ability of PMT was significantly correlated with their creativity ability ( $r = - 0.765$ ,  $p < .01$ ) in negative way and with high level.

The qualitative content analysis of the interview transcripts indicated the participants' opinions on this last relationship. The following is a typical representative interviewee response:

"I think that a teacher who is able to instruct consistent with constructivist approach has high level of beliefs of creativity and problem solving. She or he can successfully form atmosphere for the classroom with the help of this beliefs. When s/he faces with any problem in the lesson, s/he can effectively provide a creative solution to the problem, apply the solution to the problem situation and solve the problem. S/he can create new learning opportunities for students and help them effectively. "

In light of both qualitative and quantitative findings of the present study, it can be explained that PET's constructivist-based teaching practice is positively correlated with creativity ability and negatively correlated with problem solving ability.

## CONCLUSION

It was found that constructivist-based teaching practice of PMT was negatively correlated with their problem solving ability and positively correlated with their creativity ability. In this respect, it can be stated that PMT having high level of the belief of having the ability of creativity tend to instruct consistent with constructivist approach. On the other hand, PMT having low level of the belief of not solving problems are more likely to instruct consistent with constructivist approach. In addition, PMT's views about these relationships confirm the findings of statistical procedures used in order to find these relationships. Also, problem solving ability of PMT was negatively correlated with their creativity ability. In light of this finding, it can be told that PMT having high level of the belief of having the ability of creativity tend to have low level of the belief of not solving problems.

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