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Effects of Problem Based Learnıng on Prospectıve Scıence Teachers' Problem Solvıng Skılls

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Abstract

It can be said that teachers have an important role as a guide in science and technology education. When it's about training successful teachers, problem solving skill and positive thinking skill comes to foreground. Problem based learning, which is an effective approach on problem solving might have a positive effect on these skills. Within this scope this study's aim is to research effects of problem based learning on prospective teachers' problem solving skills.

Experimental practice was made with science prospective teachers who were studying fourth grade in Dokuz Eylul University Buca Faculty of Education. This study is conducted with pre test post test quasi experimental research design. Courses of experiment group continued with problem based learning while courses of control group continued with general biology laboratory instruction program.

Problem Solving Skills Scale applied on prospective teachers in experiment and control groups. In addition, semi structured interviews applied on prospective teachers in experiment group after experimental practice.

Analysis of obtained data made with SPSS program. After data analysis, it is determined that a significant difference found in problem solving skill perceptions between experiment and control group in favor of experiment group.

1. Introduction

One of the most important components of science and technology course is science and technology laboratory. Since 2005 science and technology education program, science courses have been done with laboratory support [1]. Thus, science laboratory and experiments have gained importance in science and technology education program based on constructivist approach. Activity of science and technology teachers gained importance. Therefore, we can say that increasing effectiveness of science and technology laboratory increases the permanency of gained knowledge. New and effective approaches on science and technology laboratory may promote problem solving and knowledge using skills. Problem based learning (PBL) which uses daily life problems and promotes student centered learning is a good example for this. Daily life problems used in problem based learning may provide cognitive conflict [2]. These problems are solved in social stages where individuals are interactive with their environments. Individuals have chance to evaluate their own learnings by discussing and exchanging views [3]. In addition, role of educator in problem based learning is to guide students during learning process instead of transferring knowledge [4]. Therefore we can say that problem based learning may improve teachers' problem solving skills.

Fundamentals of problem based learning depends on Dewey's [5] work which emphasizes bonds between activity, thinking and learning. Problem based learning first entered on literature after work of Barrows and Tombly in Canada McMaster University Medicine Faculty at the end of 1960's. Barrows and Tombly emphasizes on differences brought by problem solving on learning. On first trials, small student groups formed and students are expected to decide between problem and situation [6].

Problem based learning first used in Dokuz Eylul University Medicine Faculty between 1997-1998 in Turkey. There were also similar problem based learning activities in Hacettepe University and Pamukkale University medicine faculties [7]. Teacher education programs in Canada and USA formed based on this approach.

Problem based learning is a student centered learning model based on Dewey's "Learning by living and doing" principle [8]. Problem based learning is an effective approach on problem solving by placing problem in center from used method and technique to measure and evaluation [9]. Problem based learning encourages students to search, learn, discuss, choose the most appropiate solution to problem and apply by using scenarios including daily life problems [10]. In another words, problem based learning provides related learning experience by becoming "spine of learning" [11].

1.1. Problem statement:

What are the effects of using problem based learning in biology laboratory on prospective science teachers problem solving skills?

2. Method

2.1. Research model

In this research pre-test post-test control group quasi experimental design used. In pre-test post-test control group quasi experimental design, an experiment group which exposed to independent variable and a control group which is not exposed to independent variable included. Thus, this design consist of two or more groups as experiment group(s) and control group. In this design participants can't be selected randomly. If there is no significant difference between groups' pre-test scores, it can be defined as relative group equivalence. Pre-test and post-test scores are compared in order to determine if there is a significant difference [12,13]. In this research student group exposed to problem based learning and student group exposed to general biology laboratory curriculum and activities compared in order to determine if there is a significant difference or not. Thus, students exposed to PBL formed experiment group and students exposed to general biology laboratory curriculum and activities formed control group.

Table 1. Symbolic view of research design

GROUPS	PRE TEST	PROCESS	POST TEST
EXPERIMENT GROUP	*T1*	*Problem Based Learning*	*T1*
CONTROL GROUP	*T1*	*General Biology Laboratory Curriculum and Activities*	*T1*

T1: Problem solving skills scale

2.2. Workgroup

Appropiate sampling chosen in this research and a workgroup was formed in line with quasi experimental design. In experimental studies generalizability is lower than descriptive studies. Thus, workgroup should be preferred in experimental studies [13].

This research took place on 2012-2013 education year in Dokuz Eylül University Buca Faculty of Education. Experiment group (n=47) and control group (n=49) were formed from students studying "Biology Laboratory I" course in science education department of Dokuz Eylul University Buca Faculty of Education on 2012-2013 fall semester.

2.3. Data collection tools

Problem solving skills scale

In order to determine students' problem solving skills, a likert type scale developed by [14] used in this study. Data collection tool used on an adult group consist of 38 participants in order to define structure validity and reliability coefficient. After pilot study it's found that participants couldn't understand some items in scale. These items were redesigned in line with expert views. In this shape scale was applied on 65 different participants (103 total). After pilot study, scale was applied on 550 participants chosen by researchers. Scale consists of 18 items and include five factors. These factors are "thinking effects of problem solution", "problem solution via modelling", "searching for alternative solutions", "decisivity on application of solution", "analysis of encountered problems". Reliabilities of factors in scale are 0,95, 0,98, 0,82, 0,82 and 0,87 in same order. Cronbach alpha reliability coefficient for whole scale found as 0,88. Minimum score can be taken from scale is 18 while maximum score is 90.

3. Findings

In process of solution to problem statement of this research indicated as "what are the effects of using problem based learning in biology laboratory on prospective science teachers problem solving skills?" data collected from participants were analysed with ANCOVA. Analysis results show that participants'

post test problem solving skills scores have a significant difference in favor of the experiment group ($F_{(1,91)}$ = 12.57, p = .001, η_p^2 = .121). According to obtained results we can say that using problem based learning in biology laboratory has a positive effect on prospective science teachers' problem solving skills.

4. Results and Discussion

Problem solving skills should be thought as one of social-emotional adequacy and important from this angle of view [15]. Problem based learning provides learning experiences in which individuals start from a problem and dominate the whole topic [11,16]. Finding a strong solution for encountered problem helps individuals to gain resistance by dealing with difficulties and keeping up their orientation in a balanced way [17]. In problem solving, students' prior knowledge, used cognitive processes and self perception have important roles. Problem based learning is a learning method that encourages students to realize and determine their learning needs, learning about their learning, promoting functional knowledge, promoting teamwork and helping topics to be comprehended deeply and in a holistic way [18]. Therefore, it can be tought that problem based learning helps students' problem solving. Problem based learning targets learning mew knowledge by solving encountered problems in discussion group in guidance of educator [19]. In problem based learning students examine problem and provides solution by using prior knowledge and new knowledge [20]. Problem based learning uses real life problems presented to students in order to improve problem solving skills, promote knowledge gain and provide required concept of course [21,22,23]. Problem based learning has a problem to solve, thus problem solving skills of students studying in problem based learning environment should be improved [24]. In this line, we can say that problem based learning has a positive effect on students' problem solving skills.

Problem based learning is a learning method in which learning occurs on problem, fundamental processes underneath problem are comprehended and solved in group discussions. Thus, it's thought that problem solving process is important in problem based learning. Therefore in this study using problem solving skills during problem based learning might have affected prospective science teachers' perceptions in a positive way and indicated results might be depending on this affection.

4.1. Implications

Results of this study discussed and following implications are suggested in line with results:

- Findings show that using problem based learning have positive effects on prospective science teachers' problem solving skills. Therefore, problem based learning may be used in order to improve prospective science teachers' problem solving skills.
- Further studies should be done about problem based learning in order to see wider results.
- More studies should be done with different groups and different variables about problem based learning.

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