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The Investigation of the Effects of Authentic Assessment Approach on Prospective Teachers' Problem-Solving Skills

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Abstract

The purpose of this study was to investigate the effect of authentic assessment, an approach used in Scientific Research Methods, on problem solving skills of prospective classroom teachers. The participant groups of the study consisted of sophomore prospective teachers who study at Dicle University in the Ziya Gökalp Education Faculty Classroom Teaching Department during 2013-2014 academic spring term. The two classrooms in the department were randomly assigned as experimental group (Group B) and control group (Group A). The experimental group was given authentic tasks and asked to do them group work. The authentic tasks fulfilled by prospective teachers were analyzed in accordance with the authentic assessment approach. Authentic assessment tools such as self-assessment, group assessment, portfolio assessment, teacher-peer assessment, weekly performance assessment, and student journals were used in the experimental group. Meanwhile, control group activities were based on a subject-oriented curriculum design and teacher-centered traditional practices and assessment were carried out. Methods like verbal lectures, discussions, and question-answers were used. In addition, the evaluation process was conducted on the mid-term exam essay in traditional sense. While the pre-test and post-test results of the experimental group indicate a statistically significant positive difference for the post-test, the difference between pre- and post-test results for the control groups were not found to be statistically significant. Moreover, a comparative analysis of adjusted post-test results based on pre-test results of experimental and control groups indicated a statistically significant positive difference in favor of experimental group.

Keywords: authentic assessment, problem solving skills, prospective teachers

1. Introduction

Nowadays, the rapid increase in the technological innovations and the changes in social construct have made it essential to look for different qualities in individuals (Kutlu, Doğan, & Karakaya, 2010). Hence, rather than individuals who can memorize information, the importance of those who can use it, question and discuss, and solve problems with this information has gained significant value (Akınoğlu, 2009; Güneş, 2010; Şentürk & Baş, 2010). As a result of this, one of the main purposes of today's education is to raise individuals who have the ability to solve problems. (Çevik, 2011; Saracaloğlu, Serin, & Bozkurt, 2001; Karacaoğlu, 2011; Kutlu et al., 2010). According to Gagne (1985), the ultimate purpose of educational programs is to train students how to solve the problems they might face both in school-related topics and throughout their lives (Senemoğlu, 2005). Teachers have the most important responsibility in training and developing such problem-solving skills in their students (Polat & Tümkaya, 2010; Çevik, 2011; Bingham, 1998). But teachers are expected to have effective problem-solving skills to fulfill this responsibility (Polat & Tümkaya, 2010). The abilities to solve problems can efficiently be taught with problem-solving training (Çevik, 2011). Therefore, pre service teacher education may have a significant role in equipping teachers with these skills. It has been essential to apply practices to develop such problem-solving skills during pre- service teacher education as it is very difficult to make them gain and develop such skills through traditional teacher and topic oriented contexts (Ev, 2010). Consequently, it is very important to determine what kind of an effect authentic assessment approach (King, 2000, p. 153; Wiggins, 1998; in Svinicki, 2004) has on the development of teachers' problem-solving skills.

The purpose of this study was to investigate the effect of authentic assessment, an approach used in Scientific

Research Methods, on problem solving skills of classroom prospective teachers. The research questions to be answered are as follows:

1) Is there a significant difference between the pre-test and post-test scores based on problem-solving skills of an experimental group, who were educated with authentic assessment approach and traditionally educated control group?

2) Is there a significant difference between post test scores of the experimental group who were educated with authentic assessment approach, and the traditionally educated control group when their pre-test scores are controlled?

1.1 Authentic Assessment

The English term 'authentic' is associated with words as real, original, reliable, major, genuine, correct and main in Turkish (Tureng, 2013). In 1988 the term was initially used in learning and assessment contexts and then, in 1992, authenticity was used to represent appropriate, meaningful, essential and valuable success forms of individuals. Authentic assessment as a term was first expressed by Wiggins (1989) (Chang & Chiu, 2005). Recently, within a constructivist approach, as frequently stated in an educational context, it has been necessary for students to construct active assessment approaches instead of giving non-active responses. Nowadays, the students are expected to actively demonstrate what they know and what they are able to do. Authentic assessment rather stands for the application and utilization of knowledge as opposed to secluded skill assessments. Moreover, it contains the overall performance of meaningful but complicated tasks in challenging contexts (Montgomery, 2002).

Authentic assessment is considered to be a new approach in assessment. This approach associates learning with real and complicated situations and contexts (Olfos & Zulanta, 2007). It is an assessment based on student practices in which real world performances are repeated (Svinicki, 2004). According to Eby (1998), authentic assessment is a task that mostly enables students to use their cognitive processes besides showing them what they have learnt and what they do. Authentic assessment which is also denoted as performance assessment, appropriate assessment, alternative assessment, or direct assessment, contains such techniques as written texts, portfolios, checklists, teacher observations, and group projects (Olfos & Zulanta, 2007).

Traditional exams cannot explore real changes in student knowledge. On the other hand, assessment approaches that emphasize learning process, and encourage students to conduct cognitive and reflective activities are consistent with constructivist concepts. Meanwhile, authentic assessment reflects such an alternative assessment technique. This assessment is based upon authentic learning tasks instead of separate tests and focuses on the process as much as the product (Tynjälä, 1999). Authentic assessment requires implementation of necessary skills inside the classroom and utilization of them to underpin further learnings (Mintah, 2003). In such an assessment, the student demonstrates his/her skill towards an attitude in real life context and is assessed based on this fundamental performance (Woster, 1993).

Authentic assessment displays the implementation of students' certain skills and judgment, and dwells more on problem-solving, comprehension, critical thinking, reasoning, and metacognition. Hence, students are supposed to deal with meaningful materials and problem solving through authentic assessment (King, 2000). In other words, authentic assessment necessitates students using their prior knowledge, recent teachings, and skills to overcome real and complicated problems. For instance, students can create a project on a topic they have chosen, prepare a research report and present their end products for evaluators (DiMartino & Castaneda, 2007).

1.2 Problem Solving Skills

A problem can be defined as 'an obstacle that stands against the strength one collects to attain an aim' (Bingham, 1998, p. 18). But a problematic situation needs to carry some characteristics. These characteristics are listed below (Öğülmüş, 2006):

1) There should be a difference between present situation and intended situation (tone),
2) The individual should realize the condition,
3) The realized difference should have a tension on the individual,
4) The individual should have attempts to resolve tension,
5) The attempts of resolution should be hindered.

Problem solving, as the last step of mental and intellectual processes, (Duman, 2008) could be defined as 'being able to find solutions by doing further attempts to overcome a problem through the simple application of

previously gained experiences' (Kokut, 2002). According to Heppner (1987, p. 3), on the other hand, problem solving indicates how the individual copes with daily problems, what he thinks when he struggles with real life problems, and how he behaves and feels about those problems. Thus, problem solving skills involve required abilities to overcome a problem (Yetkin & Başcan, 2008). Because encountering various problems is not limited to the time spent at school, it is a life-long needed skill (Bingham, 1998). An individual's life is a process full of making and solving problems because he generates a new one while attempting to solve another problem (Taşpınar, 2014).

Problem solving skills play one of the most significant roles in becoming an individual and coping with his/her environment. The development and welfare of humanity depends upon the improvement of this outstanding skill because one has to handle his/her own problems with his/her self-problem solving skills (Güçlü, 2003). If individuals are expected to have such cognitive, affective and psychomotor skills as to keep up with the problems they confront life-long, these skills might not be expected to occur through random education (Yaşar, 2011). Thus, problem solving skills of individuals can effectively be attained through educational practices that ensure problem solving development (Çevik, 2011), because one of the fundamental characteristics of education is to raise individuals who have cognitive, affective and psychomotor skills to cope with confronted problems (Yaşar, 2011).

Within the learning context, effective problem solving constitutes a substantial part of performance and productivity. Significantly successful individuals realize complications timely and immediately take action to solve them (Bransford & Steain, 1993; in Miller & Nunn, 2001). Individuals discover their talents thanks to problem solving opportunities. While the individual who is encouraged to seek a solution for encountered difficulties endeavors to act as required for the problem, at the same time, s/he has an opportunity to use his/her knowledge, intellectual, skills and needs (Bingham, 1998, p. 12). Furthermore, individuals are supposed to learn problem solving skills to correspond to their living contexts, as it helps the individual and the social group to harmonize with each other (Senemoğlu, 2005).

According to D'Zurilla and Goldfried (1971), a rational problem solving model contains four fundamental skills as (a) identification and formulation of the problem (b) finding alternative solutions (c) decision-making and (d) application of the solution and assessment (Bell & D'Zurilla, 2009; Bedel & Arı, 2012).

2. Methodology

2.1 Research Model

In this study a quasi-experimental nonequivalent control group model was used. The quasi-experimental nonequivalent control group model is one of models most commonly used in educational sciences, which has pre-test, post-test, experiment and control group. However, groups may not be equal prior to the experiment. Groups are naturally formed and the participants are carefully regarded to have similar qualifications. The experimental and control groups are randomly assigned (Campbell & Stanley, 1963; Karasar, 2009).

2.2 Research Group

The participant groups of the study consisted of sophomore prospective teachers at Dicle University Ziya Gökalp Education Faculty Classroom Teaching Department during the 2013-2014 academic spring term. The two classrooms in the department were randomly assigned as the experimental group (Group B) and control group (Group A). The experimental group included 42 prospective teachers, while the control group had 44 prospective teachers. However, because one of the control group participants (a female prospective teacher) did not take part in the post test, the analysis included only 43 participants. The gender distribution for experimental and control groups are presented in Table 1.

Table 1. Gender distribution for experimental and control groups

	Gender	n	%
Experimental Group	Female	21	50.00
	Male	21	50.00
	Total	42	100.00
Control Group	Female	26	60.50
	Male	17	39.50
	Total	43	100.00

The findings whether experimental and control groups were equal based on dependent variable prior to the application are presented in Table 2.

Table 2. Independent sample T-test results for group based problem solving skills pre-test scores of the prospective teachers

Grup	n	$\overline{X}$	Ss	sd	t	p
Experimental	42	73.48	16.38	83	-1.317	.191
Control	43	78.09	15.94			

Analyzing Table 2, it can be seen that there is no significant difference between experimental and control groups problem-solving skills pre-test scores. ($t_{(83)} = -1.317$, $p = .191 > .05$). Consequently, it can be claimed that experimental and control groups were similar in their problem-solving skills prior to the application.

2.3 Application Process

The practices carried out in the experimental group at Ziya Gokalp Education Faculty, Department of Classroom Teaching 2/B Branch of the prospective teachers studying "Research Methods" covers practices performed in the course of 13 weeks. In this process the prospective teachers fulfilled assigned authentic tasks working in the groups. In the first week, the students were informed about the process by the application of a pre-test. On the second week, group presentations on basic concepts of scientific research and discussions on presentations were held. By identifying their research subjects in the third week, the groups studied these subjects until the 12th week. The groups presented their completed studies in the symposium held on the 12th week. The post-test was assigned on the 13th week. Authentic tasks performed by prospective teachers were evaluated in accordance with authentic assessment approach. Authentic assessment tools such as self-assessment, group assessment, portfolio assessment, teacher-peer assessment, weekly performance assessment, and student journals were used in the experimental group.

Meanwhile, control group activities were based on a subject-oriented curriculum design and teacher-centered traditional practices and assessment were carried out. Methods like verbal lectures, discussions, question-answers were used. In addition, the evaluation process was conducted in mid-term exam essay in the traditional sense.

2.3 Data Collection Tools

In this study, data were collected using the "Problem Solving Inventory" (PSI) was used. PSI was developed by Heppner & Petersen (1982), and adapted to Turkish by N. Şahin, N. H. Şahin, and Heppner (1993). PSI is a self-report with 35 items and 1-6 Likert type scale which measures self-perception about individual's problem-solving skills. On each item, the individuals are asked how often they act the same way as indicated on each scale item. The options are "(1) I always act like that", "(2) I frequently act like that", "(3) I often act like that", "(4) I sometimes act like that", "(5) I rarely act like that" and "(6) I never act like that". The items 9, 22 and 29 are excluded from scoring. The scoring ranges from 32 to 192. A higher score indicates that the individual perceives him/herself inadequate in problem solving skills (Şahin et al., 1993; Şavaşır & Şahin, 1997).

As a result of factor analysis, the scale was found to be comprised of six considerations as "Hasty Attitude" (items 13, 14, 15, 17, 21, 25, 26, 30 and 32), "Thoughtful Attitude" (items 18, 20, 31, 33 and 35), "Avoidant

Attitude" (items 1, 2, 3 and 4), "Evaluative Attitude" (items 6, 7 and 8), "Confident Attitude" (items 5, 23, 24, 27, 28 and 34) and "Planned Attitude" (items 10, 12, 16 and 19). Based on these factors, the generated Cronbach Alpha coefficients of factor subscales were subsequently found to be .78, .76, .74, .69, .64 and .59 (Şahin et al., 1993; Şavaşır & Şahin, 1997).

Reliability analysis of Cronbach Alpha coefficients for the present study was calculated .864 for pre-test and 875 for post-test.

2.4 Data Analysis

Demographic variables for prospective teachers were analyzed in percentage and frequency analysis. Mean and standard deviation of pre-test and post-test scores for experimental and control groups obtained from the data collection tool were calculated. In order to determine whether the data obtained from data collection tool shows normal distribution or not, Komogorov-Smirnov test was done. As a result of Komogorov-Smirnov test, it was determined that both pre-test and post-test scores have normal distribution ($Z = .856$, $p = .456 > .05$; $Z = 1.115$, $p = .166 > .05$). To determine whether there was a significant difference between the pre-test scores of the groups, an independent sampling T-test was conducted. The difference between groups' adjusted post-test scores according to pre-test scores was examined with covariance analysis (ANCOVA). Paired-Samples T-test was used in order to compare pre-test and post-test scores of both experimental and control groups obtained from data collection tools. In case a significant difference was found as a result of performed statistical procedures, the impact value was calculated to determine the size of the difference. Eta squared value was used to calculate the impact value. According to Chone (1988), if the Eta square value is between .01 and .06 it is interpreted as minor, from .06 to .14 moderate, and .14 or more is interpreted as major (in Pallant, 2005; Akbulut, 2010).

3. Findings

Table 3 presents the difference between pre-test and post-test scores for problem solving skills of the experimental group to whom activities based on authentic assessment approach were assigned, and of the control group to whom traditional teaching practices and assessment were assigned.

Table 3. Paired-samples T-Test scores for the difference between pre-test and post-test scores based on problem solving skills of experimental and control groups

Group	Test	n	$\overline{X}$	ss	sd	t	p	η^2
Experimental	Pretest	42	73.48	16.38	41	2.284	.028*	.113
	Posttest	42	68.67	14.74				
Control	Pretest	43	78.09	15.94	42	-.927	.359	
	Posttest	43	80.09	16.38				

Examining Table 3, where pre-test and post-test scores for problem solving skills of the experimental group are compared, it can be seen that there is a statistically significant difference in favor of post-test ($t_{(41)} = 2.284$, $p = .028 < .05$). Taking Eta square into account, the significance of difference (.113) is observed at a moderate level. According to this, in terms of problem solving skills, the prospective teachers in experimental group feel more positively compared to before the conduction of the study. On the other hand, the difference pre-test and post test scores for problem solving skills of the control group ($t_{(42)} = -.927$, $p = .359 > .05$) does not show any significance. According to these results, the prospective teachers in the control group do not show any significant difference in their self-perception of problem solving skills compared to their states prior to the conduction of the study. In order to take possible impacts of pre-test scores on post-tests under control, adjusted according to their pre-test scores, the differences between post-test scores for problem solving skills of the experimental and the control groups were examined with Covariance Analysis (ANCOVA). Statistical results for the analysis are presented in Table 4 and Covariance Analysis (ANCOVA) results are in Table 5.

Table 4. Averages for problem solving skills post test scores of experimental and control groups based on adjusted pre-test scores

Group	n	Pre-test	Post-test	Adjusted Post-test Averages
Experimental	42	73.48	68.67	70.06
Control	43	78.09	80.09	78.73

Analyzing Table 4, it can be seen that based on their adjusted pre-test scores, the average post test scores of the experimental group for problem solving skills is 70.06 and the control group is 78.73.

Table 5. ANCOVA test results of experimental and control groups post-test averages based on their adjusted pre-test scores

Source of Variance	Sum of Squares	sd	Average of Squares	F	P	η^2
Pre-test	7686.51	1	7686.51	50.446	.000*	.381
Group	**1566.94**	**1**	**1566.94**	**10.284**	**.000***	**.111**
Error	12494.45	82	152.37			
Total	22955.01	84				

When Table 5 is examined, a statistically significant difference ($F_{(1,82)} = 10.284$, $p = .000 < .05$) in post-test scores for problem solving skills that were adjusted according to pre-test scores can be observed between the experimental group and the control group. Considering Eta-square value (.111), the significance of identified difference is moderate.

4. Discussion and Conclusions

Analyzing the first sub-problem of the study, the comparison of pre-test and post-test scores for problem-solving skills of the experimental group indicate a positive result in favor of post-test scores. In other words, there has been a significant increase in the perception for problem solving skills of the experimental group compared to their conditions prior to the study. The significance of the difference for Eta-square is moderate. In contrast, there has been statistically no significant difference between pre-test and posttest scores for problem solving skills of the control group. Examining findings for the second sub-problem of the study, there has been a significantly positive difference between the experimental group and the control group in favor of the experimental group when their posttest scores for problem solving skills were adjusted according to pre-test scores. Determined according to Eta-square value, the significance of this difference is moderate. Analyzing findings for the first and second sub-problem, authentic assessment approach is observed to have a positive impact on prospective teachers' perception of problem solving skills, but traditional education and assessment is observed to have no significant impact on this perception. In other words, it can be interpreted that the tasks based on authentic assessment approach have been more effective in the improvement of prospective teachers' problem solving skills than traditional education and assessment tasks in their Scientific Research Methods classes.

An individual's problem solving knowledge and skill can merely be improved by an education designated to solve problems effectively (Polat & Tümkaya, 2010). Problem solving skills can also be improved through repeated occasions in which the individual him/herself solves problems of great importance to him/her (Bingham, 1998). In addition, authentic assessment, because of its focus on problem solving (King, 2000:153; Wiggins, 1998; in Svinicki, 2004) and requiring students to demonstrate a range of skills related to the solution of complex problems (Wiggins, 1998; in Svinicki, 2004; DiMartino & Castaneda, 2007) presents reproducible opportunities for the solution of problems. In this sense, it is believed that because the prospective teachers in the experimental group applied the learning and assessment process in actual tasks, and that by fulfilling these tasks, they tried to find solutions to the problems they faced, this factor made a positive contribution to their perception of problem solving skills. In other words, the prospective teachers in the experimental group tried to find out solutions to a real scientific problem following scientific phases. Trying to find out solutions to a scientific problem, the prospective teachers also faced and tried to solve other problems like reaching out to experts, finding related resources and convincing participants to fill in the data collection tools, and problems related to group work. All

these efforts are expected to have a positive impact on their problem solving skills. Besides the impact of the application based on authentic assessment approaches, in order to improve students' problem solving skills, carrying out the Scientific Research Methods in higher education institutions in practice might be another reason of this result (Yaşar, 2014). Likewise, it is stated that student-centered teaching methods in practice contribute positively to the development of students' problem solving skills (Hançer & Yalçın, 2009, p. 70; Benzer & Şahin, 2013, p. 384). Studies carried out by Koçyiğit (2011) and Kaya (2010) indicate that findings support this conclusion by nature. In his study, Koçyiğit (2011) reached the conclusion that authentic task-oriented constructive approaches are more effective in developing prospective teachers' problem solving skills than curriculum-based practices. Kaya (2010) also determined in his study that the applications based on constructivist teaching contribute more positively to the improvement of prospective teachers' problem solving skills than curriculum-based tasks.

The following suggestions were made in the light of the results obtained:

1) Based on the result that authentic assessment contributes positively to the perception of prospective teachers' problem-solving skills, it is recommended to use this approach in acquiring problem solving skills in teacher education.
2) This research is limited only to the Scientific Research Methods course and classroom teaching prospective teachers. The possible effect of authentic assessment approach on problem solving skills can be studied in different courses and prospective teachers from different branches of teaching.
3) Further experimental studies can be conducted for further methods that could have an impact on the improvement of problem solving skills.

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Note

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