



EFFECT OF LABORATORY ACTIVITIES DESIGNED BASED ON PREDICTION- OBSERVATION - EXPLANATION (POE) STRATEGY ON PRE-SERVICE SCIENCE TEACHERS' UNDERSTANDING OF ACID-BASE SUBJECT

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Abstract

The purpose of this study was to investigate the effect of laboratory activities designed based on Prediction – Observation–Explanation (POE) strategy on pre-service science teachers' understanding of acid- bases subject in chemistry III course. A total of 69 pre-service science teachers who took chemistry III course in the fall semester of 2010-2011 academic year in the department of science education at Pamukkale University participated in the study. Two control groups and an experimental group were employed in the study. Of the participants, 22 pre-service science teachers were in experimental group, 22 pre-service science teachers were in control 1 group and 25 pre-service science teachers were in control 2 group. While approach to laboratory-based on POE strategy was applied to the experimental group and the control 2 group, and laboratory method in the program was employed to the control 1 group over a period of six weeks. A quasi- experimental design and two control groups (C1G, N=22; C2G, N=25) and experimental group (EG, N=22) were used. Acid and Base Concept Test (ABCT) and Science Process Skills Test (SPST) were used for data collection and administered to pre-service science teachers. The ABCT and SPST were administered to the control 1 group and the experimental group as a pre-test and were given all groups as a post-test. Data were analyzed using depended on t-test. The results indicated that approach to laboratory-based on POE strategy provided significantly achievement compared with laboratory method in the program on the understanding of acid-base concepts. Results also indicated that POE strategy helped to gain a better understanding of scientific concepts that are relevant acid- base concepts. As a conclusion the results of the present study showed that activities presented based on POE strategy had a significant effect on pre-service science teachers' conceptual understanding of acid-base. Results showed that POE strategy did not have a significant effect on pre-service science teachers' science process skills subject.

Keywords: Science Education, POE Strategy, Science Process Skills, Conceptual Achievement.

INTRODUCTION

People, who teach and learn science, can follow developments of science and technology easily, they can provide their needs and they can adapt and cope with nature easily. People learn facts and events in life, they try to comprehend them and implement in their daily life. Life-enhancing inventions, including cars, computers, televisions and cell phone are products of technology in. If we want to take the advantage of change and developments in science and science products, we speed up changes and development in science (Temizyürek, 2009; Uras and Kurşunluoğlu, 2009). Science, environment and lives of human beings to understand the world, interpreting the

environment and the world that inspired the idea of a regularity in search of knowledge, skills and attitude is. Science teaching and learning in laboratory studies are of great important. In laboratory studies, students can easily gain first-hand experiences by doing activities. Laboratory studies allow students participate in activities related to science, and observing, thinking, ideas generation and the development of skills such as making comments (Ayas and et al., 2005; Özmen and Yiğit, 2006). One of the ways to promote students' attitudes toward science is to use laboratory in science courses. Methods can be used to think about results of experiments for students in laboratory. The POE strategy which provides active participation in lessons is a teaching strategy. In this case, the POE strategy can be used in laboratory. The POE strategy provides a more effective teaching strategy. POE is a strategy that can be used in learning and teaching of concepts. The POE strategy was firstly developed by White and Gunstone (1992). In the POE strategy are asked students to do experiments for the estimate, then make the observation and description and then ask to compare their observations with the predictions (White and Gunstone, 1992; Çepni and Çil, 2009; Liew, 2004; Köse et al., 2003).

METHOD

In this study, an experimental group, a control 1 group and a control 2 group were selected in research on the school's classes. Experimental research is the uneven pattern of control-group (non-equivalent control-group) "quasi-experimental design" can be said to be. According to this model, neutral assignment method, the control 1 group, the control 2 group and the experimental group were created in the three groups, measurements were made by applying pre-tests before trying an experimental and control 1 group, were applying post-tests all groups after the study. The control 2 group pre-test was not being implemented because the pre-test, post-test results to examine whether the impact. Which the experimental group and the control 2 group of pre-service science teachers in "Approach to Laboratory-Based on POE strategy ", which the control 1 group of pre-service science teachers in the " Laboratory Method in the Program " was applied for six weeks. Participants were 69 pre-service science teachers who took general chemistry III course in the fall semester of 2010-2011 academic year at Pamukkale University Turkey. The control 1 group consisted of 22 pre-service science teachers, the control 2 group consisted of 25 pre-service science teachers and the experimental group consisted of 22 pre-service science teachers. In order to measure the development of research skills within the experimental group, the SPST, which developed by Burns et al.(1985), was used in the study. The adaptation process of the SPST into Turkish was employed by Geban et al. (1992). Its Cronbach's alpha reliability coefficient was found as 0.85. Acids and Bases Concept Test (ABCT) developed by Geban and Çetingül (2005) was used to in order to measure the development of conceptual success. Its Cronbach's alpha reliability coefficient was found as 0.81.

FINDINGS

ABCT and SPST tests were applied to determine the effect of approach to laboratory-based on POE strategy and laboratory method in the program. Pre-service science teachers' data which obtained from ABCT and SPST were given below.

Table 1.1: Pre-service science teachers' ABCT pre-test - post-test scores on average t- test results for the control 1 group and the experimental group

Group	Measurement	N	X	sd	t	p
Control 1	Pre-test	22	10.14	21	-1.37	0.19
	Post-test	22	11.00			
Experimental	Pre-test	22	11.09	21	-7.52	0.00
	Post-test	22	14.68			

The results of the analysis presented in Table 1.1. showed that ABCT pre-test and post-test scores of pre-service science teachers in the control 1 group was not a significant difference between the mean [$t = -1.37, p > 0.05$] and ABCT pre-test and post-test scores of pre-service science teachers in the experimental group was a significant difference between the mean [$t = -7.52, p < 0.05$].

Table 1.2: Pre-service science teachers' ABCT means and standard deviations of the post-test scores for the experimental group and the control 2 group

Group	N	X	ss	sd	t	p
Experimental	22	14.68	2.50	21	0.90	0.38
Control 2	22	15.45	2.87			

The results of the analysis presented in Table 1.2. showed that experimental group of pre-service science teachers' ABCT, the post-test grade average of 14.68 while the control 2 group of pre-service science teachers' ABCT, average post-test grade of 15.45 was. As a result of the t-test between the mean the experimental and the control 2 group did not differ significantly [$t = 1.34, p > 0.05$].

Table 1.3: Pre-service science teachers' ABCT means and standard deviations of the post-test scores for the control 1 group and the control 2 group

Group	N	X	ss	sd	t	p
Control 1	22	11.00	2.98	21	-5.31	0.00
Control 2	22	15.45	2.87			

The results of the analysis presented in Table 1.3. showed that post-test grade average of the control 1 group of pre-service science teachers' ABCT 11:00, while the average grade of the control 2 group pre-service science teachers' ABCT 15:45 was. As a result of the t-test were significant differences between means [$t = -5.31, p < 0.05$].

Table 1.4: Pre-service science teachers' SPST pre-test and post-test scores on average t- test results for the control 1 group.

Group	Measurement	N	X	ss	sd	t	p
Control 1	Pre-test	22	23.18	4.35	21	-1.38	0.18
	Post-test	22	24.23	3.93			

The results of the analysis presented in Table 1.4. showed that pre-test and post-test scores of the control 1 group of pre-service science teachers' SPST mean there was a significant difference between the observed [$t = 24.97, p > 0.05$].

Table 1.5: Pre-service science teachers' SPST pre-test and post-test scores on average t- test results for the experimental group.

Group	Measurement	N	X	ss	sd	t	p
Experimental	Pre-test	22	24.73	3.24	21	-0.77	0.45
	Post-test	22	25.45	3.57			

The results of the analysis presented in Table 1.5. showed that pre-test and post-test scores of experimental group of pre-service science teachers' SPST mean there was not a significant difference between the observed [$t = 26.02, p > 0.05$].

Table 1.6: Pre-service science teachers' SPST post-test scores on average t- test results for the experimental group and the control 2 group

Group	N	X	ss	sd	t	p
Experimental	22	25.45	3.57	21	0.76	0.39
Control 2	22	25.64	3.90			

The results of the analysis presented in Table 1.6. showed that the experimental group post-test mean score of pre-service science teachers was 25.45 while the control 2 group, pre-service science teachers was 25.64. As a result of the t-test between the mean the experimental and the control 2 groups did not differ significantly [$t = -5.31, p > 0.05$].

Table 1.7: Pre-service science teachers' SPST post-test scores on averages t-test results for the control 1 group and the control 2 group

Group	N	X	ss	sd	t	p
Control 1	22	24.23	3.93	21	0.20	0.66
Control 2	22	25.64	3.90			

The results of the analysis presented in Table 1.7. showed that control 1 group post-test mean score of pre-service science teachers was 24.23, while control 2 group post-test mean score of pre-service

science teachers was 25.64 . As a result of the t-test between means was there a significant difference [$t = 0.20, p > 0.05$].

DISCUSSION

Lives of certain substances (lemon, soap) is the structure of acids and bases. For this reason, pre-service science teachers have better information about acids and bases are important. Pre-service science teachers are in difficulty in expressing acid-base concepts including PH, force, etc. The result of this study showed that most of the pre-service science teachers pose incomplete information and misconceptions about acids and bases. Therefore, one should be aware of pre-service science teachers' pre-knowledge, if any one should be aware of the missing information and misconceptions, appropriate teaching strategies and methods used or developed when the teaching activity (Ayhan, 2004; Geban and Tamer, 2006). In this study, the POE strategy was found to be useful in teaching process. Pre- service science teachers obtained the ability to express themselves to colleagues and instructor. This strategy helped the development of pre-service science teachers' abilities to make observations and description (Çepni and Çil, 2009; White and Gunstone, 1992; Köse et al., 2003; Ayas and Yılmaz, 2004).

CONCLUSION

In this study, the worksheets were used to approach laboratory based on POE strategy. Pre-service science teachers participated in more actively to lessons. At the same time they have shared the results of observations with colleagues and instructor. POE strategy allowed the development of self-expression and communications skills of pre-service science teachers. Pre-service science teachers searched their prior knowledge, then they interacted in new information with prior knowledge. Thus, they see what is missing to learn and misconceptions, they attempt to correct misconceptions or complete incomplete learning. We can conclude that the approach to laboratory-based on POE strategy is more effective laboratory method in the program. In this study, the results showed that the approach laboratory based on POE strategy and laboratory method in the program were not effective on pre-service science teachers' science process skills. The reasons of this result maybe as follows: pre-service science teachers' scientific process skills were not sufficient to develop for the six weeks time period, pre-service science teachers did not to care questions in SPST, activities were lack of property to develop pre-service science teachers' science process skills. The results of this study showed that POE strategy was an effective laboratory strategy. In brief, the POE strategy increased the motivation of science pre-service science teachers towards science and helps to remove misconceptions. Given the POE strategy was expected to be helpful for pre-service science teachers and educators.

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