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Examination of prospective science teachers' achievement on basic geography topics and effectiveness of poster-based teaching for learning these topics

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Abstract

There were two major purposes in this study and it was conducted in two stages according to these purposes. The purpose of the first stage was to examine prospective teachers' (geography, primary school and science) knowledge level about geography topics and to study department, gender and department×gender interaction effects on their knowledge level. The purpose of the second stage was to investigate the effectiveness of the teaching method based on the poster to learn the geography topics. The first stage used an ex post facto design. Sample of this stage consisted of 164 prospective teachers. Data of both the stages were collected with Geography Achievement Test (GAT, α = .81). Two-Way Independent-Samples ANOVA was applied to assess the effects of department, gender and the department×gender interaction. The results indicated that there was statistically significant difference between the departments' mean scores on GAT and department×gender interaction effects were not significant. The second stage used a one-group pretest-posttest design in order to investigate the effectiveness of the teaching method based on the poster to learn/teach the geography/science topics. Sample of this stage consisted of 47 prospective science teachers. The null hypothesis that there will be no statistically significant differences between the treatment group's mean scores of pretest and posttest on GAT was tested using One-Way Repeated-Measures ANOVA. In summarize, the prospective teachers' achievement level of the geography/science topics in the context of GAT was inadequate and the treatment was effective to learn/teach the geography topics. Teachers and curriculum development experts should favour the teaching method based on the poster for a successful geography/science education.

Keywords: Teacher education; science education; posters; teaching methods

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1. Introduction

1.1. Introduce the problem

Turkey has just taken an important step that follows ongoing developments in worldwide science and technology education. Some reforms have recently been made concerning better learning and more effective teaching and an important step was taken in the educational field when the Turkish elementary curriculum was revised to a great extent in 2005. The curriculum was reorganized in 2013 (TMNE, 2005, 2013, 2017). The most important characteristics of the curriculum are that it has several learning areas dedicated to understanding, attitudes and skills, and there is constructivist approach for each phase, which is also enriched with teaching activities. The earth and the universe, the living things, and the environment are several of the learning areas. In line with these aims, textbooks have been revised, and in-service teachers have been enrolled in intensive courses, workshops and summer courses throughout the country to better enable them to use the new curriculum.

With these reforms, the Turkish Higher Education Council (THEC) modified the courses of education faculties in parallel with the new elementary school curriculum (THEC, 2007, 2018). For example, some courses related to basic geography topics were added to especially primary school and science education curricula.

However, one of the most important issues in the Turkish higher education system is that Turkish instructors frequently use traditional teaching approaches in teacher education. This inconsistency between the elementary education and higher education is a serious problem in teacher education. Teachers should be trained according to the needs of schools and the modern methods.

In addition, the Turkish elementary curriculum revised frequently indicates projects, performance tasks, collaborative projects and posters as new teaching approaches. Thus, not surprisingly, poster preparations and applications have been enhanced by new educational technology in classrooms. These new teaching approaches have changed the nature of the classroom or have the potential to do so.

Also, in order teachers of children to move toward to more constructivist approaches to teaching, they must experience such initiatives in their own teacher education programs (DeVries & Kohlberg, 1987; Duckworth, 1987; Jones, 1986). Fosnot (1989) stated the importance of providing pre-service teachers with opportunities to reflect on their learning processes in order to reach deeper understanding of ideas (Katz & Chard, 1989). Duckworth (1987) explains this process as understanding that "each individual has to construct her own knowledge" (p. 22).

In this context, there were two aims of the study: the first was to examine prospective teachers' (PTs), knowledge of basic geography topics. The second was to investigate the effectiveness of a poster–based teaching approaches (consisting of the determination of poster subjects with argumentation, conducting library–online searches, preparation and presentation of posters in classroom) to learn these topics. The second part of the present study examined the effectiveness of a poster–based teaching for overcoming the prospective science teachers' (PSTs) probable learning difficulties concerning basic geography topics.

1.2. Research questions and hypotheses

In order to reach these purposes, the following two main research and subresearch questions guided this study:

The Research Question 1: How is the prospective teachers' knowledge level about geography topics?

The Research Question 2: Is a poster–based teaching method effective for learning these topics?

The Subresearch Question 1: Does the fact that the prospective teachers are in the different departments (geography, science and primary school teaching) have different effects on their knowledge level?

The Subresearch Question 2: Does the gender have a different effect on prospective teachers' knowledge level?

The Subresearch Question 3: Does the department by gender interaction have a significant effect on prospective teachers' knowledge level?

The Subresearch Question 4: There is a significant differences between the treatment group's pretest and posttest mean scores on GAT?

In order to find answers the subresearch questions of the Research Question 1, and the Research Question 2, the following four null hypotheses were postulated, and each was tested against an alternative hypothesis, respectively:

Null hypothesis 1, H_0: There will not be statistically significant differences between prospective geography, science and primary school teachers' mean scores on GAT.

H_0: $\mu_1 = \mu_2 = \mu_3$

Alternative hypothesis 1, H_1: There will be statistically significant differences between prospective geography, science and primary school teachers' mean scores on GAT.

H_1: $\mu_1 \neq \mu_2 \neq \mu_3$

where μ_1, μ_2 and μ_3 are prospective geography, science and primary school teachers' population mean scores on GAT, respectively.

Null hypothesis 2, H_0: There will not be statistically significant differences between female and male prospective teachers' mean scores on GAT.

H_0: $\mu_1 - \mu_2 = 0$

Alternative hypothesis 2, H_1: There will be statistically significant differences between female and male prospective teachers' mean scores on GAT.

H_1: $\mu_1 - \mu_2 \neq 0$

where μ_1 and μ_2 are female and male prospective teachers' population mean scores on GAT, respectively.

Null hypothesis 3, H_0: There will not be a statistically significant interaction between the department and gender on GAT.

H_0: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5 = \mu_6$

Alternative hypothesis 3, H_1: There will be a statistically significant interaction between the department and gender on GAT.

H_1: $\mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4 \neq \mu_5 \neq \mu_6$

where μ_1, μ_2, μ_3, μ_4, μ_5 and μ_6 are prospective geography-female, geography-male, science-female, science-male, primary-female and primary-male teachers' population mean scores of GAT, respectively.

Null hypothesis 4, H_0: There will not be statistically significant differences between the treatment group's pre test and post test mean scores on GAT.

H_0: $\mu_1 - \mu_2 = 0$

Alternative hypothesis 4, H_1: There will be statistically significant differences between the treatment group's pretest and posttest mean scores on GAT.

H_1: $\mu_1 - \mu_2 \neq 0$

where μ_1 and μ_2 are the treatment group's population mean scores on GAT.

2. Method

2.1. Sample

The population of the groups were selected from three department (Geography: 40, female: 19 and male: 21; Science: 84, female: 53 and male: 31; Primary School: 40, female: 31 and male: 9; Total: 164, female: 103 and male: 61).) of education faculty at the state university in Turkey (prospective geography teachers, PGTs and females/males: PGFTs/PGMTs;rospective primary school teachers, PPTs and females/males: PPFTs/PPMTs and prospective science teachers, PSTs and females/males: PSFTs/PSMTs). The PSTs were in their last year of education (grade 4). The research included two samples and was administered in two stages. The first stage included 164 PTs. In this stage, the PTs' knowledge levels of basic geography topics were determined. We called the "identification group" this group of 84 PSTs. The second stage included 47 voluntary PSTs (female: 26 and male: 21), and in this stage, the effectiveness of a poster–based teaching method for learning basic geography topics was investigated. We called this a group as "treatment group".

2.2. Variables

This study, the dependent variable was the PTs' scores on the Geography Achievement Test (GAT). The independent variables of the first stage were the formal geography teaching treatment during the pre-university and university education, department, gender and the department×gender interaction, and that of the second stage was the teaching method.

2.3. Instrumentation and data collection

Data were collected with the GAT developed by the researchers. The GAT was used to collect the quantitative data of both stages. The test is a 67–item–and–3–point Likert–type achievement scale of 0 to 2. The knowledge content of the test is a mixed level of the high school and university levels, and it includes the basic geography topics and concepts. The expressions of the test items are correct or incorrect, and the options are "True," "I do not know" and "False." If a PT ticks "True" or "I do not know" or "False" for a correct item expression, he/she gets 2, 1 or 0 point(s), respectively. If the same PT ticks "True," "I do not know" or "False" for an incorrect item, he/she gets 0, 1 or 2 point(s), respectively. Thus, the possible range of total test scores for the GAT is "0–134" points (67×2 = 134 points). The GAT's Cronbach alpha reliability coefficient was found to be .81, and this value considerably exceeded Nunnally's (1978, p. 245) criterion of .70 to be adequate.

The GAT was developed by considering specific issues of teacher candidates in the curriculum. The test was first developed by the researchers, and at the beginning, it consisted of 71 items. University educators examined the content validity of each item in the test. The test was carried out with a pilot sample of 185 PTs from the previous academic year. Because the corrected item–total correlation coefficients of four items were under .20 or negative, these items were eliminated from the test. Thus, the final test consisted of 67 items.

2.4. Procedures and research design

The first stage used an ex post facto design and a quantitative survey methodology (Cohen et al., 2000, p. 206). As expressed above, in this stage, the PTs' knowledge of basic geography topics and the department, gender, and department×gender interaction effects on their knowledge levels were examined. The second stage used a one–group pre–posttest quasi–experimental research design (Campbell, & Stanley, 1973, p. 6). In this stage, the effectiveness of the poster–based teaching method (consisting of the determination of poster subjects with argumentation, conducting library–online searches, preparation and presentation of posters in the classroom) for learning basic geography topics was studied in a group of 47 PSTs. The teaching treatment based on presentations with posters was continued for 7 weeks at the 4 hours per week. The GAT was administered to the treatment group of 47 PSTs as pre and posttest.

2.5. Treatment

In the treatment subtitle, the poster–based teaching method conducted in the second stage of the study was explained.

There were various activities carried out for the following 7 weeks to familiarize the PSTs with the three–staged method and to help them determine poster subjects with argumentation, carry out library–online searches for information and exhibit their findings as poster presentations in a classroom. In the first week, 47 PSTs in the treatment group were given detailed information about the purpose of a scientific poster and how it should be prepared and presented, and then they were divided into 11 small groups of 4 to 5 students. The small groups prepared to do their own research, including formulating specific questions, proposing various solutions, and gathering evidence for the solutions proposed.

(a) Determination of poster subjects with argumentation: As stated above, the PSTs were organized in small groups. Based on this premise, they were asked to suggest basic geography topics related to the curriculum. The teaching approach was composed of argumentative discourse activities as proposed Driver, Newton and Osborne (2000) and Erduran, Simon, and Osborne (2004). The groups discussed and produced ideas for one week and then determined their study topics.

The issues finally selected for the investigations included:

1) Our galaxy

2) Moves of our world

3) Formation, shape and structure of our world

4) Landforms

5) Climate and weather events

6) Rivers, lakes and the formation mechanism

7) Volcanic activities and the formation mechanisms

8) Natural park in our country and features

9) Arid areas and deserts

10) Fossils, types and properties

11) Ecology

There were 11 research topics that were proposed by the PSTs. But some topics like planets, continents, oceans and geothermal resources were not selected by the PSTs.

Accordingly, one research topics was selected by each small group of PSTs after they were involved with intensive discussions concerning the criteria used to make a final decision.

(b) Library and online searches: The PSTs were given practical information about how to carry out a library search. They were shown how to use internet databases provided by the university and internet search engines. This phase involved the use of internet and library data and traditional print resources. For 3 weeks, the PSTs designed and conducted their own investigations to support their research and were sometimes advised by the experts with whom they had consulted.

For the goal of the second stage, we planned in detail how the study was designed and how data were obtained and analyzed. According to Mertler and Charles (2005, pp. 47–70), such a way for studying defines a method. Accordingly, the teaching treatment in this stage was a method. Because this method was based on posters, we called this teaching treatment as “poster–based teaching method”.

(c) Poster preparation and presentation: Each group also prepared poster presentations to use during the last two weeks of the course and following the completion of library and online searches. The posters were prepared in the general format as outlined in the literature (Huddle, 2000a and 2000b). All posters had a title, the presenters’ names, and an abstract, such as those commonly used in scientific meetings and publications. The PSTs were informed of the time and place for the poster presentations. Also, each group examined the poster presentations of others and was involved in the procedures and findings of all of the other groups. In the spirit of scientific practice, a group’s members answered other groups’ questions. In this manner, the group’s members formed their small groups based on their own interests just like scientists do.

2.6. Data analysis

Data were analyzed using the *SPSS* for Windows software. The hypotheses of the study were expressed in only the null hypothesis form instead of both the null and alternative forms and only the null hypotheses were tested to be a compulsory rule of the statistical hypothesis testing (Gill, 1999).

To assess the effects of department, gender, and the department×gender interaction on the PTs’ achievements on the GAT, two–way independent–samples ANOVA was applied.

To examine the effect of the treatment in the experimental part of the study, one–way repeated–measures ANOVA was used. Post–hoc pairwise comparisons were carried out with Bonferroni's test (Green et al., 2000, p. 214).

In the first and second stages, the PSTs' achievement levels on the GAT were examined by comparing their means with a score of 70%, which is commonly accepted by scientific consensus to be a good mean. In the second stage, the magnitude of the treatment effect was defined also in Hake's (1998) scale of the normalized gain in addition to both Cohen's (1992) partial eta–squared scale of the effect size and the criterion of 70%.

3. Results

The results section was organized according to the order of Subresearch Questions 1, 2, 3 and 4, which led into Research Question 1, and Research Question 2. As stated above, Subresearch Questions 2, 3 and 4 and Research Question 2 were answered by testing Null Hypotheses 1, 2, 3 and 4 in terms of both the descriptive and inferential statistics, respectively. Subresearch Question 1 was answered in testing Null Hypotheses 1, 2 and 3 in terms of the descriptive statistics. Before testing the null hypotheses, the assumptions were examined.

As observed in Tables 1 and 4, the sample sizes per group ranged from 9 to 103 prospective teachers. Because the sample sizes for PSTs (n = 84), female (n = 103), male (n = 61) and PSFTs (n = 53) were greater than 50. The results of the Kolmogorov–Smirnov test showed that these 4 groups' data were not normally distributed (all *ps* < .05) (Foster, 1998, p. 96). The normality of the data of the rest 10 groups whose sample size was fewer than or equal to 50 was examined using the Shapiro–Wilk test (Foster, 1998, p. 96). The results of the Shapiro–Wilk test indicated that the groups' data, except the treatment group's (N = 47) post–pretest difference scores, were normally distributed (9 *ps* > .05). According to Gravetter and Wallnau (2004, p. 358), when the sample size per group is at least 30, the normality assumption can be ignored.

After the testing of the normality assumptions, the results were presented in a systematic way of the research questions and the null hypotheses. In the context of answering Subresearch Questions 2, 3 and 4, Null Hypotheses 1, 2 and 3 were tested using two–way independent–samples ANOVA at a time. In addition, Subresearch Question 1 was answered in testing Null Hypotheses 1, 2 and 3 in terms of descriptive statistics.

Before testing the hypotheses, the assumption of equal error variances which, in addition to the normality assumption, is another assumption of two–way independent–samples ANOVA was examined. The results of Levene's test indicated that this assumption was not met ($p < .05$). However, if this assumption is violated, to reduce the likelihood of making a Type I error, Tabachnick and Fidell (2007, p. 86) suggest the significance level of .025 or .010 rather than the conventional .05 level. Or, if the group sizes are equal or approximately equal (largest/smallest < 1.5), then the F statistics are robust for unequal variances (Stevens, 2002, p. 268). In the hypotheses testing with two–way independent–samples ANOVA, Stevens' (2002, p. 268) criterion of the "largest/smallest < 1.5" could not be met. However, the level of significance was set to a more conservative one of .01, which Tabachnick and Fidell (2007, p. 86) suggest, instead of .05.

The results of the descriptive statistics and two–way independent–samples ANOVA of the departments', genders', department×gender interactions' and sample's scores on the GAT are presented in Tables 1 and 2, respectively.

Table 1. Results of the descriptive statistics of the departments', genders', department × gender interactions' and sample's scores on the GAT

						95% *CI*	
Department	Gender	*n*	*M*	*SD*	*SE*	*LB*	*UB*
Geography	Female	19	80.50	11.77	2.70	74.85	86.20
	Male	21	82.57	14.09	3.08	76.16	88.99
	Total	40	81.60	12.92	2.04	77.47	85.73
Primary school	Female	31	76.58	6.03	1.08	74.37	78.79
	Male	9	78.67	8.23	2.74	72.34	84.99
	Total	40	77.05	6.53	1.03	74.96	79.14
Science	Female	53	61.75	7.95	1.09	59.56	63.95
	Male	31	61.10	6.32	1.14	58.78	63.42
	Total	84	61.51	7.36	0.80	59.91	63.11
Total	Female	103	69.68	11.68	1.15	67.40	71.96
	Male	61	71.08	14.20	1.82	67.45	74.72
	Total	164	70.20	12.65	0.99	68.25	72.15

Table 2. Results of two–way independent–samples ANOVA of the departments', genders' and department×gender interactions' scores on the GAT

Source of variance	*SS*	*df*	*MS*	*F*	*p*	η_p^2	*OP*
Department	12695.12	2	6347.56	79.67	.000	.50	1.00
Gender	40.93	1	40.93	0.51	.48		
Department × gender	67.18	2	33.59	0.42	.66		
Error	12587.95	158	79.67				
Total	26084.36	163					

As observed in Table 2, at the adjusted significance level of .01, the results of the two–way independent–samples ANOVA succeeded in rejecting Null Hypothesis 1, $F(2, 158) = 79.67$, $p = .000$, $\eta_p^2 = .50$, $OP = 1.00$. However, in the context of testing Hypotheses 2 and 3, the main effect of gender and the department×gender interaction effect were not significant, $F(1, 158) = 0.51$, $p = .48$ and $F(2, 158) = 0.42$, p = .66, respectively. In addition, for the department independent variable, the results of the two–way independent–samples ANOVA yielded a large effect size ($\eta_p^2 = .50 > .14$) (Cohen, 1988, pp. 283 and 287; Green et al., 2000, p. 169) and an adequate statistical power to reject the null hypothesis ($OP = 1.00 > .80$) (Bausell, & Li, 2002, p. 40; Murphy, & Myors, 2004, pp. 15 and 91). Because the main effect of gender and the department×gender interaction effect were not significant, the effect sizes and statistical powers were not reported for them (Weinberg & Abramowitz, 2002, p. 652).

According to the results of two–way independent–samples ANOVA in Table 2, because the department effects were significant, the Bonferroni post–hoc test was used for a multiple comparison of their mean scores. Two of the three pairwise comparisons, geography–science and primary school–science, were significant for the effect of different departments at the .05 level, using the Holm's sequential Bonferroni procedure (Green et al., 2000, p. 214), $p = .000 < \alpha = .05/3 = .017$. According to the results of the descriptive statistics of the departments in Table 1, these differences were in favor of the departments of geography education and primary school education compared with the department of science education.

In the context of answering Subresearch Question 1, the identification group's descriptive statistics results were given in Table 1. All scores were far lower than the mean of 70%, which is commonly accepted by scientific consensus to be a good mean. These results indicated that in all levels of the independent variables of the first stage, the PTs' achievement levels on the GAT were absolutely inadequate.

In the context of Research Question 1, because the main effect of department was significant, their mean scores on the GAT were also compared visually with the graphs in Figure 1 as a sample.

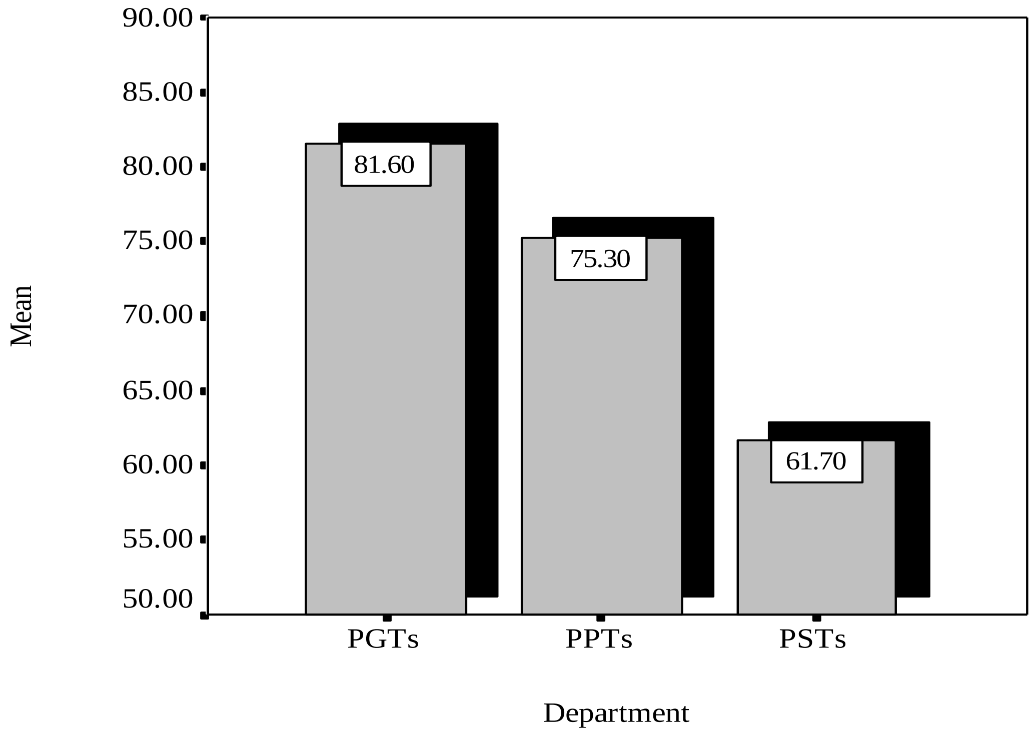

Figure 1. Bar graphs of the mean scores of the departments

Null Hypothesis 4 was tested using a one–way repeated–measures ANOVA. The treatment group's one–way repeated–measures ANOVA and descriptive statistics results of pre and posttest data on the GAT are presented in Tables 3 and 4, respectively.

Table 3. The treatment group's one–way repeated–measures ANOVA results of data on the GAT

Source of variance	*SS*	*df*	*MS*	*F*	*p*	η_p^2	*OP*
Between–subjects	6168.92	46	134.11				
Within–subjects	6928.18	1	6928.18	91.84	.000	.67	1.00
Error	3470.32	46	75.44				
Total	16567.42	93	7137.73				

Table 4. The treatment group's descriptive statistics and paired–samples t–test results of pre and posttest data on the GAT

Measurement	*N*	*M*	*SD*	*SE*	ΔM	*SD*	*SE*	*df*	*t*	*p*	η_p^2
Pretest	47	59.77	8.74	1.28	17.17	12.28	1.79	46	9.58	.000	.67
Posttest	47	76.94	11.54	1.68							

The results of the one–way repeated–measures ANOVA in Table 3 succeeded in rejecting Null Hypothesis 4, $F(1, 46) = 91.84$, $p = .000$, $\eta_p^2 = .67$, $OP = 1.00$. As observed in Table 4, because the posttest mean score was greater than that of the pretest, this difference was in favor of the posttest score. In addition, the results of the one–way repeated–measures ANOVA yielded a large effect size ($\eta_p^2 = .67 > .14$) (Cohen, 1988, pp. 283 and 287, and 1992; Green et al., 2000, p. 169) for the treatment and an adequate statistical power ($OP = 1.00 > .80$) (Bausell, & Li, 2002, p. 40; Murphy, & Myors, 2004, pp. 15 and 91) to reject the null hypothesis.

The treatment effect was investigated using a one–way repeated–measures ANOVA instead of a paired–samples *t*–test. Nevertheless, for the sake of comparison, in addition to the results of the one–way repeated–measures ANOVA in Table 3, the results of the paired–samples *t* tests are also presented in Table 4. As observed in Tables 3 and 4, the *t* value of $|9.58|$ yielded by the results of the paired–samples *t* tests is equal to the square root of the *F* value of 91.84 that the one–way repeated–measures ANOVA had computed.

The treatment group's pre and posttest mean scores on the GAT were also compared visually with the graphs in Figure 2.

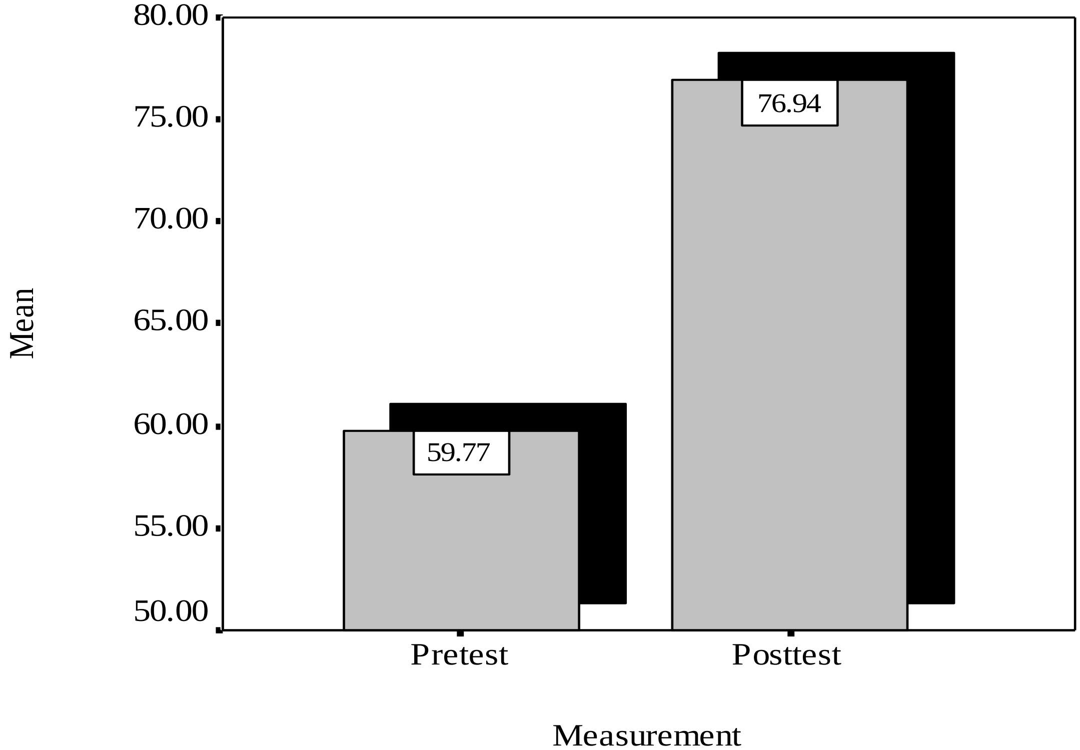

Figure 2. Bar graphs of the treatment group's mean scores of pre and posttest

4. Discussion

The first objective of this study was to examine PTs'; PGTs', PPTs', PSTs', females', males', PGFTs', PGMTs', PPFTs', PPMTs', PSFTs' and PSMTs' knowledge of basic geography topics and to study the department, gender, and department×gender interaction effects on their knowledge. For this objective, their mean scores on the GAT were determined. As observed in Table 1 and expressed in the results chapter, all groups' mean scores were far lower than the mean of 70%. The highest score was the PGMTs' mean, and it even was only 61.62%. According to these results, it could be stated that in all levels of the independent variables of the first stage, the PTs' achievement levels on the GAT were absolutely inadequate. These results showed that the formal teaching treatment applied during the pre university and university education was not generally effective. Both the PGTs and PPTs were relatively more successful than the PSTs; the PGTs' and PPTs' means were very close to each other. In fact, this might be a normal result. PGTs have intensively studied some geography topics, and PPTs have studied lessons on General Geography and the Geomorphology and Geopolitics of Turkey. However, PSTs have studied only basic geography topics in geography lessons. In addition, all of the PTs studied basic geography topics during their primary and high school educations. The credit difference of geography lessons that the PTs studied during their university educations yielded a large effect size of .50. Tallmadge (1977, p. 34) suggests that the effect size should be .25 or greater in Cohen's (1992) *f* scale of the effect size to be educationally significant.

In spite of these differences between the departments, the very small means relative to the score of 70% indicated that geography teaching treatments in all three departments were defective. In fact, there were PTs' learning difficulties not only in basic geography topics but also in science (Sarikaya, 2004, 2007) and mathematics (Bell, 1982) topics. These results showed that PTs' learning difficulties were common enough to be independent of the branches.

Unaldi and Bilgi (2008) studied prospective geography teachers' levels of awareness of the greenhouse effect, global climate change and the depletion of the ozone layer. The mean of the sample of 150 prospective geography teachers who were in the same category of prospective geography teachers in our study's first stage sample was 61.08%. It is interesting that this mean was very close to the mean of 60.90% in our study. This similarity of the means of different samples of the same category is evidence of the reliability of our study's results. The same study also investigated the gender effect on prospective geography teachers' levels of awareness of the greenhouse effect, global climate change and the depletion of the ozone layer. The males' mean (M = 63.48%) was significantly greater than the females' mean (M = 59.05%). However, as observed in Table 1, in our study, the females' and the males' means were very close to each other in both geography department and the total, and the differences were not statistically significant. In addition, in the context of the department×gender interaction effects, the fact that females and males are in different departments did not have an effect on their achievements.

The identification group' results showed that PTs' achievement levels, even those of PGTs, were quite inadequate. The reasons for this result might be poor methods and teacher–centered methods for teaching and learning basic geography topics in universities and high schools. In the second stage of this study, we proposed a new teaching and learning method as an alternative to these inadequate methods. In this stage, the effectiveness of a poster–based teaching method was examined for teaching and learning basic geography topics in the context of the GAT and in Table 3 showed that the treatment group's pre and posttest mean scores on the GAT were significantly different. According to the descriptive statistics results in Table 4, this difference was in favor of the posttest mean. In other words, the poster–based teaching treatment is effective for teaching and learning geography topics.

The mean of 84 PSTs in the identification group and pretest mean of 47 PSTs in the treatment group were 45.90% and 44.60%, respectively. It is interesting that these means were very close to each other. This similarity of the means of different samples of the same category is another evidence of the reliability of our study's results, in addition to the results of Unaldi and Bilgi's 2008 study.

We evaluate misconceptions/learning difficulties as illnesses needed to be treated. However, an unknown illness cannot be cured! Therefore, this study investigated both prospective teachers' achievement levels in basic geography topics and remedying their possible misconceptions/learning difficulties. Because of these properties, this study was both the diagnostic and remedial studies. These were important characteristics of the study in scientific research methodology.

Additionally, in our study, we have observed this benefit and increased communication among PSTs. In a previous study, Farber and Penhale (1995) indicated that a poster presentation fosters the development of important professional communication skills. Akister and Kim (1998) reported on the verbal dialogue generated by posters and the opportunities for students to learn from each other, noting that during the poster session, students study each other's works, and thus, while students are assessed, there is a shared learning environment. Also, Moule et al. (1998) found that students gain a sense of achievement through the process of developing and producing posters. Posters sessions provide enjoyable experiences and effective learning for students.

Some studies in the literature supported all these results of our study. For example, according to Sisak (1997), the process of poster sessions as a teaching tool resulted in individual success for students in a junior level biochemistry course. Hay and Miller (1992) discussed the nature and application of an undergraduate research poster exercise in a university geography course. In the study, the researchers stated that poster applications would increase students' learning. Also, a study by Huddle (2000b) emphasized that classroom poster applications are a useful teaching tool for effective learning.

In light of all of these findings, it can be concluded that PTs' knowledge of basic geography topics is inadequate, and the poster–based teaching treatment is educationally useful for teaching and learning geography topics, in particular, and all courses, in general, at all levels of education. The approach led the PSTs to develop shared conceptual understandings through online and face to face dialogues as a community of learners.

Finally, there is clearly a need to explore ideas of simultaneous teaching and learning, and students' experiences as learners in the university can be directly related to their experiences as teachers in their department. The results of the study showed that this special design, the poster–based teaching method, is an effective teaching and learning way in education. Thus, we hope that PTs will use this method in their own classes.

5. Conclusions

This study developed a measurement instrument (GAT) to determine PTs' knowledge of geography, identified the PTs' learning difficulties concerning basic geography topics, and examined the effectiveness of a poster–based teaching method for overcoming these difficulties. The study results provided further evidence to support earlier research findings and indicated that PTs had difficulties with a variety of basic geography topics. The clearest evidence of this finding was that even the mean of PGTs was far lower than the conventional cutoff score of 70% for successfully assessing. The reason for this result might be traditional methods used to teach and learn geography topics in universities and/or high schools. Thus, the results of this study call into question current teacher–centered teaching methods and inform teachers and instructors that even PTs/students who studied high–level geography courses generally could not comprehend basic geography topics. Other important results of this research are that visual lesson materials, such as posters, make learning a topic easier. The most important outcome indicates the fact that teaching and learning are possible in academic environments in which learners play an active role.

The most important factor in influencing student learning is the quality of teaching, and it goes without saying that the quality of teacher also influences that of teaching. Accordingly, for a successful teaching, PTs need to be well trained.

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