



The Effect of Inquiry-Based Learning Activities on Attitudes towards Teaching Profession¹

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Abstract

This study aims to examine the effects of inquiry-based learning activities on the attitudes of science teacher candidates toward the teaching profession. In line with this main purpose, the attitudes were examined according to gender, willingness to choose the department, the activities in the course, and the level of influence of the course content on the attitude towards the teaching profession. Furthermore, at the end of the lesson, the candidates' opinions about the activities performed in the lesson were investigated. The sample consists of 28 candidates studying in the Department of Science Education at a state university in Ankara in the spring semester of the 2017-2018 academic year. In the study, where a single group pretest-posttest experimental model was used, the Attitude Scale of Teaching Profession and an open-ended questionnaire were used as data collection tools. As a result, no statistically significant differences were found between the pretest-posttest attitude score averages of the candidates and the pretest-posttest attitude score averages in terms of gender. A statistically significant difference was found between the post-test attitude score averages in terms of willingly choosing the department and the level of effectiveness of the activities performed in the course on the attitude towards the teaching profession. Furthermore, most of the candidates (n=27) responded as the activities in the lesson and the effect of the course content on the attitude towards the teaching profession had "a positive effect." They explained this mostly with reasons like learning how teaching works under the theme of Profession, being ready for the profession, feeling like a teacher, and so on. In the Process theme, the explanation of the effect of the presentations is the majority.

INTRODUCTION

Attitude is described as a learned internal condition that influences one's choices in individual actions in response to events and situations. It is a favorable or unfavorable attitude toward a certain item, circumstance, or event (Türker & Turanlı, 2008). The teacher is the person responsible for educating individuals in line with the needs of the age. Teachers' capacity to perform these tasks and improve educational quality depends on their favorable attitudes toward the profession before and throughout their service, their affective field competencies, and their essential motivation (Karadağ, 2012). The teaching profession is defined in different dimensions, such as role expectations, how and where to be trained, the qualifications to be possessed, and the characteristics of a good teacher (Üstüner, 2006). All these dimensions are like chains that complete each other in the process. For this reason, it is

thought that the attitude towards the profession will have an important role in fulfilling the requirements of the profession more effectively.

The explanations given about the teaching-learning process with the headings of “Teacher-student role” and “Adopted strategies and methods” in the 2018 Science Curriculum in force in Türkiye are similar to the 2017 curriculum. In the 2017 and 2018 Science Curricula, the inquiry-based learning approach is based, and the teacher is in the role of “encouraging and directing individual”; the student, on the other hand, is in the role of “individual who researches, questions, explains, discusses the source of information and turns it into a product.” Unlike the previous teaching programs, both curricula emphasize innovative thinking in the sub-field of engineering and design skills within the scope of skill learning. In addition, it is envisaged to use argumentation, problem-based learning, project-based learning and cooperative learning methods in lessons (MEB, 2017; MEB, 2018). In this research, innovative thinking, problem-solving method, project-based learning and 5E lesson plan preparation activities were carried out within the framework of inquiry-based activities.

Teachers, who are practitioners of the curriculum in learning environments, mostly teach their lessons within the framework of the information and activities in the textbook (Newton, Newton, Blake & Brown, 2002; TTKB, 2021). However, it can be claimed that it is not a desired and expected situation in education for teachers to adhere to the textbooks one-to-one. It is important to use different learning methods and techniques envisaged by the curriculum in the conduct of this course, which includes a lot of difficult-to-understand concepts such as science. In this context, it is necessary to ensure that teacher candidates studying at the university gain experience in these subjects by doing different activities and activities before starting their professional life (Ecevit & Kaptan, 2019; Uyanık, 2017). Thus, it will be possible to train candidates who think, research, and offer ideas. At the same time, it will be able to contribute to the positive development of emotional qualities such as beliefs, attitudes, and motivations associated with the teaching profession within the scope of the process’s activities. In light of this knowledge, it is reasonable to conclude that attitudes toward the profession have an essential role in the effectiveness of education and achieving desired results.

The training that the teacher candidates have received before the service is related to the quality of the teachers (Beare, Marshall, Torgerson, Tracz & Chiero, 2012). Cochran-Smith and Zeichner (2005) pointed out that the knowledge, skills, and dispositions of the teacher training professionals related to the actual practices in the school. At this point, the importance of the education that teacher candidates receive during their university education becomes evident. It is expected that pre-service teachers will have professional competencies that will facilitate the learning of students with their pre-service training (Ecevit & Kaptan, 2019; Karataş, 2020; Rajić, Hoşgörür & Drvodelić, 2015). In the profession, it is stated that the professional competencies of teachers are to develop student’s problem-solving, creativity, and research skills (Şişman, 2002), to plan activities suitable for student levels, to organize individual and group work, and to use appropriate materials (Valli & Renert-Ariev, 2002).

It is stated that teachers who have just started their profession have difficulties in solving problems, and this situation affects them negatively (Haser, 2010). In this regard, it is believed that the fact that they feel competent in terms of serving the demands of today’s pupils would favorably improve their attitudes toward the profession. The goal of today’s teaching programs is to provide pre-service teachers with various experiences in preparing them for the profession (Tatto, Lerman & Novotta, 2009). Pre-service teachers are required to graduate with certain competencies and equipment in structured learning environments. In this respect, new teachers

need to learn new technologies in their pre-service training and use them actively in their teaching so that they do not experience difficulties in the first years of the profession. Ahmad, Said, Zeb, Sihatullaj and Rehman (2013) concluded in their study that teachers with positive attitudes towards the teaching profession are more successful in teaching and learning processes and participate in academic activities willingly. In this context, the training given to the candidates should lead them to develop positive attitudes toward the teaching profession (Johnson & Howell, 2005).

Within the context of the study's findings, the relevance of the gender factor in changing attitudes about the teaching profession will be assessed. The quantity of survey-type research in this field is abundant in the literature (Akpınar, Yıldız & Ergin, 2006; Chakraborty & Mondal, 2014; akır, Kan & Snbl, 2006; apri & elikkaleli, 2008; Dođan & oban, 2009; Hussain, Ali, Khan, Ramzan & Qadeer, 2011; Terzi & Tezci, 2007). Among these, it was reported that the attitudes of teacher candidates towards the profession did not differ according to the gender factor, or those female teacher candidates had more positive attitudes than males. Furthermore, research in the literature has been conducted to investigate the influence of activities such as reflective thinking and material design on the transformation of teacher candidates' attitudes about the teaching profession during their higher education (Peker, Kkgenay & Acar, 2018; Tok, 2008). However, no study has been found in the literature on the effect of inquiry-based learning activities foreseen by the pre-service curriculum on the attitudes of teacher candidates toward the profession. As a result, it is hoped that this study, in conjunction with the gender factor, will make significant contributions to the literature by examining whether studies aimed at carrying out learning activities in the classroom environment, which is one of the requirements of the teaching profession, are effective in changing attitudes toward the profession. Furthermore, it is claimed that another component that may influence the attitude toward the profession during the activities is whether or not the department is chosen consciously. Considering that the preference of the department is important in the choice of profession, the effects of the positive or negative attitudes of the candidates towards the profession were investigated.

Because it is established that good attitudes of teacher candidates toward the profession have a favorable impact on their professional life (Johnson & Howell, 2005), their education should be geared toward helping them to acquire positive attitudes about their profession. According to these arguments, it is critical to investigate the impact of learning activities conducted with teacher candidates within the scope of a course within the framework of curricular outcomes on their attitudes toward the profession.

The Purpose of Study

The aim of this study aims to examine the effects of inquiry-based learning activities carried out within a course on the attitudes of science teacher candidates toward the teaching profession. In line with this main purpose, the attitudes of the candidates were examined according to their gender, choosing the department willingly, the level of influence of the activities carried out in the course, and course content on the attitude towards the teaching profession. Furthermore, using an open-ended questionnaire at the end of the class, information was gathered concerning the impact of the instructional activities on attitudes about the teaching profession. Thus, using two separate measuring instruments, it is hoped to acquire detailed information regarding the attitude toward the teaching profession. Answers to the following sub-problems were sought in this context.

1. Is there a statistically significant difference between science teacher candidates' attitudes towards the teaching profession before and after the application?
2. Is there a statistically significant difference between the attitudes of science teacher candidates towards the teaching profession before and after the application in terms of gender?
3. Is there a statistically significant difference between science teacher candidates' attitude scores towards the teaching profession after the application, in terms of the level of choosing the department willingly and the effect of the activities carried out in the course on the attitude towards the teaching profession?
4. What are the views of science teacher candidates about the activities performed in the lesson?

METHOD

Study Design

A single-group pre-test/post-test research design was utilized in the quantitative part of this study, which integrated quantitative and qualitative research methodologies, to examine the influence of research inquiry-based learning activities on attitudes toward the teaching profession. The basic assumption of the design is that “post-test scores are higher than pre-test scores, and this is because the applied method is effective” (Karasar, 2004). This design is based on the assumption that the experimental situation of each sample is compared with itself and is more efficient in using the in-group experimental setup. In addition, the case study method was used in the qualitative dimension, in which opinions about the activities carried out in the course were determined.

Study Group

The study's sample includes 28 second-grade teacher candidates (N=28) enrolled in the Science Education Department of a public university in Ankara during the spring term of the 2017-2018 academic year. The convenience sampling approach was used to choose the sample. The descriptive features of the samples are listed below.

Table 1. Gender distribution of science teacher candidates

Gender	f	%
Female	22	78.6
Male	6	21.4

Table 1 shows that 78.6% of the applicants are female and 21.4% are male.

Content and Steps of Teaching Used in the Research

This study was conducted during the second-year spring semester of the Science Education Department's “Science-Technology Program and Planning” course. The content of the course is generally in the form of the science curriculum, planning in science teaching, and planning of teaching activities. It enriches the activities with daily life examples by using appropriate teaching principles, methods, and techniques through planning. In this context, activities based on inquiry-based learning activities were carried out throughout the term to determine the changes in the attitudes of teacher candidates towards the teaching profession. In the first weeks, the theoretical information in the curriculum of the course was given, the candidates were informed about the activities, and groups were formed to work together. Afterward, activities such as innovative thinking, a problem-solving method, project-based learning, 5E lesson plan preparation, presentation preparation, and presentation activities were carried out respectively. Some examples of the activities carried out are presented in Appendix 1. A brief information about the activities determined within the scope of the research is as follows:

1. To write down problem situations and outcomes that will encourage students to think innovatively with examples from daily life for innovative thinking,
2. Preparing an outcome they have chosen from the Science Curriculum (2017) with a scenario taking into account the problem-solving steps (steps followed for problem-solving),
3. To prepare for an outcome they have chosen from the Science Curriculum (2017) following the steps of the project-based learning method,
4. Preparing an outcome they chose from the Science Curriculum (2017) in the form of a daily lesson plan according to the 5E learning model,
5. Presenting the prepared learning activities in the classroom.

Care was taken to plan the activities to include at least two learning areas (Science Process Skill, Science-Technology-Society-Environment, Attitude-Value, Science and Engineering). The aim here is to allow teacher candidates to see the equivalence of learning areas in activities. In addition, during the presentations, each stage of the plan was criticized, and it was evaluated whether it reflected the expected performance from the research investigation strategy. In this context, their performances were evaluated as good and moderately poor with the analytical rubric prepared according to certain criteria regarding the activities carried out. With the scores obtained from the scoring key, it was tried to determine the dominance of the candidates in the learning activities they prepared.

Data Collection Tools

In this study, answers to sub-problems were sought with two data collection tools, quantitative and qualitative data.

1. Quantitative data collection tool: The alteration in attitudes of candidate teachers regarding the teaching profession was measured by using The Attitude towards Teaching Profession Scale. Üstüner (2006) devised a scale of 34 items, 10 of which are negative and 24 of which are positive. The scale was created to assess the attitudes of candidates enrolled in teaching programs about the teaching profession. Options and point equivalents in the expressions in the 5-point Likert-type scale; 5=Strongly Agree, 4=Mostly Agree, 3=Moderately Agree, 2=Partly Agree, and 1=Strongly Disagree. While the highest score that can be obtained from the scale is 170, the lowest score is 34, and the Cronbach Alpha reliability coefficient of the scale is .89. In the reliability analysis made by the researchers, the Cronbach Alpha reliability coefficient of the scale was calculated as .92.

2. Qualitative data collection tool: An open-ended questionnaire consisting of 7 questions about the attitude towards the teaching profession was applied. The researchers have created the questionnaire. Two science educators assessed the questionnaire for consistency of language and meaning in the questions. In accordance with the expert comments, required regulations were made on the survey questions, and the statements were completed. Only one question was included in this study. The question is about the activities done in the lesson and the effect of the course content on the attitude towards the teaching profession.

Validity-Reliability Check

Internal validity is related to the explanation of the changes observed in the dependent variable with the independent variable. Factors that threaten internal validity in quantitative research can be listed as the selection of subjects, maturation of subjects, data collection tool, history of subjects, and subject loss effect (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz & Demirel, 2014). In this study, some of the factors mentioned were taken under control and internal validity was ensured. Regarding the background factor of the subjects, internal validity was ensured thanks to the willingness of the majority of the candidates to come to this section and to start the research without prejudice. In the study, the same data collection tool was

applied to the participants in all measurements by the researcher herself. To minimize the effect of subject selection and subject loss, the researcher conducted her research in the classroom where she lectured, and attention was paid to ensuring that the study group remained in sufficient numbers.

Accurate data reporting and explanations of how findings are obtained are crucial for validity in qualitative studies (Yıldırım & Şimşek, 2016). Within the scope of this analysis, the conformity of the research findings with the elements addressed during the creation of the interview question was examined. Furthermore, the researchers assessed the consistency and importance of the data on a regular basis. Internal validity (credibility) of the findings was established using direct quotes. The study model, universe and sample, data collection technique, and data analysis were all extensively explored to ensure external validity (transferability).

Clarifying the strategies used during the stages of the study and allowing other researchers to utilize them in comparable ways are some of the actions to be taken in terms of dependability in qualitative investigations (Yıldırım & Şimşek, 2016). Two researchers coded the data acquired for this study at different periods, and the internal reliability (consistency) of the data was attempted to be guaranteed by comparing the codes. The purpose is to get an objective point of view in order to ensure the results' integrity. It has been attempted to contribute to external reliability by presenting the study's stages in full and concisely, as well as keeping raw data for future inspection (repeatability).

Data Analysis

In this study, the data were analyzed both quantitatively and qualitatively.

1. Quantitative analysis of data: The quantitative analysis of the study consists of the examination of the data received from the attitude scale towards the teaching profession using the IBM SPSS Statistic 22 tool. Before making a comparison between the pre-test and post-test scores of the candidates, it was checked whether the data were in a normal distribution. The distribution is considered normal if the skewness and kurtosis values of the data are at specific rates (Taşpınar, 2017). At a 0.05 confidence level, the Z value obtained by dividing the skewness and kurtosis values by their standard errors is within 1.96 limits, specifying that the distribution is normal (Can, 2014; Taşpınar, 2017). In this context, the normal distribution control of the data group compared to the sub-problems of the study was made according to the Z score, and it was determined that the Z scores were within the limits of ± 1.96 . In this instance, the data were examined using the parametric tests' independent groups' t-Test and dependent groups' t-Test. The significance threshold of 0.05 was used to interpret the findings. The effect size is a statistical metric that may be used to calculate the magnitude of the change between two average scores (Taşpınar, 2017). For variables with a statistically significant difference, the effect size was calculated using Cohen's d.

The formula "sequence width/number of groups to be created" (Tekin, 1993) was used to calculate the interval width of the scale for the analysis of data collected from the scale. In this case, the arithmetic mean weights used to evaluate the study findings are as follows:

- 1.00-1.80=Strongly Disagree
- 1.81-2.60=Partly Agree
- 2.61-3.40=Moderately Agree
- 3.41-4.20=Mostly Agree
- 4.21-5.00=Strongly Agree

2. Qualitative analysis of data: The data collected from open-ended question were analyzed qualitatively. The method of content analysis was used to analyze written replies to open-ended question. The purpose of content analysis is to discover concepts and relationships that may be utilized to comprehend the subject matter better. In this setting, similar data are brought together around specific concepts and themes, and they are arranged and expounded in an understandable manner (Yıldırım & Şimşek, 2016).

The content analysis went through the following stages:

1. The codes were produced after the researchers separately reviewed the raw data a couple of times at different times.
2. Researchers collaborated to see whether there were any discrepancies between the codes. A scoreboard was established to ensure that the codes were consistent. The scoreboard used the “Consensus” and “Dissensus” calculation methods. Codes were re-examined in the appropriate data collection where the researchers disagreed, and a consensus was established. Frequency values were assigned based on the frequency of the codes.
3. Miles and Huberman’s (1994) percentile compliance reliability was used to compute consensus and dissensus. “Consensus / (Agreement + Disagreement) x 100” = Concordance reliability. The coding percentage was calculated after all of these processes. Reaching a dependability percentage of at least 70%, according to (Yıldırım & Şimşek, 2016), implies that the codes are trustworthy. In the study, the percentage of compliance reliability attained was determined to be 75%. In this instance, the concordance reliability valuation between the encoders is sufficient.
4. Codes having equivalent meaning linkages were grouped together under a certain category once consistency across the codes was confirmed. These linkages were then sought to be articulated under a higher-level theme.

FINDINGS

The results of a comparison of science teacher candidates’ attitude scores towards the teaching profession before and after application, as well as the distribution of these scores according to gender, willfully choosing the department, activities performed in the course, and the level of the course content affecting the attitude towards the teaching profession (Yes, No, Partially) are presented below. There are indications about the applicants’ views of the influence of the course activities on their attitudes toward the teaching profession.

1. Is there a statistically significant difference between science teacher candidates’ attitudes towards the teaching profession before and after the application?

The dependent groups’ t-Test was used to compare teacher candidates’ pre-test-post-test attitude score averages regarding the teaching profession. Table 2 summarizes the findings.

Table 2. Dependent groups t-Test results regarding pre-test-post-test attitude score averages of teacher candidates towards the teaching profession

Measurement	N	χ	Sd	df	t	p
Pre-test	28	4.03	.737	27	-1.657	.109
Post-test	28	4.16	.623			

Table 2 shows that the pre-test attitude mean score of the pre-test teacher candidates is $\chi_{(pre-test)}=4.03$, and the post-test attitude mean score is $\chi_{(post-test)}=4.16$. It was deemed that the applicants’ score ranges in both metrics were *mostly agree*. No statistically significant difference was found between the pretest-posttest attitude score averages of the candidates [$t_{(27)}=-1.657, p>.05$]. However, post-test attitude mean scores are higher than pre-test attitude

mean scores. When the results are evaluated in terms of score averages, it can be said that inquiry-based learning activities cause a slight change in the attitudes of the candidates towards the teaching profession.

2. *Is there a statistically significant difference between the attitudes of science teacher candidates towards the teaching profession before and after the application in terms of gender?*

Independent groups t-Test was used to see if the pre-test-post-test attitude mean scores of teacher candidates for the teaching profession differed by gender. Table 3 displays the results.

Table 3. The independent groups' t-Test results of the pre-test-post-test attitude mean scores of teacher candidates towards the teaching profession in terms of gender

Measurement	Gender	N	χ	Sd	df	t	p
Pre-test	Female	22	3.93	.778	26	-1.283	.211
	Male	6	4.36	.463			
Post-test	Female	22	4.08	.650	26	-1.228	.230
	Male	6	4.43	.456			

When the pre-test attitude means scores of the teacher candidates are analyzed in terms of gender, the scores of the female candidates are $\chi_{(\text{female})}=3.93$, and the scores of the male candidates are $\chi_{(\text{male})}=4.36$. When the post-test attitude score averages are reviewed, it is observed that the female candidates' scores are $\chi_{(\text{female})}=4.08$, while the male candidates' scores are $\chi_{(\text{male})}=4.43$. It was revealed that the candidates' score ranges in both measurements *mostly agree* for females and *strongly agree* for males. In terms of gender, no statistically significant difference was detected between the applicants' pre-test attitude mean scores and their post-test attitude mean scores [$t_{(26)}=-1.283$; $t_{(26)}=-1.228$, $p>.05$]. The fact that implementations have a comparable influence on gender explains this outcome.

3. *Is there a statistically significant difference between science teacher candidates' attitude scores towards the teaching profession after the application, in terms of the level of choosing the department willingly and the effect of the activities carried out in the course on the attitude towards the teaching profession?*

The independent group t-Test was used to compare the post-test attitude mean scores of teacher candidates toward the teaching profession in terms of the degree of willingly choosing the department and the activities carried out in the course are noteworthy in terms of their influence on the attitude. The findings are shown in Tables 4 and 5.

Table 4. Independent group's t-Test results regarding post-test attitude point averages of teacher candidates in terms of choosing the department willingly

Choosing the department	N	χ	Sd	df	t	p*	Effect size (d)
Yes	19	4.44	.385	26	4.653	.000	0.21
No	9	3.56	.618				

$p<.05$

In Table 4, when the post-test attitude means scores of the teacher candidates in terms of choosing the department willingly are examined, it is seen that the scores of the candidates who say yes are $\chi_{(\text{yes})}=4.44$, and the scores of the candidates who say no are $\chi_{(\text{no})}=3.56$. It has been determined that the score ranges of the candidates are at the level of *strongly agree* and *mostly agree*. A statistically significant difference was found between the post-test attitude score averages of the candidates in terms of choosing the department willingly [$t_{(26)}=4.653$, $p<.05$].

In addition, it was determined that the significant difference between the posttest attitude score averages in terms of choosing the department willingly had a *low level* ($d=0.21$) effect. According to this result, candidates who answered yes to choosing the department willingly caused a low level of effect on those who answered no. In other words, it can be explained that choosing the department willingly has a lower effect on the change of attitudes of the candidates who say yes to the teaching profession, compared to those who say no.

Table 5. Independent group's t-Test results regarding post-test attitude point averages in terms of teacher candidates' level of influence on the activities carried out in the course

Influence of the activities	N	χ	Sd	df	t	p*	Effect size (d)
Yes	20	4.34	.450	26	2.666	.013	0.97
Partially	8	3.71	.791				

$p < .05$

When the teacher candidates' post-test attitude mean scores are examined in terms of the level of influence of the course activities, it is seen in Table 5 that the scores of the teacher candidates who say yes are $\chi_{(yes)}=4.34$, and the scores of the teacher candidates who say partially are $\chi_{(partially)}=3.71$. It has been discovered that the candidates' score ranges are between *strongly agree* and *mostly agree*. There was a statistically significant difference in the post-test attitude score averages of the applicants in terms of the effect of the course activities on the candidates' attitude towards the teaching profession [$t_{(26)}=2.666$, $p < 0.05$]. Furthermore, it was discovered that the substantial difference between the post-test attitude score averages on the attitude affect levels of the course activities has a *high level* ($d=0.97$) influence. According to this study, candidates who replied yes to the influence of course activities on attitudes toward the teaching profession had a high level of effect on those who only partially answered.

4. What are the views of science teacher candidates about the activities performed in the lesson?

The question "Did the activities and course content in this course affect your attitude towards the teaching profession positively or negatively? Explain your answer with reasons.

Affected Positively, Because

Affected Negatively, Because

It partially affected the Direction, Because..."

The distribution of the answers given to the question is given in Table 6.

Table 6. Findings on the effects of the activities and course content in the course

Theme	Category	Codes	f
Profession	Learning	- Learning how teaching works	13
		- Being ready for the profession	7
		- Feeling like a teacher	3
		- Being knowledgeable	3
		- Learning the curriculum	2
		- Learning to plan	2
		- Method learning	2
Process	Activity	- Impact of presentations	6
		- Giving examples from daily life	1
	Behavior	- Being conscious	2
	Negative	- Being boring	1
Affective	Self-confidence	- Confident	1

*Some descriptions have omitted more than one code.

The answers to this question were “Positively affected (n=27)” and “Partially positively affected (n=2)”. Table 6 reveals that the responses to the first question are generally grouped under the Profession (f=32) theme. When the codes under the profession theme are reviewed, it is discovered that they are gathered as learning how teaching works, being ready for the profession, feeling like a teacher, being knowledgeable, learning the curriculum, learning to plan, and learning methods. However, the effect of the presentations and the codes of being conscious draw attention to the Process theme. The names of all teacher candidates were kept confidential and codes such as S1, S2...S10 were used. Accordingly, concerning the theme of Profession, S1: *“Learning about the functioning of teaching, what should be done and what should not be done, had a positive effect on me.”* While S15: *“We had the opportunity to examine the curriculum and how the lesson is handled, how the topics are explained. While the topics are being explained, we have seen what needs to be paid attention to by doing activities in this lesson.”* expressed an opinion. S18: *“In part, we also practiced teaching, and I learned about this profession more profoundly thanks to assignments and in-class activities. I thought about what kind of teacher I should be. My worries about the future have decreased.”* S16 said: *“While preparing our homework, it made me think that I can use such things in the future when I become a teacher. It taught us methods we could use.”* expressed their opinion. S26: *“I felt as a teacher with the homework we did and I had an idea about how I should explain it to my students.”* Regarding the Process theme, S3: *“Giving examples from daily life to every subject in the course made the profession more interesting to me. The presentations we made in class helped me to be more ready for the teaching profession.”* While S5 expressed an opinion as *“It made me more conscious about the course and more knowledgeable about the profession.”*

DISCUSSION AND SUGGESTIONS

The qualification, character and professional qualifications of the teacher are the cornerstones on which a successful education depends (Emejidio & Gepila, 2020). The qualifications of teachers, who are an important element of the education system, are content knowledge, pedagogical formation knowledge, general culture and talent knowledge (Demirel, 1999). In addition to these competencies, attitude, which is one of the affective domain characteristics, is also important (Oral, 2004). The teaching profession requires candidates with specified competencies and positive attitudes (Srilatha, 2017).

Teacher candidates’ attitudes toward the profession should be favorable in order for them to successfully complete the criteria of the teaching profession and be successful in the profession (Ayık & Ataş, 2014). The expression “attitude toward the profession” refers to ‘the individual’s mood, conduct, and devotion to the profession’ (Hussain et al., 2011). According to attitude research, a teacher’s productivity and classroom performance are heavily influenced by his attitude toward the profession (Bhargava & Pathy, 2014; Srilatha, 2017). Because, besides conveying information to students, the teacher is a role model that supports their personality development in all aspects (Karataş, 2020). In his study, Mathai (1992) stressed that attitude toward the profession and success in teaching are associated. The disparities in pre-service teachers’ attitudes toward the teaching profession can be attributed to variances in learning settings, instructional materials, and tactics used in the teacher training program (Mordi, 1991). Under this context, the diversity of roles expected from the teacher in the current science curriculum and the use of innovative methods and techniques in the learning environment imply that the experiences that pre-service teachers have during their undergraduate education are important and necessary. In their study, Ecevit and Kaptan (2019) state that applications based on argumentation-supported inquiry positively improve the teaching competencies of science teacher candidates. Accordingly, thanks to the practices, the pre-service teachers’ ability to design a teaching-learning process improved, some changes and awareness occurred in their

teaching-learning understanding, and their science teaching self-efficacy beliefs increased because they actively experienced the process. This finding supports our explanation.

In this study, inquiry-based learning activities were carried out with science teacher candidates within the framework of the outcomes in the curriculum. The aim here is to gain knowledge and skills about various learning methods and techniques before starting the profession. At the end of the study, no statistically significant difference was found between the pre-test attitude mean scores of the teacher candidates and the post-test attitude mean scores. However, posttest attitude mean scores are higher than pretest attitude mean scores. Attitude has an important role in the effective emergence of knowledge and skills suitable for the teaching profession. In other words, a positive attitude towards the teaching profession becomes meaningful when it develops together with the knowledge and skills related to the profession (Andronache, Bocoş, Bocoş & Macri, 2014). This can happen over time, with long-term interactions with the profession in pre-service training. In this study, pre-service teachers' attitudes towards the profession were evaluated within the framework of the activities carried out during the course, and their attitudes towards the profession did not differ significantly. The reason for this result can be shown as the fact that the applied courses related to the teaching profession are mainly included in the 3rd and 4th grades in the science education undergraduate program and that they have not yet taken these courses. Studies examining teacher candidates' attitudes toward the teaching profession according to grade level support this view. In his study, Uyanık (2017) found that classroom teacher candidates' attitudes towards the teaching profession were at a low level in the first years of their undergraduate education, and there was a significant increase in their attitudes in the third and fourth years. He suggested that for the development of positive attitudes towards the profession, practices in which pre-service teachers are active should be carried out in instructional courses. Terzi and Tezci (2007) state that there is a significant difference between the first and last year candidates of the university teacher training programs in order to interpret the effectiveness of the teaching profession courses on the attitude towards the profession. In their study, Şahin Taşkın and Hacıömeroğlu (2010) stated that most of the pre-service classroom teachers in the last year are useful in terms of teaching methods and techniques of field education courses, and most of the classroom, preschool and science teacher candidates stated that vocational knowledge courses positively affect their professional development.

There are studies in the literature examining the effects of various teaching practices on teacher candidates' attitudes toward the profession. Kartal, Yamak and Kavak (2017) examined the effect of microteaching practices on the professional attitudes of science teacher candidates within the scope of the Special Teaching Methods course. As a result of the study, microteaching had a positive effect on the attitudes of pre-service teachers toward the teaching profession. Similarly, the studies of Tok (2008) and Peker et al. (2018) are in line with these results. In this case, pre-service teachers who have a positive attitude will do their jobs with pleasure and willingly in the future, and as a result, they will make significant contributions to education (Ayık & Ataş, 2014). Their attitudes towards the profession will change as their classroom professional experiences increase (Kartal et al., 2017). There was no statistically significant difference in pretest-posttest attitude mean scores based on gender. Accordingly, the practices carried out in the course had a similar effect on the gender variable. It is possible to see more survey-type studies on this subject. According to Chakraborty and Mondal (2014), and Çakır et al. (2006), there is no substantial gender difference in teacher candidates' attitudes toward the profession. Similarly, Uyanık (2017), in his study with prospective classroom teachers, concluded that there was no difference in terms of gender in the first three grades in the teaching profession attitude scores. Kesen and Polat (2014) reported that there was no

significant difference in the attitudes of teacher candidates towards teaching according to gender. On the other hand, in their study with secondary school teachers, Hussain et al. (2011) found that the attitudes of the majority of teachers towards the profession were not positive, and there were differences in terms of gender. Accordingly, it was determined that female teachers had a more positive attitude. There are findings in favor of female teacher candidates in the literature (Akpınar et al., 2006; Çapri & Çelikkaleli, 2008). Similarly, studies in the literature (Benjamin, Sahayarani & Stanly, 2011; Malsawmi & Renthlei, 2015; Naik & Pathy, 1997) concluded that female teachers have more positive attitudes towards the teaching profession than male teachers. There is an opinion that the teaching profession is more suitable for women in bringing together working and family life conditions in society (Doğan & Çoban, 2009; Terzi & Tezci, 2007). As a general tendency, teacher candidates may have this thought. However, the learning activities carried out in this study can be explained by the fact that many factors such as working with the group, communicating, and sharing what they have learned with each other equate to this tendency. However, it can also be effective for them to gain first-hand experience with the requirements of the teaching profession.

There was a statistically significant difference between the candidates' post-test attitude score averages in terms of the influence of the course activities on their attitude toward the teaching profession [$t_{(26)}=2.666$; $p<0.05$]. Furthermore, it was discovered that the substantial difference between the post-test attitude score averages on the attitude affect levels of the course activities has a high level ($d=0.97$) influence. According to this study, candidates who replied yes to the influence of course activities on attitudes toward the teaching profession had a high degree of effect on those who only partially answered. If positive attitudes are instilled in teacher candidates through learning environments, they will demonstrate more favorable behaviors toward their pupils after they enter the profession (Çeliköz & Çetin, 2004). Because experience, which is one of the factors affecting attitude, makes an important contribution to the formation of attitude (Suja, 2007). Environments should be created to support teacher candidates' positive attitudes toward science teaching. In this context, it is appropriate to design and implement certain courses, strategies, and methods (Kartal et al., 2017). Based on the results of this study, teacher candidates gained various experiences (presentation, homework, etc.), especially professional experience, thanks to the inquiry-based learning activities carried out, and this situation changed their attitudes towards the profession in a positive way. In this context, the learning environments to be presented to the candidates should include the competencies required by the profession and should support the use of the methods and techniques prescribed by the curriculum. The education that teacher candidates receive in professional knowledge and field courses has an important role in the formation of their attitudes towards the profession (Şahin Taşkın & Hacıömeroğlu, 2010).

The teacher who has a positive attitude towards the profession will reflect this in the teaching in the classroom. In such a classroom atmosphere, there will be students who have positive attitudes toward their peers, school, and learning. Therefore, knowing teachers' attitudes toward teaching is an important factor in understanding the learning environment (Rimm-Kaufman & Sawyer, 2004). As a result, teacher candidates need to be aware of the requirements of the profession, its content, their roles, and many other pedagogical and field-specific competencies before starting the profession. Because in this way, he will develop an attitude during his education at the faculty and will perform his profession with this attitude.

Suggestions that can be made in light of the study's findings are as follows:

- Inquiry-based learning activities can be designed to be a project product to be carried out at the next grade level, and their effects on the attitude towards the teaching profession or different variables can be examined.
- In a similar study, the effect of the gender variable can be investigated in depth with one of the mixed-method research designs.
- In new studies, the effect of learning activities that make teacher candidates active on the attitude toward the teaching profession can be examined.
- In future studies, the attitudes of different sample groups (undergraduate groups such as classroom, mathematics, biology, graduate, and teacher) towards the profession can be examined.

CONCLUSION

The quantitative and qualitative findings of the study show that inquiry-based learning activities generally positively affect the attitudes of science teacher candidates toward the teaching profession. Among the qualitative findings, learning how teaching works, being ready for the profession, feeling like a teacher, the effect of the presentations, and so on were observed as common points of view. At the same time, while the activities carried out did not cause a significant difference between the genders, they created a significant difference in favor of those who chose the department willingly and those who thought that the activities carried out in the course affected the attitude towards the teaching profession.

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Appendix 1: Some examples of the activities

1. Innovative thinking

Problem: Kış aylarında meydana gelen buzlu yolların trafik kazalarına neden olması.

Öğrencinin Probleme İstelik Çözümler Üretebilmesi için;

- * Trafik kazalarına sebep olabilecek nedenler araştırılabilir.
- * Bu zamana kadar bu probleme karşı hangi tedbirler alınmış araştırılıp, yapılan yeniliklerden esinlenip yeni fikirler ortaya çıkabilir. Yada yapılan bir çözüm yolunu kendileri geliştirebilirler.

Çözüm: Kış aylarında meydana gelen trafik kazalarının büyük çoğunluğunu gizli buzlanmalar oluşturmaktadır. Bu yüzden yoldaki buzlanmaları sürücülere haber veren bir sistem yapılabilir. Yol kenarlarında bulunan renkli trafik işaretleriyle yolun buzlu olduğuna belirtilebilir. Yolların kenarında enerjisini güneşten alan sinyal vericiler renkli trafik kutasına sinyal gönderecek ve sığınma mavi ışık yansıtarak. Bu renk normal trafik ışığındaki renklere farklı olacaktır (Yeşil, kırmızı, beyaz)

2. Problem-solving method

5. sınıf 6. Ünite - İnsan ve Çevre

Konu Kavramları : Çevre kirliliği, çevreyi koruma ve güzelleştirme, insan-çevre etkileşimi
 Kazanım : İnsan ve çevre arasındaki etkileşimin önemini ifade eder.
 Çevre kirliliğinin insanların sağlığı üzerindeki olumsuz etkilerine değinir.

İlgili Kazanım ve Öğrenme Alanı : FTTG, BSB

Senaryo : Bilgehan ailesiyle birlikte amcasının evine ziyarete gitmişti. Evin yakınında mermer fabrikası bulunuyordu. Bilge eve vardktan bir süre sonra daha zor nefes aldığını farketmişti. Etrafına baktığında ise havanın daha kirli olduğunu görmüştü. Bunun nedenini düşündü ;

Problemın Belirlenmesi : Bilge, bu kirliliğin nedenini öğrenmeye karar vermişti. Ayrıca çevresinde gördüğü atıkların fabrikayla alakalı olup olmadığını düşünmeye başladı. Acaba bu kirliliğe fabrika mı neden oluyordu ?

Problemın Anlaşılması : Bilge'nin aklına Fen Bilimleri dersinde öğrendiği çevre kirliliği konusu geldi. Öğretmeni nüfusun artmasıyla çevre kirliliğinin ortaya çıktığını ve canlıların hayatını olumsuz etkilediğini söylemişti. Bilge bunları hatırlayınca fabrika ile hava arasında bir bağlantının olduğunu farketti.

Hipotezlerin Oluşturulması : Bilge başka sebepleri de olabileceğini düşünmeye başlamıştı. Diğer sebeplerin ;

- Fabrikanın atıklarını suya ve çevreye bırakması
- Fabrikanın şehrinde bulunması
- Nüfusun fazla olması sebebiyle aşırı kentleşmenin olması olabileceğini düşündü.

Problemle İlgili Bilgi Toplanması : Konuyu iyice öğrenebilmek için ders kitabında bu konuyla ilgili olan metni okudu. Daha sonra internetten araştırmaya karar verdi. Gerekli bilgileri edindikten sonra Bilgehan bu sorunu çözmek için neler yapılabilir diye düşündü. Aklına fabrikaların yerleşim yerlerine uzak yapılması gerektiği, yerleşim yapılırken planlı ve düzenli yapılması gerektiği, atıkların çevreye değil uygun bir tesise gönderilmesinin gerekli olduğu geldi. Ayrıca fabrikaların kurallarına uyup uymadığında denetlenmeli idi.

Hipotezler Arasında En Uygun Olanın Seçilmesi : Bu testlerin hangi özelliklerinin olması gerektiğini öğrenmek için araştırma yaptı. Testin binalardan uzak beton saha üzerine yapılmış olmasını, zararlı gazların kontrollü bir şekilde filtrelili baca yardımıyla atmosfere bırakılması gerektiğini öğrendi.

Bilgehan bu araştırmayla atıkların testlere gönderilmesinin ne kadar önemli olduğunu anladı. Böyle yapıldığında atıklar çevreye bırakılmayacak, doğal dengeyi de bozmayacaktı.

Genel Bir Sonuca Varma : Bilgehan bu konuyla ilgili haberleri okuduğunda yakın mesafede bulunan iki fabrikanın çevresinin çok farklı olduğunu gördü. Çünkü bir fabrika atıklarını toprağa bırakırken diğeri özel testlere gönderiyordu. Bilge, bu iki doğal çevreyi kıyasladığında en faydalı sonucun atık testleri olduğunu anladı.

3. Project-based learning

Konu: 6. Sınıf Dünya ve Eren - Güneş Sistemi ve Tutulmalar

Kazanımlar : * Güneş tutulması esnasında Ay'ın hangi eurede olduğuna değinilir.

* Güneş tutulması çeşitlerine değinilir.

* Güneş tutulmasının her ay olmadığına değinilir.

* Ay tutulmasının nasıl olduğunu tahmin eder

* Ay tutulmasında Ay'ın hangi eurede olduğuna değinilir.

* Ay tutulmasının her ay olmadığına değinilir

Projenin Adı: Güneş ve ay tutulmasının maket modelle gösterimi

Projenin Amacı: Güneş ve ay tutulması kavranlarının benimsenilmesi, yarı gölge tam gölge oluşumunun öğrenilmesi

İlgili Öğrenme Alanı: FTTQ, BSB

Projede Kullanılacak Materyaller: Farklı büyüklükte 3 top, el feneri, siyah karton, ayakkabı kutusu.

→ **Proje Aşamaları**

* **Konu seçimi:** Öğrenci güneş ve ay tutulması konusunun sbael bir anlatım ile gök da kavranmadığını, yarı gölge vb. kavranların öğrenemediğini düşündü. Bu yüzden de konu hakkında maket tasarlanıyo karar verdi. Bu yüzden 6. sınıf Dünya ve euren ünitesinden, Güneş ve Ay tutulmaları konusunu seçmiştir

* **Bilgi Toplama:** Öğrenci ders kitaplarından, ansiklopedilerden ve ucetli internet sitelerinden araştırmalar yapmış, bilgi toplamış ve yeterli bilgi birikimine ulaşmıştır

* **Projeyi tamamlama:** Yeterli bilgiler sonucu, öğrenci 3 farklı boyutta top kullanarak dünya, güneş ve ay modelleri oluşturmuş ve siyah bir ortamda bunların gölge oluşumlarını gözlemlemiştir. Diğer gölgelerin gerçekten de güneş ve ayın görülmesine engel olduğunu gözleyip, güneş ve ay kavranlarını açıklayabilmıştır

* **Yöntem:** Bu projeyi oluştururken hiübir bilgi sahibi olmayan öğrenci ilk başta yeterli kaynaklardan bilgi toplayıp bir fikir sahibi olmuş daha sonra bu projeyi tasarlamıştır. Projesinde farklı 3 boyutta top kullanmasının nedeni güneş, dünya ve ayın boyutlarının farklı olmasıdır. Yine aynı şekilde siyah kartonla kaplı bir ortam oluşturmasının nedeni gölge oluşumunun siyah ortamda oluşabildiğini bildiği, bu konu hakkında önceden yeterli bir bilgiye sahip olduğu iaindir.

* **Takvim:** 1. Hafta → Proje konusu seçimi

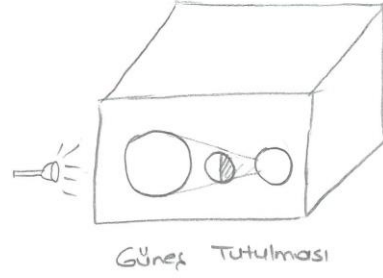
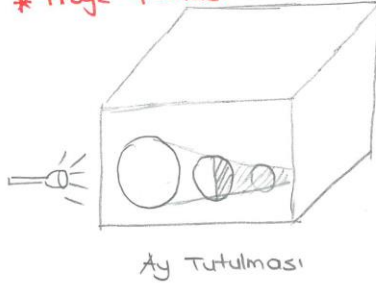
2. ve 3. Hafta → Proje hakkında bilgi toplama

4. 5. ve 6. Hafta → Projeyi tamamlama ve ilgili yöntemleri kullanma

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Toplam Proje Süresi = 6 Hafta

* Proje Şeması



* **Projenin Faydası** Öğrenci anlatılarak soyut olarak çok da kavrayamadığı güneş ve ay tutulması kavramını, yarı gölge, tam gölge kavramını görerek, yani somut olarak daha iyi öğrenecek ve daha iyi aklında kalacaktır

* Projede Kullanılan Kaynaklar

Fen Bilgisi 6.Sınıf ders kitabı,
Ansiklopediler
İlgili internet siteleri

* **Projenin Sonuçları:** * Ay, güneş ve dünya arasında girdiğinde ayın gölgesi dünyanın bir bölümünü kapotır Dünyanın o bölgesi güneşten tam ışık almaz. Buna güneş tutulması denir.

* Ay yüzüne düşecek güneş ışınları, dünyanın ay ve güneş arasında girmesiyle dünya tarafından engellenir. Karanlıkta kalan ay kısa bir sürede olsa dünyadan gözlenemez. Bu da ay tutulmasıdır.

* Işık kaynağından gelen ışık, cisme çarpıp ve arkasında bir karartı oluşturursa buna tam gölge denir. Eğer 2 kaynaktan gelen ışık kesişiyor ve burada bir gölge oluşuyorsa bu da yarı gölgedir. Tam gölge yarı gölgeye göre daha karandır. (kürenin tamamı ışıksız kalan bölgesi tam bölge, kısmen ışık alan bölgesi yarı gölge)

Örnek Gündelik Problemler

- Televizyonda güneş ve ay tutulmasıyla ilgili haberi gören bir öğrencinin merak edip araştırma yaptığı halde konuyu çok da kavrayamaması
- Güneş ve ay tutulması kavramlarının öğrencileri tarafından sürekli birbirine karıştırılan bir fen öğretmenin 2 farklı olayı kavratmak istemesi

¹ A part of this study was presented as an oral presentation at the 14th National Science and Mathematics Education Congress held online between 19-21 May 2021.