Id: 1231121

Participatory Educational Research (PER)
Vol.10(6), pp. 192-207, November 2023
Available online at http://www.perjournal.com
ISSN: 2148-6123
http://dx.doi.org/10.17275/per.23.96.10.6

Pre-Service Science Teachers' Experiences of an Expert-Guided Online Education Project

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Article history

Received:
08.01.2023

Received in revised form:
24.07.2023

Accepted:
09.10.2023

Key words:
pre-service science teachers, teacher education, distance education, constructivism

There exist different approaches and models in teacher training. Among them, the constructivist approach is widely preferred in many countries. The constructivist approach is commonly embraced for its role in helping educators nurture students who actively investigate, inquire, and exhibit curiosity about the world. In recent years, incidents such as pandemic and natural disasters seriously affect normal life and have led to educational environments becoming online. Thus, the need to adapt constructivist learning approaches to online environments emerged. In line with this need, an online education project was organized to enable pre-service science teachers to gain knowledge, experience and awareness about how constructivist learning approaches can be integrated into distance education environments. This research aimed to reveal the experiences of pre-service science teachers (PSST) regarding the online education project. The research adopted the phenomenology design. Data were collected from 19 PSSTs through semi-structured focus group interviews. The PSSTs' experiences fell in the following six themes: the perceptions of the teaching profession, the use of constructivist approach in distance education, lesson planning competencies in distance education, technological/pedagogical competencies, (Limited) contribution to subject knowledge and professional and academic career goals. The research findings offer valuable insight regarding the advantages of education project focused on enhancing the lesson planning skills of pre-service science teachers in line with the constructivist approach within distance learning settings. Based on the results, suggestions were made that could shed light on similar educational projects for teachers and teacher candidates from other fields.

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Introduction

There exist different approaches (traditional, behavioral, cognitive and constructivist approaches) and models in teacher training. In recent years, constructivist approach has been adopted in teacher education in many countries including Turkey (Erdal & Karakaya, 2009). One of the reasons for this preference is to enable teachers to raise students as individuals who search, question, and have interest and curiosity about the events around them (Trotman, 2015). According to constructivist programs, teachers are expected to guide the teaching process (Güneş, 2012). Teacher education, which is commonly based on the constructivist approach, can be divided into four parts as pre-service education, teaching experience, in-service training and postgraduate education. Among these, pre-service education is the most commonly inquired subject.

Pre-service education aims to develop various skills of pre-service teachers such as developing their skills in information and communication technologies before starting to work at schools, and using these skills in their lessons (CoHE, 2007; FAPEO, 2011). In Turkey, education faculties are expected to train teachers in accordance with the teacher competency framework determined by the Ministry of National Education (Güneş, 2012; MoNe, 2002). However, the relevant literature reveals that pre-service teachers in education faculties are not sufficiently equipped with the skills appropriate to the framework of teacher proficiency (Güneş, 2012). One of the reasons of this may be the transfer of theoretical knowledge rather than practical skills at education faculties (Doğan, 1999). This indicates that the constructivist approach is not utilized at the desired level in teacher training programs (Kesal & Aksu, 2005). Pre-service teachers take many theoretical courses (such as teaching approaches, assessment and evaluation, and alike) based on constructivism in their undergraduate education (CoHE, 2018). However, teachers who start teaching at schools experience some difficulties while applying their knowledge to the real classroom settings.

Curriculum in Turkey has been organized in accordance with the constructivist philosophy since 2004. Despite this, studies show that teachers do not use constructivist-based methods/strategies in their classrooms sufficiently (Tatar & Ceyhan, 2018). Teachers' feeling of inadequacy in creating learning environments suitable for constructivist approach and preparing lesson plans (Gömleksiz, 2007) and not getting enough mentor support (Bakay, 2006; Eraslan, 2008) can be shown among the reasons why they cannot conduct lessons based on constructivism. Therefore, it is important to provide pre-service teachers with guidance which is neglected in pre-service training to increase their competence in applying the constructivist approach (Ayvacı & Bakırcı, 2012). Moreover, due to the Covid-19 epidemic, which has affected the whole world in the last few years, teacher training, like all educational activities, has almost completely moved to online environments. This situation brought along the need to adapt the constructivist approach to distance education (Gómez, 2020).

Although it is necessary to use different methods and techniques to activate students in online environments, research show that pre-service teachers/teachers/academics have difficulty in online learning and tend to use traditional methods in their lessons (Bakioğlu & Çevik, 2020, Tunaz, 2023). The fact that teachers do not have sufficient knowledge about how to adapt the constructivist approach to online lessons and their belief that the constructivist approach cannot be used in online lessons can be listed among the reasons why they turn to traditional approaches in online lessons. In fact, contrary to the negative perceptions of teachers, the constructivist approach includes a structure that will guide students' meaningful learning by activating them in online lessons (Mathur & Murray, 2006). Therefore, there is a need for training to improve pre-service teachers' beliefs and perceptions about the integration of

constructivism into distance education.

Educational projects supported by Scientific and Technological Research Council of Türkiye (STRCT) or other institutions are carried out in order to support pre-service and in-service teachers (Mirici & Uzel, 2019; Yaman et al., 2021). For example, Mirici and Uzel (2019) carried out "project consultancy trainer training" for teachers in cooperation with STRCT and the Ministry of National Education (MoNE). The result of their research revealed that the teachers' incompetence was eliminated, and their self-confidence/motivation increased. This result highlights the significance of supporting the existing incompetence of teacher/pre-service teachers with supportive education projects. In another study, Yaman et al. (2021) conducted a 6-day education project with 24 postgraduate students. In the education project, the researchers created a social learning environment by enabling graduate students to work with faculty members from different fields. Students prepared projects by one-on-one interaction with experts and presented their proposals in a panel. At the end of the training, the participants' desire to write a project and their self-confidence in overcoming the difficulties they may encounter during the project process increased. The participants stated that they had more detailed information about the project development process. Also, the study of Mayer et al. (2017) reported that interactive online activities improve students' social cohesion and have a positive effect on student satisfaction. Thus, these results show that experts and pre-service teachers working together in an interactive way increase the efficiency of the education projects. Differing from these studies, we aimed to enhance pre-service teachers' competencies in utilizing constructivist approach in their lessons through an expert-guided online education project.

According to Speily and Kardan (2018), online learning environments have two main interrelated challenges: lack of access to (appropriate) information and lack of participation. Students need help to overcome these problems (Huang & Law, 2022). Therefore, measures should be taken in these issues in designing online education settings. Involvement of experts in the online learning process can be a way to overcome these limitations. If experts join learning environments and guide learners, a more effective learning environment can be created. The mentor plays a key role in supporting the professional development of a novice teacher. However, for mentors to be effective in promoting novice teachers, they should value their own professional development and be aware of the importance of life-long learning (Zuljan & Bizjak, 2007). Thus, we desired to contribute to both the professional development of pre-service teachers and their mentoring role in the field with the project we have carried out. Based on above idea, we carried out an education project in which experts and pre-service science teachers worked in cooperation. The education project aimed to enable pre-service science teachers to gain knowledge, experience and awareness about how learning approaches based on constructivist philosophy can be integrated into distance science education settings. A total of 32 pre-service teachers and 25 experts participated to the project. Within the scope of the education project, workshops were organized in which pre-service teachers prepared lesson plans according to the teaching methods and approaches used in science education such as argumentation, project-based learning, STEM, and the nature of science. In each workshop, 2-3 experts guided the pre-service teachers. As a result of the education project, 16 lesson plans were prepared.

The present study aims to reveal the pre-service science teachers' experiences of this education project. This research shows the contribution of the project in the elimination of pre-service teachers' prejudices that the constructivist approach cannot be applied in distance education. Also, the results of this research can serve as a source about the effectiveness of an

education project based on learner-experts cooperation in making the participants aware of their incompetency and eliminating them.

Method

Research Design

This research adopted phenomenology design of qualitative research method. Qualitative research focuses on understanding the specific context and its impact on participants (Maxwell, 2013). Phenomenological research focuses on the individuals who experience a phenomenon (Creswell, 2013). This study aimed to determine the pre-service science teachers' experiences about the education project where they work interactively with experts. Therefore, phenomenology design was utilized.

Research Group

The participants of the research are 19 pre-service science teachers (PSST) studying in the third and fourth grades of education faculties of 15 state universities in Turkey. All of the participants were women. The participants of the study were determined by criterion and convenience sampling. In this context, the pre-service teachers who voluntarily agreed to participate in the study among the pre-service teachers participating in the education project were included in the study. Demographic information about the participants is presented in Table 1.

Table 1 Demographics of the pre-service teachers interviewed in focus groups

	Code	Gender	Year	University		Code	Gender	Year	University
Focus Group 1	P1	Female	4	Boğaziçi University	Focus Group 2	P11	Female	4	Muğla Sıtkı Koçman University
	P2	Female	4	Gazi University		P12	Female	4	Erciyes University
	P3	Female	3	Erciyes University		P13	Female	3	Erciyes University
	P4	Female	4	Adnan Menderes University		P14	Female	3	Erciyes University
	P5	Female	4	Kilis 7 Aralık University		P15	Female	4	Muğla Sıtkı Koçman University
	P6	Female	4	Erciyes University		P16	Female	4	Mersin University
	P7	Female	4	Erciyes University		P17	Female	4	Ege University
	P8	Female	4	Gazi University		P18	Female	3	Giresun University
	P9	Female	4	Erciyes University		P19	Female	4	Balıkesir University
	P10	Female	3	Ege University					

Data Collection

The data of the research were collected through semi-structured focus group interviews. Focus group interview is a type of data collection based on the discussion of a certain number of participants by focusing on a certain topic (Wilkinson, 2004, p. 177). In focus group interviews, participants freely discuss different ideas and thoughts without any pressure (Krueger & Casey, 2000).

There are different views about how many participants should be included in focus group interviews. While Kitzinger (1995) states that focus group interviews should be conducted with four to eight people, Johnson and Christensen (2004) suggest that focus groups can consist of six to twelve participants. In this research, focus group interviews were held with two groups of nine and ten pre-service teachers. Interviews were carried out using an interview protocol designed by the researchers. In line with this protocol, seven open-ended questions and some probe questions were asked to the participants. For example, the first question in the interview was as follows:

Q1: "Has this education project changed your perception of the teaching profession? How?"
Probe: What is the role of working in collaboration with experts in this change?

At the beginning of the focus group interviews, participants were assured that their real names and personal information would remain confidential. A total 32 pre-service teachers participated in the education project, but the participants were selected among these pre-service teachers on a voluntary basis. The interviews were hold online. Before the interviews, the participants were asked for their permission to record audio and video, and then each group discussion was recorded. Focus group interviews lasted an average of 50 minutes.

Data Analysis

In this study, we aimed to analyze the answers of the pre-service teachers in depth. For this purpose, the PSSTs' responses to the open-ended questions were analyzed using content analysis (Marshall & Rossman, 2006). Content analysis is defined as the systematic summarization of data on a topic with words or phrases that will reflect these data (Büyüköztürk et al., 2008). As it is known, in the content analysis, qualitative data that are similar to each other are organized under certain codes, categories and themes. In the research, the answers of the participants to the interview questions were analyzed according to the analysis framework suggested by Creswell (2013). The analysis was carried out in two main stages. In the first stage of data analysis, the researchers independently analyzed the data. Each researcher labeled the data with codes. Then, in the second stage, then they came together and discussed about the codes they determined and continued the analysis until they reached a consensus. At this stage, the overlapping and excessive codes were merged and expressed as meaningful propositions. At the last stage, the codes were grouped under themes. The themes were determined in parallel with the frame in the interview form.

Validity and Reliability

In order to ensure credibility of the research, the data collection tool was examined by experts, the views of the participants were presented through direct quotations (Creswell, 2003), long-term interaction was ensured with the participants during and before the interview (Houser, 2015; Streubert & Carpenter, 2011), and during the interview, the answers of the participants were confirmed after each question (Erlandson et al., 1993). In order to ensure transferability, criterion sampling was preferred to convey the experiences of the participants (Sharts Hopko, 2002), and all stages of the study were described in detail (Creswell, 2003). While creating the themes to ensure dependability, the authors reached a consensus in data analysis (Patton, 2014) and the findings were presented without comment (Lincoln & Guba, 1985). To ensure confirmability, the consistency of the findings and conclusion discussion was checked by an expert on qualitative research.

Findings

The codes determined as a result of the analysis were collected under six themes. In this section, these themes are explained in order. In these explanations, information is given about the scope of the relevant theme. The themes that emerged as a result of the data analysis are as follows;

(1) Perceptions of the teaching profession
(2) Use of constructivist approach in distance education
(3) Lesson planning competencies in distance education
(4) Technological/pedagogical competencies
(5) (Limited) contribution to subject knowledge
(6) Professional and academic career goals

The codes under these themes are presented in Table 2. Then, the content of each theme and the codes under the themes were explained with quotations from the participants' views.

Table 2 Codes and themes regarding PSSTs' experiences of education projects

Themes	Codes
Perception towards teaching profession	Teaching is a profession that requires creativity. Teachers should cooperate. Teachers should give feedback to their students and colleagues. Teachers should be active listeners and observers. Teachers should be open to criticism. Teachers should follow current developments and be in constant development. Teachers' pedagogical and technological competencies should be developed.
Use of Constructivist Approach in Distance Education	Distance education can be carried out in accordance with the constructivist approach. Factors leading to this thought; Newly learned digital tools Teachers sharing their own experiences Sample applications Small group and field expert interaction Getting immediate feedback
Lesson Planning Competency in Distance Education	Lesson planning skills by using different digital tools in a unique way Collaborative lesson planning skills Ability to prepare detailed plans in which affective and psychomotor features are integrated Planning skills to teach 21st century skills
Technological/Pedagogical Competencies	Acquiring competence to use technology Getting to know different web2.0 tools Gaining experience in teaching different subject areas Gaining competence to enrich and differentiate objectives Ability to be a guide in lessons Gaining competence to organize the objectives, content and measurement tools compatibly Noticing the competencies of the target group

(Limited) Contribution to Subject Knowledge	Limited
Professional and Academic Career Goals	Realizing which subjects can be studied in graduate studies Gaining self-efficacy to make an academic career Increasing the interest and desire for the teaching profession Increasing proficiency in the teaching profession Emulation to academic studies Graduate studies improve teachers' professional competencies

Perception towards Teaching Profession

Analysis of the pre-service teachers' answers revealed that the education project had an impact on their perceptions about the teaching profession. According to participants, project made them realize that teaching is a profession that requires creativity, teachers should cooperate with colleagues, give feedback to their students and colleagues, be active listeners and observers, be open to criticism, and follow current developments to increase their pedagogical and technological competencies. Of the participants, P16 revealed that the Project made her realize that the teaching profession requires creativity as follows: "*We learned to produce something original in the creativity part... I think that the activity developed my brain's creativity in such a short time. The teacher should have the ability to think creatively*". Similarly, P17 expressed her opinion on the need for teachers to cooperate as;

> *"For example, I was a little afraid of having group work or collaborating with other teachers in my future carrier, I was afraid. I used to think that I could handle it on my own, but I learned a lot from my friends as much as my teachers, all my friends took part in group work and gave ideas. (This situation) showed me that the teaching profession can actually be carried out in cooperation with other teachers."*

Another finding that emerged from the answers of the pre-service teachers is that teachers should give feedback to each other's and their students' studies. For example, P18 expressed her opinion in the following dialogue with the researcher:

> *"P18: In this process, we saw that the students offer something, when you (teachers) give instant feedback, I honestly think that the next product will be much better when the wrong or deficiency is corrected by the teacher.*
>
> *Researcher: What is your inference from this point about teaching profession?*
>
> *P18: When we become teachers, our instant feedback on what they (students) do will make them understand. I think that they would be much more productive if we provide feedback as teachers in our activities."*

Use of Constructivist Approach in Distance Education

All of the pre-service teachers emphasized that they started thinking distance education could be carried out in accordance with the constructivist approach. Afterwards, the pre-service teachers were asked whether the studies carried out in the project were effective in their thoughts. The participants stated that the digital tools they learned in the project, the trainers' personal experiences, the activities they carried out, their interactions with the group members and field experts, and the feedback they received from the trainers were effective on their thoughts. For example, P4, who thinks that the new Web 2.0 tools she learned in the project made her realize that constructivism can also be used in distance education, explained her thought as;

> *"I was very biased about this. For example, I was thinking that the teacher is active, and the student is not very active in online education. I only knew Kahoot and a few apps. But after learning about different applications, I saw that students can be active in the lesson. I think constructivism can be used very well in online education."*

Pre-service teachers emphasized that the interaction with group members and teachers and the instant feedback they received during their online studies were effective in the formation of their thoughts that the constructivist approach of distance education can be applied in distance education. As one of these participants, P6 stated that stated:

> *"There is a perception that the student is passive in distance education, but constructivism can be adapted to the distance, the student can also be active. Field experts gave immediate feedback and worked with small groups; the contribution of the instructors was great."*

Lesson Planning Competency in Distance Education

Analysis of the participants' opinions revealed that the project improved the pre-service teachers' lessons planning competencies in accordance with distance education. These competencies are named by participants as ability of planning lessons using different digital tools in a unique way, planning lessons in collaboration, preparing a detailed plan in which objectives about affective, psychomotor, nature of science and 21. century skills are integrated, and. For example, P11 thought that the project gave them the ability to plan lessons by using different digital tools in a unique way. She explained her idea as;:

> *"We have learned so much about Web 2.0 tools. After a while, we started to connect the tools to each other. For example, there was no voiceover in the digital story tool, and we used it by blending it with the Web 2.0 tool, which has another voiceover."*

Another competence brought to the forefront by the participants was expressed as the ability to plan lessons in cooperation. In this regard, P18 thought that she improved her lesson planning competency in cooperation with her peers and field experts in the project. She noted her thoughts in the following manner:

> *"I realized that we could meet with people we never knew before and prepare lesson plans. It is very important to gain awareness of this because it is a situation that breaks prejudices. In the beginning, we were all very prejudiced about it."*

Participants also underlined that in the project, they improved their ability to prepare detailed plans in which their affective and psychomotor objectives were integrated as well as students' cognitive development. For example, P12 asserted her thought as below:

> *"We normally only emphasize cognitive objectives. Here, we became more aware of affective, psychomotor, and the nature of science objectives. All teachers paid great attention to this point… I can say this was an advantage for me."*

Technological/Pedagogical Competencies

This category is about the participants' views about the contribution of the project on their technological/pedagogical competencies. According to participants, their technological/pedagogical competencies have increased in the project. That is, the project enabled pre-service teachers to gain proficiency in the use of technology, to get to know different web 2.0 tools, to gain experience in teaching different subject areas, to enrich the content with the affective domain objectives, to gain the ability to guide the lessons, to understand that the acquisitions and measurement tools should be compatible, and to realize the competencies of the target learner group. In this context, P8 explained her thoughts that the project increased her technological competence and her competence in teaching different subjects of science as follows:

> *"I didn't know much about technology. More precisely, I couldn't use it, but in the project, I saw that I can use it, I can do it. For example, while making a presentation, I easily shared the screen and used other applications. It has helped me a lot in terms of technology. From a pedagogical point of view, I have mastered the program in a general way by examining the program of science and looking at its subjects."*

P6 stated that the project increased her competency to enrich the course content with the affective domain objectives. She expressed her thoughts as below:

> *"For example, the issue of self-regulation. I didn't know how to integrate it to the lesson. We mention it in the class, but we don't put too much emphasis on it. However, I learned how to emphasize this part in the lesson plans we prepared within the scope of the project. Therefore, working in interaction with the field experts has been of great benefit for me".*

Another issue emphasized by the participants about the contribution of the project to their pedagogical competencies, is that they learned how to guide their future students. P9's views on how the project increased her knowledge and awareness about being a facilitator in the lesson are as follows:

> *"I didn't understand what facilitating meant. For example, I was saying, in project-based learning, the teacher is the facilitator. In this project, the field experts showed a good example of how this facilitating can be made".*

(Limited) Contribution to Subject Knowledge

Analysis of the pre-service teachers' responses disclosed that pre-service teachers' subject knowledge has developed at a limited level in the project. All participants agreed that

the project had only a limited contribution on the pre-service teachers' content knowledge. P18's thoughts on this subject are as follows:

> *"We worked on a waste related issue. The instructor gave many examples from daily life which I did not know. At the same time, he gave up-to-date information such as that a new continent was formed from wastes. He gave many such examples. I benefited a lot as content knowledge. But we focused more on learning outcomes and how we can teach outcomes using web 2.0 tools. I think that the part we focused on was the other (teaching) part rather than the content knowledge."*

Professional and Academic Career Goals

Analysis of research data revealed that pre-service teachers professional and academic career goals were shaped thorough the project. In this context, pre-service teachers stated that their experiences within the project helped them to decide the subjects they could study on in their future graduate studies, increased their interest and self-efficacy in making an academic career, their interest and competence for the teaching profession. Participants also stated that doing graduate studies improve teachers' professional competence. P9 who thinks that the project made participants realize what subjects they could work on in their future graduate education explained her thought as follows:

> *"After I graduate, I will apply for a master's degree, but I haven't decided on which subject I will work yet. Thanks to this project, I learned different subjects such as scientific creativity. It drew my interest. I could study and specialize on topics like this that I did not know. In this respect, (project) has been beneficial to me".*

P14, who stated that she did not have a goal of getting a postgraduate education before participating in the project, explained how her mind had changed in her following statements:

> "*I did not have a master's degree among my goals. There never was. But when I looked at my teachers (in the project), I said, I can get a master's degree too. I can get my master's degree and work on these issues; I can help my colleagues and students. In this way, I can say that the project changed my mind*".

Some of the participants stated that the project increased their interest and self-efficacy in making an academic career. In this regard, P14 expressed her thoughts as follows :

> *"Being an academician is a very difficult process. I can say that I am inspired by the academicians in the project. They talked about their research. So, I asked myself questions such as why should I not talk about my studies, why can't I write a thesis or an article. In this sense, my goals have been shaped a little more in this project."*

Lastly, pre-service teachers stated they realized that doing academic work improves teachers' professional competencies. P18 expressed her thoughts in the following:

> *"There were secondary school teachers in the project who had completed their doctorate. There is a big difference between the teachers working in the Ministry of National Education and the secondary school teachers*

working in the project. Normally, teachers have to constantly learn. However, our teachers working in the Ministry of National Education, unfortunately, remain as they graduated. But in the meantime, many things are changing. Therefore, teachers need to constantly improve themselves."

Discussion

The result of the study revealed that the expert-guided online education project has changed participants' perceptions about the teaching profession in a positive way and developed an awareness of the characteristics that teachers should have. PSSTs' views showed that the feedback and corrections given by the experts in the project have the biggest share in creating this positive effect. PSSTs should be aware of their own norms and values so that they can help their students develop their own potential (Loughran, 2006). It is known that beginning teachers adopt and apply the practices of their higher education instructors to their own teaching practices (MacPhail et al., 2006). Therefore, the more pre-service teachers interact with different experts, the more they will benefit from the experience of the experts.

The education project, which is based on interaction with experts, has reduced the prejudices that distance education cannot be done in accordance with the constructivist approach. The experts' personal experiences, their constructive feedback and corrections, and the digital tools they used during the project were effective in the reduction of prejudices. The relevant literature also shows that distance education courses are generally carried out with traditional methods. Lecture method and question-answer technique are mostly preferred by the lecturers (Duman, 2020, Taşçı, 2021). Besides, Paydar and Doğan (2019) drew attention to the lack of motivation of students and the limitations caused by teaching methods in open and distance education. Kaleli Yılmaz and Güven (2015) reported that pre-service teachers consider distance education a boring, non-interactive, and emotionless form of education. Thus, this result of the education project is valuable in that the project has changed the prejudice that has been identified in the literature.

The education project developed PSSTs' competencies in using appropriate digital tools, collaborating with colleagues and experts, enriching the objectives in cognitive and affective terms, and planning appropriate lesson for distance science education. It is a necessity to reconsider the professional competence and professional development of teachers in order to keep up with the changes in the 21st century (Buldu, 2014). In parallel with this need, the education project had a positive effect on increasing technological competencies such as introducing different web 2.0 tools and using them for different purposes in different parts of a lesson. For example, in the education project, participants were taught how to use web 2.0 tools not only in the introduction and development phase of their lesson, but also in the assessment and evaluation phase. During and after the one-to-one workshop sessions, the experts gave feedback to the participants and made corrections on their lesson plans. In distance education, giving feedback and making corrections on pre-service teachers' studies is significant (Duman, 2020). Hamutoğlu et al. (2019) also stated that not giving feedback to students in distance education affects students' success negatively.

The education project contributed positively to the development of pedagogical competences such as enriching the lesson plan in terms of affective and cognitive dimensions, preparing an assessment tool suitable for the subject and student level, and ensuring objective-subject-measurement tool harmony. Pre-service teachers who have problems while preparing a lesson plan will also have problems interacting with the students during the implementation of the

plan (Aşiroğlu & Koç Akran, 2018). Therefore, the pre-service teachers should experience the proficiency in terms of preparing lesson plans by being aware of the holistic needs of students before starting teaching.

In the education project, the experts guided the pre-service science teachers while they were preparing lesson plans. In this way, the experts showed the participants how to facilitate a student in lessons in a practical way. In other words, the experts mentored the pre-service science teachers. Mentoring can be defined as the more experienced and skilled person giving training and counseling to the less experienced and skilled person on professional and personal development issues (Anderson & Shannon, 1988). In the education project, experts contributed to the professional development of the participants by providing a kind of mentorship.

The education project was effective in shaping the career goals of the participants and changing their prejudices about making an academic career. In other words, the project changed the perception that an academic career is made just to work at the university. The project made pre-service science teachers realize that they can do postgraduate education to increase their qualifications in the teaching profession.

Limitations

Like all other research, this research has certain limitation. First, the participants of the study consisted of 19 pre-service science teachers studying in the third and fourth grades of education faculties of 15 state universities in Turkey. This is a limitation in terms of sample size and diversity, and more pre-service teachers from different departments could be studied. In this way, richer data can be obtained for the research. Also, the interviews with the participants were conducted online as focus group interviews. Face-to-face and one-on-one interviews can also provide richer results. Lastly, since the interviews were conducted on voluntary base, all of the participants were women. In order to eliminate this limitation, it would be more appropriate to include male pre-service science teachers in the study.

Conclusion

Educational projects are effective in terms of bringing together the participants and experts and providing an environment for working in interaction and cooperation. As a matter of fact, in the seminars or workshops held within the scope of in-service or pre-service training, teachers are not given enough opportunity to practice (Alagül & Gürsel, 2019). In such trainings, pre and in-service teachers usually take a passive role as a listener. Therefore, trainings fall short in bringing about changes in teachers' behaviors (Cochran-Smith & Zeichner, 2005). Uçar (2017) revealed that the trainings should be structured with smaller groups with more intense interaction and the participants' views should be taken into consideration. By establishing a connection between theory and practice in teacher training, teacher learning should be guaranteed, learning opportunities should be increased and teachers' learning processes should be focused (Desimone, 2009). The way of teaching and the guidance of experts enable pre-service teachers to realize their own level of knowledge and to be encouraged when they feel insufficient. Thus, pre-service teachers can benefit from the experts effectively with well-structured pre and in-service education projects (Goodyear & Casey, 2015).

Suggestions

Based on these findings and results, the following recommendations can be made;

- In this study, the experiences of pre-service science teachers in an education project aiming to develop their competences in applying the constructivist approach in distance education were examined. Similar education projects can be planned for teachers and teacher candidates from other fields.
- New research can be planned to determine the effectiveness of the education project by using the quantitative research method.
- The research findings provided evidence that the education project was effective. Therefore, such education projects for pre- and in-service teachers can be carried out in the future.
- Pre-service teachers in education project stated that the education project had a limited effect on the development of their subject knowledge. In future projects, measures can be taken to overcome this limitation.

Acknowledgement

The data of this research were collected from pre-service science teachers who participated in the project called "Pre-service science teachers construct distance education through interactive applications" supported within the scope of TÜBİTAK 2237-A Grant Program for Scientific Training.

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