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THE PREFERRED MENTORING ATTRIBUTES AND PRACTICES FOR EFFECTIVE SCIENCE TEACHING

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Abstract. *Pre-service teachers encounter many different mentor teachers during the teaching practicum process. While some teachers give sufficient coverage to early childhood science education, some do not. This research aimed to explain effective mentoring attributes and practices of the mentors which preferred by pre-service pre-school teachers during science teaching activities throughout the teaching practice lessons. The study was designed in line with the Q-methodology. The participants of the study were 39 pre-service teachers. Quantitative data were collected with the Q measurement tool developed by the researchers to describe the mentoring attributes and practices in science teaching. In addition, qualitative data were collected and analyzed through an open-ended questionnaire. The results obtained in the study revealed that pre-service pre-school teachers preferred the mentoring attributes and practices, in which they could get support at the point of personal development in science teaching. In addition, it was found that the same pre-service teachers were less likely to prefer the mentor who gave feedback and tried to be a role model while science teaching.*

Keywords: *effective mentoring, mentor teachers, pre-school education, science teaching*

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Introduction

In the first year when teachers start work, they have hard time to create their education plan, evaluation of children's learning, designing classroom environment for specific topic such as science teaching. Teacher trainings foresee such situations that pre-service teachers encounter and try to enable them to gain experience by providing the opportunity to practice what to do and how to act in the face of these situations. This reveals the importance of practicum in teacher training programs. Practical training and school experience courses in teacher training programs are two important courses designed to enable pre-service teachers to gain experience. These courses are conducted in schools, and the mentor, who is the executive of the process, plays a very important role in training pre-service teachers (Hudson et al., 2009; Ngoepe, 2014). In the literature, it is seen that the support given by the mentor during the practice process contributes to the socialization of pre-service teachers as well as their emotional and psychological development, acquisition of the teaching ethics, development of classroom management skills, and increases their pedagogical knowledge (Abed & Abd-El-Khalick, 2015; Hobson et al., 2009; Hudson, 2005; Marable & Raimondi, 2007; McIntyre et al., 2005; Wang et al., 2008).

Moody (2009) emphasized that pre-service teachers want to make observations throughout the mentoring process on how the mentors achieve classroom management, how they assess their students, in addition to how they determine and use methods and techniques in the learning-teaching process. This provides the opportunity for pre-service teachers to compare the teaching practices of the mentor with the knowledge gained throughout the teacher training program (Hobson et al., 2009; Moody, 2009). On the other hand, Beck and Kosnik (2002) stated that pre-service teachers need emotional support and mentors should support them in this regard. In addition, some other studies have emphasized that science mentor teachers should know the syllabi, teaching methods and techniques, possible problems in the field and how they can be overcome and share such information with pre-service teachers (Bradbury & Wilson, 2020). However, in the study by Hudson (2007), the author stated that mentors had much more difficulty in proving mentorship on specific subjects such as science teaching, and therefore they did not feel comfortable.

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Hudson et al. (2005) created a model of mentoring support in different categories for pre-service science teachers and evaluated the mentorships that pre-service teachers received in this process. The five mentoring attributes and practices that characterize effective mentoring practices in science teaching as personal attributes, system requirements, pedagogical knowledge, modelling and feedback (Hudson et al., 2005).

Personal Attributes

Teaching practice is a process that requires social interaction. In this process, the effective demonstration of the interpersonal skills of the teacher will help achieve efficient teaching (Wang & Odell, 2002). Therefore, the skills of a mentor for personal development are an indispensable requirement for pre-service teachers (Gitomer & Zisk, 2015). During the personal development process, the mentor must meet the expectations of the pre-service teacher and be able to demonstrate his/her competency (Kennedy & Dorman, 2002; Rippon & Martin, 2003). Therefore, two methods are emphasized while focusing on communication between pre-service teachers and their mentors during a science teaching process. These methods are stated as mentors being supportive and attentive, and giving opportunities to pre-service teachers while communicating with the practice student during science teaching (Hudson, 2005).

System Requirements

Another part of the mentoring model determined by Hudson et al. (2005) is system requirements. System requirements can be defined briefly as pre-service teachers being informed by mentors about relevant issues. The researchers stated that according to the system requirements in science teaching, mentors should help pre-service teachers on how to conduct science teaching and how to arrange acquisitions and concepts for a good science teaching process (Bradbury & Wilson, 2020). In addition, it was emphasized that mentors should inform the pre-service teachers about the related subject in the education program of the school and the class within the framework of the system requirements (Hudson et al., 2009).

Pedagogical Knowledge

Mentors should be able to meet pre-service teachers' expectations regarding pedagogical knowledge (Hudson & Hudson, 2018; Zanting et al., 2003). Otherwise, pre-service teachers participating in the teaching practice cannot be expected to receive support from the mentor in a pedagogical sense. In addition, it is thought that mentors who are experienced in science teaching can guide pre-service teachers during the practice process so that they can improve their teaching skills. In other words, it will be provided through a good environment where pre-service teachers can perform effective science teaching (Abed & Abd-El-Khalick, 2015; Van Ast, 2002).

Modelling

Role modelling is the most important dimension for pre-service pre-school teachers in terms of teaching practice. Research has shown that the best way to acquire teaching skills can be achieved by having an effective model (Salisu & Ransom, 2014). In a recent study by Wagner (2020), the author stated that a classroom observation was helpful to improve teachers' lesson development about related topic. In this context, the study mentioned that the mentor should be a model on how to teach science, how to manage the classroom, how to plan a science activity, and how to assess children's learning at the end of the science activity (Hudson, 2007; Jarvis et al., 2001).

Feedback

Throughout the teaching practice process, giving constructive feedback is said to be an essential condition for pre-service teachers' training process (Bishop, 2001; Hudson et al., 2005; Zachary, 2002). Also, Hudson et al. (2005) stated that pre-service science teachers were able to improve the way they taught science through feedback. The researchers emphasized that pre-service teachers who received feedback would have the opportunity to see their strengths and weaknesses during teaching practices, and improve themselves in this respect (Jarvis et al., 2001; Zachary, 2002). However, in order for a mentor to give pre-service teachers verbal or written feedback about the science teaching practice, the mentor should observe the application, examine the activity plans and assist the pre-service teacher in evaluating

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the practice. Feedback will also give the mentors the opportunity to express their expectations from the pre-service teachers in the class during the practice process (Ambrosetti, 2010; Lejonberg et al., 2018).

Research Problem

When these five mentoring attributes and practices mentioned above are analyzed in general, it is seen that important aspects are discussed on what pre-service teachers may encounter during the developing their science teaching and learning skills. On the other hand, when the studies conducted on mentor attitudes are examined, it is clearly reported that pre-service teachers are not able to gain enough experience due to the problems arising from communication between practice teachers and mentors (Ekiz, 2006). In another study, the researchers observed that pre-service teachers faced offensive and inadequate mentors instead of constructive ones (Isıkoglu et al., 2007). Accordingly, they stated that pre-service teachers had difficulties in the teaching process in the classroom and while establishing a professional relationship with the mentor. Similarly, Sağ (2008) emphasized in his study that pre-service teachers wanted to work with mentors who were collaborative and guiding role models with leadership skills. The study by Kiraz and Yildirim (2007) concluded that whether or not the mentor is experienced is not very effective on pre-service teachers, but instead, it is more influential on pre-service teachers when mentors are enthusiastic at the point of education, support in pedagogical matters, and give constructive feedback to improve pre-service teachers' skills. Moreover, Abed and Abd-El-Khalick (2015) worked with Jordanian pre-service primary teachers about their perceptions of mentoring in science teaching. Researchers concluded that pre-service teachers did not have effective mentoring experiences in pedagogical knowledge and get feedback to improve their science teaching. However, the Jordanian pre-service teachers stated that their mentor modelled what they expected. This situation revealed that while some mentor teachers can support pre-service teachers in different areas (in pedagogical knowledge and get feedback), they cannot provide enough support in some areas (modeling, system requirements, and personal attributes) in early childhood science teaching. However, since mentoring is a whole, especially in certain subjects (such as science education), mentor teachers should be able to provide sufficient support to pre-service pre-school teachers in all mentoring areas (personal attributes, pedagogical knowledge, system requirements, modeling and feedback).

Research Aim and Research Question

Also, Hudson et al. (2009) expressed that the subject-based mentoring support is a problem encountered in the development of mentoring programs. Therefore, developing a mentoring program in general is regarded as a very important requirement. However, in order to develop a mentoring program, first of all, the expectations of pre-service teachers who will receive support from the mentors, what kind of mentoring they need and the reasons for these expectations and requests should be examined empirically. The aim of this study was to explain effective mentoring attributes and practices of the mentors which were preferred by pre-service pre-school teachers within the context of science teaching in pre-school classroom. In this case, answers to the following question were sought in the study: "Which mentoring attributes and practices are preferred by pre-service pre-school teachers within the context of science teaching in pre-school classroom?"

Research Methodology

General Background

In accordance with the purpose of the study, it was needed to group the pre-service teachers' mentoring attributes and practices and to define and explain the created groups. Accordingly, the study was designed as a Q-methodology in which quantitative and qualitative data were used together in accordance with the grouping and explanation of pre-service teachers' preferences. Q-methodology is a technique where the strengths of quantitative and qualitative methods are used, and the data analysis process is carried out with special computer software (Demir & Kul, 2011). In the scientific research process, researchers stated that "this methodology allows for an understanding of the convergence, or divergence, of participant perspectives, including what aspects of the domain have value and significance to the individuals in the study" (Rodl et al., 2020, p.3). In this context, the Q-methodology puts forth an approach that can be used for grouping individual thoughts. Moreover, it gives chances to highlight viewpoints of the participants about features of teachers' instructional practices about related topics (Crowe et al., 2017; Rodl et al., 2020).

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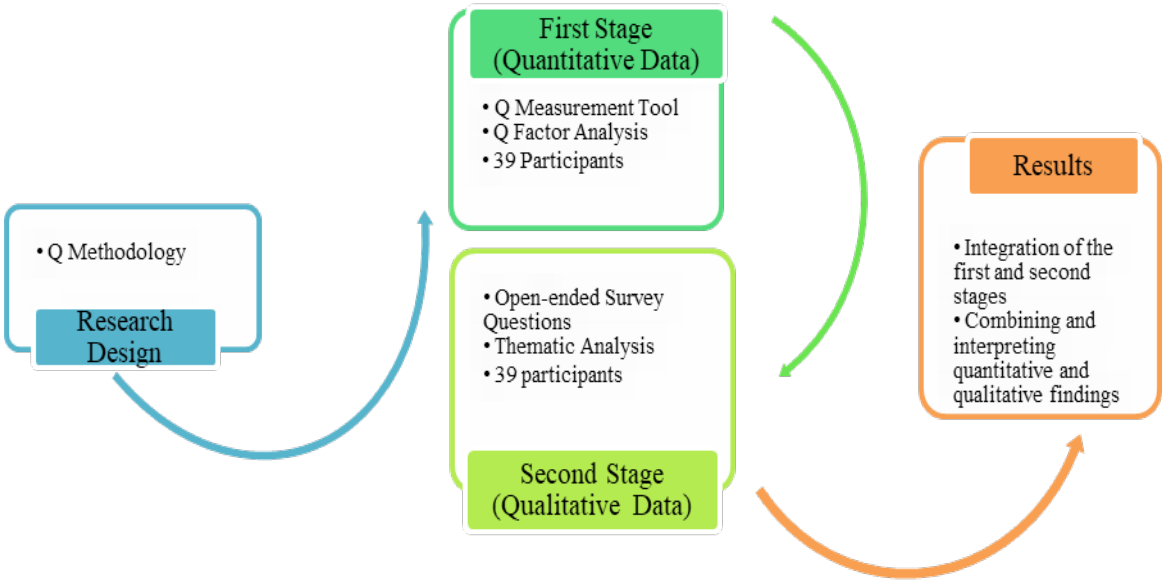
The study process is designed as a Q methodology with a two-stage approach. In this respect, the dimensions containing the mentoring attributes and practices, that mentors possess, as created from the study by Hudson et al. (2005), were defined and the Q measurement tool consisting of Q statements was developed in the context of these definitions in the first stage of the Q method. The second stage was carried out in parallel with the same stage and qualitative data were collected using open-ended survey questions (see Figure 1).

Figure 1
Schematic Representation of the Research Process



Participants

Due to the nature of the Q methodology, the selection of participants must be intentional, purposeful, or strategic rather than random. Therefore, the suitability of the participants to work is more important than the number of participants (Lutfallah, & Buchanan, 2019). In determining the participants of this study, purposive sampling was preferred. Researchers stated that Creswell (2012) stated that the aim of the using purposeful sampling is the focus on the characteristics of a population. Creswell (2012) also suggested that if purposeful sampling model will be used in the study, the researchers should determine these objectives in advance and select the research group accordingly. In the current study, the participants must first be volunteers to be included in the study. In addition, the participants are required to take science education courses before, and they must be taking the teaching experience course. Moreover, in Turkey, Early Childhood teacher education programs are 4 year long. Senior pre-service early childhood teachers are in their 4th year teacher education programs and mostly they take pre-service teacher experience classes in their final year. Depending on the university, they usually take science in early childhood education classes in their second or third year of education. In this case, 39 Turkish senior pre-service early childhood teachers who are studying at pre-school teaching and participating on a voluntary basis constituted the participant group. All participants are studying at a university in the South-eastern region of Turkey. Accordingly, all the participants consist of senior students studying in the field of pre-school and visiting the pre-school as their task for teaching experiences lesson at least ones a week. In addition, some researchers suggest that mentor teachers experience of teaching is related with their mentoring skills (Finkelstein et al., 2003; Rice, 2010). Therefore, prospective teachers who were working with mentor teachers with less than 2 years of experience were not included in the study.

Demographic information of the participants showed that most of the participants 79.5 % (N=31) comprised of female and some of them are 20.5% (N=8) male prospective teachers. The participants of the current study had previously taken at least one course about teaching science in early childhood classroom. It is important for understating mentor teachers mentoring attributes and practices about science teaching in classroom. The pre-service early child-

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hood teachers stated that the teachers who mentored the participant in the teaching practice had between 3 and 15 years of professional experience.

In determining the participants of this study, purposive sampling was preferred because Q data collection takes time, the research serves the purpose of interpretation and explanation, and does not have a generalization purpose. All of the participants consist of fourth year students studying in the field of pre-school and visiting the pre-school as their task for teaching practicum lesson. Due to the difficulties of collecting Q data, the purpose, scope and data collection technique and time were first introduced to the participants. Accordingly, 39 fourth year students studying at pre-school teaching and participating on a voluntary basis constituted the participant group. Demographic information of the participants is given in Table 1.

Table 1
Demographic Information of Participants

Participants	Gender	GPA	Taking Science Lesson Before	Mentor Teacher's years of experiences
K1	Female	2.34	Yes	8
K2	Female	3.07	Yes	8
K3	Male	2.80	Yes	9
K4	Female	2.83	Yes	8
K5	Female	2.72	Yes	6
K6	Female	2.90	Yes	2
K7	Female	3.09	Yes	9
K8	Female	3.03	Yes	9
K9	Female	3.18	Yes	2
K10	Female	2.67	Yes	3
K11	Female	3.29	Yes	9
K12	Female	2.57	Yes	11
K13	Female	3.53	Yes	15
K14	Female	3.02	Yes	13
K15	Female	3.01	Yes	23
K16	Female	3.46	Yes	9
K17	Female	2.79	Yes	13
K18	Female	3.20	Yes	13
K19	Female	3.40	Yes	3
K20	Female	2.40	Yes	2
K21	Female	3.13	Yes	7
K22	Male	3.24	Yes	7
K23	Female	2.82	Yes	10
K24	Female	3.31	Yes	10
K25	Female	2.80	Yes	15
K26	Male	3.05	Yes	3
K27	Male	3.58	Yes	9
K28	Male	2.02	Yes	15
K29	Female	2.92	Yes	3
K30	Male	2.90	Yes	5
K31	Female	3.80	Yes	10
K32	Female	3.29	Yes	6
K33	Female	3.10	Yes	3
K34	Female	2.86	Yes	7
K35	Female	3.00	Yes	7
K36	Female	3.20	Yes	14
K37	Female	2.84	Yes	4
K38	Male	3.18	Yes	6
K39	Male	3.53	Yes	8

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As can be seen in Table 1, 79.5% (N = 31) of the participant group consists of female and 20.5% (N = 8) male pre-service teachers. The overall academic achievement average of 39 pre-service teachers studying in pre-school teaching varies between 2.02-3.80 in 4th grade system (Xgpa_mean = 3.02). The participants of the current study had previously taken at least one course about teaching science in early childhood classroom. The pre-service early childhood teachers stated that the teachers who mentored the participant in the teaching practice had between 3 and 15 years of professional experience.

Data Collection Tools

In the first stage of this study, a measurement tool was developed in accordance with the nature of the Q-methodology, whose conceptual infrastructure was defined based on the dimensions containing the mentoring attributes and practices that the mentor had as stated in the study by Hudson et al, (2005) for effective science teaching.

The Q measurement tool is composed of 5 dimensions and 26 Q statements containing positive and negative expressions. In this regard, a conceptual infrastructure was created in order to develop the measurement tool containing Q statements to be used in the second stage of the study due to the non-structural design of the Q method. The Q measurement tool consists of *positive* and *negative* Q statements, representing each of the dimensions, namely, 'Personal Attributes', 'Feedback', 'Pedagogical Knowledge', 'System Requirements' and 'Modelling', which define the mentoring attributes and practices. The meaning of positive for the Q statements is positive perceptions of pre-service teachers. For example, if pre-service teachers feel that a mentor's behavior affects their science teaching in positively, that Q statements decided as positive sentences such as "I would appreciate that *my mentor gives information about the methods and techniques* required for teaching science in the pre-school class of my mentor". The opinions of three (3) experts (two (2) of them are working in the fields of Pre-school Teaching and one (1) of them is working in the field of Assessment and Evaluation of Training Programs) were invited while developing the measurement tool, for evaluation in terms of scope and appearance validity. In addition, pilot implementation of the Q measurement tool was carried out with 5 participants who are studying early childhood teacher education major and taking the practicum lesson and outside the scope of the study. At this point, feedback was obtained about the clarity and usefulness of the measuring tool by experts. Within this context, the final version of the Q measurement tool was given for the purpose of the final applications by providing the necessary adaptations. Some examples of the Q statements were used in the measurement tool given in Table 2.

Table 2
Research Tool (Q Statements Based on Mentor Teacher's Mentoring Attributes and Practices)

Qualifications	No	Type	Q Statements
Personal Attributes	12	Positive	I would like my mentor to help ***achieve a positive attitude***.
	22	Negative	I would like to ***gain positive attitude myself towards science teaching in the process*** while teaching science in the pre-school class of my mentor.
	9	Positive	I like it when my mentor supports me to ***feel comfortable*** while teaching science in pre-school class of my mentor.
	4	Negative	I ***always feel comfortable*** while teaching science in my mentor's pre-school class of my mentor.
Feedback	26	Positive	It is more important that my mentor gives me ***verbal feedback*** about science teaching that I have done in the pre-school class of my mentor.
	17	Negative	It is more important that my mentor gives me ***written feedback*** about the science teaching that I have done in the pre-school class of my mentor.
	11	Positive	I would prefer my mentor to evaluate the activities I have prepared for the science teaching in the pre-school class ***during the practice*** and give me feedback.
	3	Negative	I would prefer my mentor to evaluate the activities I have prepared for the science teaching in the pre-school class ***after the teaching practice*** to give me feedback.

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Pedagogical Knowledge	7	Positive	I would appreciate that ***my mentor shows me*** how to use the science concepts that I need to teach science in the pre-school class of my mentor.
	14	Negative	***I know how to use*** properly the necessary science concepts that I need to teach in the pre-school class of my mentor.
	21	Positive	I would appreciate that ***my mentor gives information about the methods and techniques*** required for teaching science in the pre-school class of my mentor.
	18	Negative	It affects me negatively when ***my mentor gives information about the methods and techniques*** required for teaching science in the pre-school class of my mentor.
	6	Positive	I consider it important that ***my mentor develops my skills*** in terms of classroom management while teaching science in the pre-school class of my mentor.
	2	Negative	I ***would like to improve myself with activities in*** classroom management while teaching science in the pre-school class of my mentor.
	25	Positive	I ***would like my mentor to help me improve myself*** in how to evaluate the children while teaching science in the pre-school class of my mentor.
	1	Negative	I ***would like to improve myself during my practice***, on how children can be evaluated while teaching science in the pre-school class of my mentor.
System Requirements	24	Positive	I ***would like my mentor to support me*** on how to determine the acquisitions and indicators required for science teaching in the pre-school class of my mentor.
	13	Negative	I ***would like to determine the acquisitions and indicators myself*** required for science teaching in the pre-school class of my mentor.
	10	Positive	I ***would like my mentor to assist me*** in obtaining the materials necessary for teaching science in the pre-school class of my mentor.
	5	Negative	***I can provide the teaching materials myself*** that I need for teaching science in the pre-school class of my mentor.
	19	Positive	I ***would like my mentor to help me with how to use the materials*** necessary for teaching science in the pre-school class of my mentor.
	15	Negative	I ***would like my mentor to let me decide how to use the teaching materials*** necessary for teaching science in the pre-school class of my mentor.
Modelling	8	Positive	I ***would appreciate that my mentor shows me*** how science teaching practices are carried out in the pre-school class of my mentor.
	23	Negative	I ***would like my mentor to let me use my own learning techniques*** for science teaching in the pre-school class of my mentor.
	20	Positive	I ***would like my mentor to show me how to manage the classroom*** during science teaching in the pre-school class of my mentor.
	16	Negative	I ***would prefer to ensure classroom management myself*** during the science teaching in the pre-school class of my mentor.

Some of the positive and negative 26 Q statements, describing the mentoring attributes and practices of the mentor given in Table 2 in five dimensions, were randomly numbered. In order to collect the Q data, participants were asked to place the items they preferred or not from the expressions describing the mentoring attributes and practices of the mentors in the forced distribution scale given in Figure 2 developed by the researchers. The forced distribution, which includes the grading of the expressions describing the mentoring attributes and practices of a mentor, is composed of 26 boxes in total, ± 4 one, ± 3 two, ± 2 three, ± 1 four boxes and 0 six boxes each. The forced distribution allows us to crystallize the participants' preferences, attitudes, perceptions or thoughts by forcing them to decide (Demir & Kul, 2011; Rodl et al., 2020).

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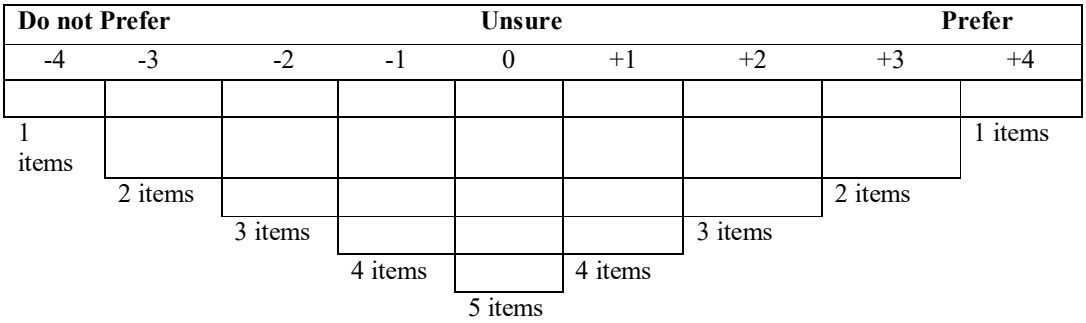
Figure 2
Schematic Representation of the Q-sort Distribution



The third tool is the information form that codes the personal information of the participant (participant number, average, whether or not he has taken science teaching courses, etc.) and the placement he made in the Q scale. In addition, in the third tool, a large writing area is given where the participants can answer the open-ended question to explain the reason for choosing the mentoring attributes and practices that they prefer from the +4 and -4 extreme values.

Data Collections

The researchers state that the data collection process has an important place in the Q method (Lutfallah & Buchanan, 2019; Rodl et al., 2020; Stenner & Stainton Rogers, 2004). Lutfallah and Buchanan (2019) pointed out that when the participants have exhausted all their possible thoughts about the Q sets, the researchers can intervene and collect the data in two phases: pre-sorting and actual sorting. In pre-sorting, the participants divide the Q sets they agree with, disagree with, and feel neutral or uncertain about domains. Next comes actual sorting. In this phase, the participants consider how strongly feel about each statement (Lutfallah & Buchanan, 2019).

For the current study, the pre-service teachers are asked to consider their relationships with mentor teachers regarding the science teaching process in the classroom. Likewise, they are asked to think about their own experiences in the process of science teaching. Later, prospective teachers are asked to examine the Q sets they prefer, do not prefer, and feel neutral or unsure about their mentor teachers' mentoring attributes and practices about science. Finally, prospective teachers are asked to write down the numbers of the expressions on the forced distribution scale given in Figure 2, evaluating how strongly they feel about each statement.

Data Analysis

In the analysis of Q data, factorization similar to exploratory factor analysis (EFA) was made. However, Q factor analysis differs slightly from EFA. While items representing the opinions of individuals are factorized and grouped in EFA, people are factorized and grouped based on the opinions in Q factor analysis. Q factor analysis was carried out in two stages. In the first stage, principal components analysis was applied. Principal component analysis is the procedure to convert variables observed to be correlated to one another into fewer variables called factors (Özdamar, 2016). In the second stage, the factors (groups) with eigenvalues greater than 1 were manually selected in the program and re-factored with the varimax rotation method. Rotating the factors provides to look at and make sense of the groupings that make up the factors from different perspectives (Özdamar, 2016). After rotations, the significance of factor loads representing individuals in the new factor groupings was evaluated at .05 level.

This level was calculated manually with the formula 'SE (p)=(1/√n).±1.96' (*n* = the number of Q statements, 1.96 refers to t value with 95% confidence interval). It was concluded that a person with a factor load above the obtained value (if it is a negative charge, it is a load value whose absolute value is taken) was significant for that group and were members of the group. *Z* values expressing the Q statement preferences were used to evaluate the participants' generally preferred mentoring attributes and practices and to compare groups based on some personal characteristics. *Z* values represent the degree of agreeing to an item (within the range of ± 4). The average *Z* value was calculated in order to determine the mentoring attributes and practices generally preferred by the participants. In order to compare the participants grouped in Q factors according to various variables, *Z* values and order of preference of positive and

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negative Q statements defining the mentoring attributes and practices of mentors were used within science teaching in early childhood classroom.

The participants were asked to explain in writing the reasons for placing the statements they placed in the +4 and -4 boxes after placing the Q statements in the forced Q scale. In this way, qualitative data were collected in order to examine the mentoring attributes and practices preferred by the participants in more depth. In the analysis of the qualitative data obtained at this stage, a thematic analysis approach was adopted. Thematic analysis process includes: i) recognizing data, ii) generating initial codes, iii) searching themes, iv) reviewing themes, v) naming and identifying them, and vi) reporting (Braun & Clarke, 2006). To make reliability of qualitative data analyze in the study, Miles and Huberman's (1994) formula was used. The formula is [Reliability = (Consensus):(Consensus + Dissidence) x100]. Related with the reliability each researchers evaluated codes differently. Accordingly, the reliability of the qualitative data was calculated as 92% [93 = (160): (160 + 12) x100]. Miles and Huberman (1994) stated that the correspondence between the researchers and coders should be over 90%.

Research Results

In this part of the study, answers were sought for the following questions: "Which mentoring attributes and practices are preferred by pre-service pre-school teachers within the context of science teaching in pre-school classroom?" In order to determine the preferences of pre-service pre-school teachers towards mentoring attributes and practices, basic components analysis and factor rotations were performed on the data collected with the Q measurement tool. The results obtained from the principal components analysis are given in Table 3.

Table 3
Results of Q Factor Analysis Principal Components Analysis

Q Factor	Eigenvalue	Explained Variance	Total Variance
1	9.51	24.33	24.33
2	3.61	12.26	36.59
3	2.57	10.16	46.75
4	2.30	7.05	53.80
5	2.05	6.57	60.37

Table 3 shows that there are five Q factors with eigenvalues greater than 1. In this case, it could be assumed that pre-service pre-school teachers have a common view on the definitions that indicate the mentoring attributes and practices of mentors. However, as a result of the analysis of the main components, the formation of five significant factors shows that the opinions of the participants are clustered in different dimensions besides the formation of a common opinion. Therefore, in order to examine closely the pre-service pre-school teachers' preferences over the qualifications that define mentoring attributes and practices and to make comparisons in various aspects, Q factors obtained as a result of analysis of basic components were rotated with the varimax technique. Findings obtained as a result of rotations, Q factors and factor loads are given in Table 5.

Table 4
Findings of Factor and Factor Loads of the Participants as a Result of Q Factor Analysis

Participants	Gender (Factor 2)	Years of Experience of the Mentor (Factor 3)	Factor 1 (*N* = 11)	Factor 2 (*N* = 7)	Factor 3 (*N* = 7)	Factor 4 (*N* = 4)	Factor 5 (*N* = 3)
PT1	Female	8	0,02	0,19	0,21	0.80X	-0,02
PT2	Female	8	0,24	0,24	-0,18	0,14	0,29
PT3	Male	11**	0,11	0,13	0.65X **	0,07	0,36
PT4	Female	8	0,10	0,21	-0,12	**0.70X**	-0,28

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Participants	Gender (Factor 2)	Years of Experience of the Mentor (Factor 3)	Factor 1 (*N* = 11)	Factor 2 (*N* = 7)	Factor 3 (*N* = 7)	Factor 4 (*N* = 4)	Factor 5 (*N* = 3)
PT5	Female	6	**0.68X**	0,17	-0,13	0,30	0,11
PT6	Female	3	0.41X	0,29	0,39	0,40	-0,05
PT7	Female	9	0,13	**0.59**X	0,43	0,27	-0,11
PT8	Female	12**	0,29	-0,12	**0.72X****	0,08	0,18
PT9	Female	5	**0.50**X	0,11	0,08	-0,09	0,37
PT10	Female	3	0,30	0,07	-0,11	0,02	0,17
PT11	Female	9	-0,04	**0.73X**	-0,27	-0,16	0,15
PT12	Female	11	0,14	0,20	0,04	0.39X	0,22
PT13	Female	15	0,16	0,34	0,02	0,15	**0.66X**
PT14	Female	13**	0,09	0,20	0.59X**	-0,40	0,42
PT15	Female	4	**0.70X**	0,52	0,25	0,04	0,07
PT16	Female	9	**0.47X**	-0,16	-0,17	-0,07	-0,02
PT17	Female	13	0,19	0,07	-0,05	0.67X	0,09
PT18	Female	13	**0.72X**	0,45	0,00	-0,06	0,12
PT19	Female	3	0,15	0,37	0,25	0,29	0,21
PT20	Female	2	**0.74X**	-0,42	0,25	0,11	0,01
PT21	Female	7	**0.48X**	0,40	-0,23	0,25	0,47
PT22	Male	7	**0.58**X	0,07	0,21	0,09	0,15
PT23	Female	9	0,33	-0,39	**0.58X**	-0,26	-0,14
PT24	Female	10	**0.68X**	0,23	-0,06	-0,26	0,22
PT25	Female	15**	0,42	-0,03	**0.68X** **	-0,24	0,06
PT26	Male*	8	0,36	0.55X*	-0,31	0,25	-0,26
PT27	Male *	9	0,27	**0.71X**	-0,07	0,37	-0,22
PT28	Male *	15	-0,03	0.82X*	-0,04	0,08	-0,02
PT29	Female	6	**0.64X**	-0,01	0,19	-0,04	0,41
PT30	Male*	7	0,07	0.72X*	0,10	-0,09	0,36
PT31	Female	10	0,35	0,11	-0,34	0,15	-0,04
PT32	Female	6	0,36	0,17	-0,13	-0,01	0,39
PT33	Female	13**	0,12	0,20	***0.82X****	0,22	0,16
PT34	Female	7	0,03	0,09	0,01	-0,13	0,03
PT35	Female	7	0,10	0,19	-0,12	-0,23	**0.57**X
PT36	Female	14**	0,40	-0,10	***0.42**X***	0,11	-0,16
PT37	Female	10	0,08	0,07	0,24	0,02	0.52X
PT38	Male	6	0,20	0,28	0,03	-0,02	0,16
PT39	Male*	8	0,06	***0.70X****	0,04	0,16	-0,03

Note: *%95 confidence interval significance SE(p)=(1/√26). ±1.96=±.388 * Significant Differences

As can be seen in Table 4, 32 of the 39 participants who constituted the study group were gathered in five Q factors. Of all the participants who form groups in the factors significantly, 34.4% (*N* = 11) of them are clustered in the first Q factor, 21.9% (*N* = 7) in the second, 21.9% (*N* = 7) in the third, 12.5% (*N* = 4) in the fourth and 9.3% (*N* = 3) in the fifth Q factor group. When the students studying at pre-school teaching are compared according to their gender, general

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average, whether or not they had taken a science teaching class, as well as mentor's years of experience, it is observed that there is a difference in the groups with variables, namely gender and years of experience of the mentor. It has been determined that male pre-service pre-school teachers are concentrated in the second Q factor (5 out of 8 participants are significantly in the second factor, 62.5%). In addition, when we divided the professional experience of the mentors of the pre-service pre-school teachers into two groups as less than 10 years of experience, and 10 and more years of experience, it was determined that the participants who were in the mentorship of those with 10 or more years of experience were clustered in the third Q factor (6 of 13 participants are significantly in the third Q factor, which stands for 46.2%). In this case, it may be stated that the pre-service pre-school teachers' mentoring attributes and practices preferred by their gender are similar. Likewise, it is seen that the mentoring attributes and practices that the pre-service teachers prefer according to the years of experience of the mentors are also clustered.

In order to evaluate the preferences of the participants for their preferred mentoring attributes and practices, *Z* score averages in each dimension expressing their Q statement preferences were calculated. Also, the *Z* score of the Q statements and the preference rankings were taken into consideration in order to compare the mentoring attributes and practices preferred by the participants who concentrate on two different factors according to some of their characteristics during science teaching. The results obtained are given in Table 5.

Table 5
Z Values for Q Sentences, Participant Preference Rankings and Average Z Values

Qualifications	Q Statements	Factor 1		Factor 2		Factor 3		Factor 4		Factor 5		Mean Score of Z
		Z	Row	Z	Row	Z	Row	Z	Row	Z	Row	
Personal Attributes	12.	0.01	15	0.72	7	-0.80	21	1.85	1	1.16	4	0.52
	22.	0.40	13	0.30	10	0.00	12	-0.57	18	-1.04	21	
	9.	0.90	4	0.13	11	-0.45	18	1.45	3	0.61	9	
	4.	-1.14	22	-0.24	17	-0.23	15	-0.70	20	-1.68	26	
Feedback	26.	0.10	16	-0.06	16	-0.17	14	0.23	11	0.63	7	-0.36
	17.	-1.71	25	0.05	14	-0.34	16	-1.25	23	1.40	3	
	11.	-2.02	26	-0.66	20	-2.12	26	-1.66	25	-1.14	23	
	3.	0.97	3	1.43	3	1.72	1	-0.72	21	2.14	1	
Pedagogical Knowledge	7.	0.58	8	-1.81	25	0.00	12	-0.99	22	-0.10	14	0.07
	14.	-0.18	17	0.93	4	-1.03	24	0.23	11	0.16	11	
	21.	0.89	5	-1.08	23	-1.37	25	-0.07	15	0.56	10	
	18.	-1.49	23	-0.40	19	-0.69	19	-1.72	16	-0.73	20	
	6.	0.21	14	-0.27	18	0.05	10	1.30	4	0.82	5	
	2.	0.45	10	0.88	6	-0.74	20	1.82	2	-0.71	19	
	25.	-0.61	20	0.06	13	0.57	9	0.78	6	0.10	12	
	1.	0.47	9	0.92	5	0.80	7	-0.39	17	-1.47	25	
System Requirements	24.	-0.69	21	-1.03	22	-0.17	14	0.01	14	0.64	6	0.15
	13.	0.61	7	0.33	9	-0.92	22	-1.41	24	-0.36	17	
	10.	0.81	6	0.02	15	0.57	9	0.42	9	-0.26	16	
	5.	-1.61	24	0.11	12	1.54	3	-0.19	16	-1.04	22	
	19.	-0.55	19	-0.71	21	1.14	5	0.21	12	0.62	8	
	15.	0.42	12	0.40	8	-0.40	17	-0.68	19	-0.25	15	

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Qualifications	Q Statements	Factor 1		Factor 2		Factor 3		Factor 4		Factor 5		Mean Score of Z
		Z	Row	Z	Row	Z	Row	Z	Row	Z	Row	
Modelling	8.	0.44	11	-1.56	24	1.60	2	0.13	13	0.00	13	-0.20
	23.	1.47	2	1.97	1	1.49	4	0.81	4	-0.52	18	
	20.	-0.40	18	-2.00	26	0.92	6	0.50	8	1.70	2	
	16.	1.87	1	1.57	2	-0.97	23	0.60	7	-1.26	24	

** Identities in which positive and negative Q sentences show symmetry*

The mean *Z* value given in Table 5 was calculated with the formula '*Z*_ mean = (*Z* value of the positive statement defining the quality of the mentoring attributes and practices - *Z* value of the negative statement defining the identity of the mentor) / the number of Q statement'. The mean *Z* value was used to evaluate the generally preferred mentoring attributes and practices of 32 participants who were divided into five different Q factors in the participant group. According to the mean *Z* values calculated in Table 5, the participants determined their preferences on the mentoring attributes and practices of the mentors in general, based on the variables, namely: 'Personal Attributes' (*Z*_ mean = 0.52), 'System Requirements' (*Z* _ mean = 0.15), 'Pedagogical Knowledge' (*Z* _ mean = 0.07), 'Modelling' (*Z* _ mean = -0.20), and 'Feedback' (*Z* _mean = -0.36), respectively. According to these findings, it could be assumed that pre-service pre-school teachers give priority to personal typologies of their mentors' mentoring attributes and practices while teaching science in early childhood classroom. In addition, pre-service teachers approached negatively against the qualifications that the mentor should have in order to be a role model and give feedback, which could be regarded as the main reason for the pre-service teachers' willingness to practice autonomously and work originally.

As seen in Table 6, 32 participants were grouped in five Q factors. Accordingly, the participants defined the mentoring attributes and practices of their preferred mentors in five different groups. However, only two of these five different groups were identified using the information about pre-service pre-school teachers (gender and years of experience of the mentor). For this reason, the mentor's mentoring attributes and practices preferred by the pre-service teachers in only two of the five different groupings are examined in more detail.

Gender

The most preferred Q statement of the 7 participants in the second Q factor is '*I would like my mentor to let me use my own learning techniques for science teaching in the pre-school class*' (*Z* = 1.97, row = 1). The second preferred Q statement in this group is the phrase '*I prefer to ensure classroom management myself during the science teaching in my mentor's pre-school class*' (*Z* = 1.57, row = 2). Accordingly, the participants clustered in this group emphasized the characteristic of a mentor as a role model since both Q statements (16th and 23rd Q statements) are expressions related to role modelling. However, at this point, the tendency is towards having a negative attitude about role models in both Q statements, that is, rather than taking the mentor as a role model, the tendency of pre-service teachers is towards having the opportunity to create their own models. Thus, it could be assumed that the participants in this group approached the mentor's mentoring attributes and practices as a role model with the highest priority in a negative manner, that is, they did not want to have role models. On the other hand, the third Q statement most preferred by the participants in the same group is '*I would prefer my mentor to evaluate the activities I have prepared for the science teaching in the pre-school class after the teaching practice to give me feedback.*' (*Z*=1.43, row=3). In this context, group participants especially preferred their mentor's mentoring attributes and practices to give feedback as this technique enables to make notifications after the application and in writing. Therefore, at the point of feedback, it could be asserted that the participants in this group preferred that mentors did not interfere with the practice and expected the feedback to be presented in writing. In addition, the Q statements preferred by these group participants in the fourth, fifth and sixth ranks are as follows: '*I know how to use properly the necessary science concepts that I need to teach in my mentor's pre-school class*', '*I would like to improve myself during my practice, on how children can be evaluated while teaching science in the pre-school class*', '*I would like to improve myself with practices in classroom management while teaching science in*

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the pre-school class of my mentor'. Accordingly, group participants did not prefer to make use of the pedagogical mentoring attributes and practices of their mentors. Therefore, it could be asserted that the participants emphasized their desire to use and apply their own pedagogical knowledge rather than the pedagogical knowledge of their mentors. In the second Q factor, 4 men out of 7 participants make up 62.5% of the participants. In this case, it was observed that male participants preferred to have mentors' mentoring attributes and practices as role models, receive feedback, and pedagogical information as a priority from among mentor mentoring attributes and practices, but they expected the mentor to help them carry out their preferences more autonomously.

Mentor Teachers' Years of Experiences

The most preferred Q statement of the 7 participants in the third Q factor is '*I would prefer my mentor to evaluate the activities I have prepared for the science teaching in the pre-school class after the teaching practice to give me feedback*' (*Z* = 1.72, row = 1). In this context, the group preferred the feedback to be given by the mentor after the practice and in writing not the verbal feedback. Therefore, it could be assumed that the participants in this group did not want the mentors' mentoring attributes and practices to interfere with the practice and expected that the intervention would be presented in writing after the application. The second preferred Q statement in this group is '*I would appreciate that my mentor shows me how science practicums are carried out in the pre-school class.*' (*Z* = 1.60, row = 2). Accordingly, the participants in this group emphasized the importance of role modelling and wanted their mentors to be a role model. In addition, in the fourth Q statement preferred by the participants of this group focused on the description of a mentor as a role model '*I would like my mentor to let me use my own learning techniques for science teaching in the pre-school class.*' (*Z = 1.49,* row = *4).* However, at this point, both Q statements are expressions that define the characteristic of being a role model involving positive and negative judgments. Hence, it could be asserted that the participants in this group consider that a mentor must have a variety of qualifications both in terms of being a role model for pre-service teachers and the necessity to create a free atmosphere. On the other hand, the third and fifth Q statements most preferred by the participants in the same group are as follows: '*I can provide the teaching materials by myself that I need for teaching science in the pre-school class.*' (*Z* = 1.54, row = 3) and '*I would like my mentor to help me with how to use the materials necessary for teaching science in the pre-school class of my mentor' (*Z = 1.14*,* row = *5*). According to the data, the group participants emphasized the necessity to meet the system requirements of a pre-service teacher as an important feature within the mentoring attributes and practices of a mentor. In this context, although the group participants wanted to provide the application materials themselves, they stated that they needed the help from the mentor in the use of the necessary materials. Consequently, the capability to use teaching materials could also be considered as one of the features in the mentoring attributes and practices of mentors that pre-service teachers prefer. Of the 7 participants in the third Q factor, 6 mentors have 10 or more years of experience, constituting 62.5% of the participants. In such a case, the group participants with experienced mentors were observed to give priority to feedback, modelling, and the system requirements with respect to the mentoring attributes and practices of the mentors. Additionally, it is observed that mentors are expected to be contributing role models who support pre-service teachers to carry out sample drills as well as creating original activities and teaching materials.

Reasons for Different Mentor Preferences

The mean *Z* value given in Table 4 was calculated with the formula '*Z*_ mean = (*Z* value of the positive statement defining the quality of the mentoring attributes and practices - *Z* value of the negative statement defining the identity of the mentor) / the number of Q statement'. The mean *Z* value was used to evaluate the generally preferred mentoring attributes and practices of 32 participants who were divided into five different Q factors in the participant group. According to the mean Z values calculated in Table 4, the participants determined their preferences on the mentoring attributes and practices of the mentors in general, based on the variables, namely: 'Personal Attributes' (*Z*_ mean = 0.52), 'System Requirements' (*Z*_ mean = 0.15), 'Pedagogical Knowledge' (*Z*_ mean = 0.07), 'Modelling' (Z_ mean = -0.20), and 'Feedback' (*Z*_mean = -0.36), respectively. Qualitative data were collected in the continuation of the Q set to determine the underlying reasons for these pre-service teachers' mentor preferences. Findings regarding the content analysis of the qualitative data collected for this purpose are given in Table 6 and Table 7.

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Table 6
The Reasons of Why the Pre-service Teachers Placed the Q Statements in +4

Themes / Q Categories	Self-Efficacy	Motivation	Autonomous	Guiding	Experience	Readiness	Total Codes
Personal Attributes	1	1	7	1	0	0	10
Pedagogical Knowledge	0	1	13	0	4	3	21
System Requirements	2	0	0	0	0	0	2
Feedback	5	1	5	2	0	0	13
Modelling	9	4	18	8	2	3	44*
Total Codes	17	7	43*	11	6	6	80

Note: *The most codes seen.

The Table 6 shows that the participants mostly prefer the Q statements from the categories of modelling ($N = 44$) and they prefer the Q statements the least about System Requirements ($N = 2$). When the reasons why the pre-service teachers chose the Q statements for +4 were observed, it was clear that they wanted to be Autonomous ($N = 43$) in most studies while the least observed was the experience of the Mentor ($N = 6$) and the preparedness of the pre-service teachers ($N = 6$). Some of the sample statements of pre-service teachers about their desire to choose +4 are given below.

> *'The involvement of the teacher while I carry out an activity in class prevents my classroom management. It makes it difficult for me to ensure classroom management in later activities. It won't let me find my own method. I would like to find my own classroom management model by trying and I cannot be comfortable if the teacher is involved.'(PT18)*
> *'Science teaching requires creativity. The mentor should not set limits. Because free ideas come out in a free environment.' (PT30)*
> *'I placed the 25th statement. I would like to exchange information with the teacher mutually in order to benefit from the mentor's experience' (PT32).*

Table 7
The Reasons of Why the Pre-service Teachers Placed the Q Statements in -4

Themes / Q Categories	Self-Efficacy	Motivation	Autonomous	Guiding	Experience	Readiness	Total Codes
Personal Attributes	2	3	2	1	1	2	9
Pedagogical Knowledge	6	0	14	11	6	3	40*
System Requirements	0	0	2	1	1	0	4
Feedback	3	8	13	5	0	0	29
Modelling	1	0	3	0	0	0	4
Total Codes	12	11	34*	18	8	5	80

Note: * The most codes seen.

The reasons why the pre-service teachers placed the Q statements in -4 were examined and the findings are shown in the Table 7. Considering the mentoring attributes and practices of the mentor in Table 7, the majority of pre-service teachers chose the Q statements about Pedagogical Knowledge ($N = 40$), while the least selected items were system requirements ($N = 4$) and modelling ($N = 4$). Likewise, when these reasons are examined, the pre-service teachers seem to give priority to the sense of Autonomy ($N = 34$), while they mention preparedness ($N = 5$) the least. Some of the sample statements of pre-service teachers about their wish to choose -4 are given below:

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'If the teacher evaluates and gives me feedback on the science activity that I am doing during the practice, it will reduce my motivation. My desire to teach the lesson and my attention level decreases. I can't feel comfortable enough. I can't manage the class. This reduces my efficiency and contribution to the lesson.' (PT33).
'The teacher's experience does not affect me negatively since I will gain experience.' (PT29).
'Because intervention from the outside distracts me when I practice, and it gets me down. I cannot carry out an efficient activity.' (PT28).

According to the average z values in Table 5 and the emerging themes in Tables 6 and 7, it can be said that prospective teachers primarily emphasize that modelling and pedagogical knowledge development are two essential mentoring preferences in science teaching. The main reason for this situation can be thought that the prospective teachers are willing to practice autonomously and work originally.

Discussion

The aim of the current study was to explain the effective mentoring attributes and practices of the mentors which were preferred by pre-service pre-school teachers within the context of science teaching in pre-school classroom. The mentor helps the pre-service teacher to socialize, develop emotionally and psychologically, acquire the teaching ethics, develop classroom management skills, and increase their pedagogical knowledge in science teaching (Abed & Abd-El-Khalick, 2015; Hudson; 2005; Wang et al., 2008). Salisu and Ransom's study (2014) found that the most important expectation of pre-service teachers from mentors is role modelling. In this study, it was observed that mentors who were *role models* and who *gave feedback* during pre-school science teaching were not preferred by pre-school teachers during science teaching. The main reasons for such outcomes were determined as a result of qualitative data revealing that pre-service teachers considered themselves competent in science teaching and wanted to be autonomous during the practice.

In order for the pre-service teachers to have positive perspectives towards science teaching and feel comfortable while teaching science in a kindergarten, they need mentors who will support, encourage and influence them at the point of science teaching (Hudson, 2005; Kennedy & Dorman, 2002). Moreover, Abed and Abd-El-Khalick (2015) stated that "Mentoring is not a disposition: mentors need specific training and professional development, which will enable them to articulate for themselves and their mentees the attributes of effective science teaching…" (p.721). In addition, Hudson (2007) stated that the mentor should use constructive language while speaking with pre-service teachers, emphasizing the necessity of sufficient personal development in mentors. In this study, the preference for mentors, who will primarily support personal development, is similar to previously conducted studies. As a result of qualitative data based on the statements made by pre-service teachers, it was determined that the reasons for such preferences were that pre-service teachers did not feel autonomous during the practice and that mentors did not use constructive language.

Moreover, in the study, while the pre-service teachers preferred to be original and autonomous during the practice, they stated that the mentors should be in the background in the science teaching process by preferring 'I would prefer to ensure classroom management myself during science teaching in the pre-school class of my mentor.' In the study by Gold (1996), the author emphasized that pre-service teachers should be given information about teaching, talking about teaching methods, and supported in terms of increasing skills, psychological development, as well as developing self-control, increasing self-confidence, and teaching efficiently. In this study, similar results were obtained with such expressions as 'I know how to use properly the necessary science concepts that I need to teach in the pre-school class of my mentor', and 'I would like to improve myself with activities in classroom management while teaching science in the pre-school class of my mentor.' In a study conducted by Izadinia (2016), similar results were acquired, and it was stated that pre-service teachers wanted to develop both psychologically and academically. This view was also supported by other researchers in different studies (Beck & Kosnik, 2002; Caires & Almeida, 2007; Ferrier-Kerr, 2009).

In addition, when qualitative data are analyzed, the fact that pre-service teachers want to be free during the practice process is similar to other studies on this subject (Beck & Kosnik 2002; Patrick, 2013; Izadinia, 2016). In their study, Beck and Kosnick (2002) stated that pre-service teachers should be provided with a free teaching environment during the practice. Likewise, Izadinia (2016) stated that although pre-service teachers stated that they needed constructive and necessary support from their mentors, they also demanded a free environment in which they could apply what they learned as well as their learning styles.

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Suggested by Maynard and Furlong (1993) long ago, the five primary steps, namely, early idealism, personal survival, dealing with difficulties, hitting the plateau, and moving on can be shown as stages that develop throughout the teaching programs of pre-service teachers. Here, in the process of early idealism, it could be assumed that pre-service teachers desire to put into practice the trainings they have received and experience they have gained in their education life in the first application. For this reason, they are likely to wish to be autonomous in the science teaching process.

The sense of trust that develops between the mentor and the pre-service teacher on feedback is important for the development of science teaching skills (Bradbury & Koballa, 2008). While the researchers stated that pre-service teachers who could not get the positive feedback of the mentor could not establish positive relations with their mentors, in which case, the pre-service teacher would find it difficult to perform the expected application (Beck & Kosnik, 2002; Smith, 2005; Smith & Lev-Ari, 2005). In a study by Caires and Almeida (2007), the authors stated that the feedback that is not well understood will not be beneficial both for pre-service teachers and mentors. In this study, it has been revealed that pre-service teachers should be given feedback on completing the application during the science teaching process. When the reasons for choosing this way of receiving feedback are examined, it is thought that there may be anxiety about losing motivations during science teaching.

In this study, it was determined that male pre-service teachers, in particular, primarily preferred the mentor's mentoring attributes and practices as *modelling, feedback*, and *pedagogical knowledge*. However, it was also observed that male pre-service teachers expected the mentors with such mentoring attributes and practices to help them carry out their own unique practices autonomously. Researchers stated that male and female prospective teachers could be provided different mentoring attributes and practices due to their mentor teachers' gender (Fowler et al., 2007; Levesque et al., 2005). Levesque et al. (2005) stated that female prospective teachers had more mentoring functions on the personal and emotional development of mentor teachers on related subject. Further, Allen and Eby (2004) stated that in male dominated cultures, female mentor teachers believe that they cannot give more support to their mentees about career development. In this case, expectations of prospective teachers could differ from their mentor teachers due to their gender. Izadinia (2016) stated that pre-service teachers were observed to expect their mentors to support them with respect to collaborating and being comfortable while working. However, the findings about gender in the current study were not generalizable because of the number of male pre-service early childhood teachers in the major.

Conclusions

To sum up, when the results obtained in this study were examined, it was determined that while different mentoring attributes and practices of the mentors during the teaching practicum process were preferred by pre-service teacher for different reasons (such as gender, years of teaching experiences, being an autonomous). In the examinations made, especially in a specific subject such as science education, pre-service teachers stated that they preferred to be role models more, but they did not prefer the feedback given during the implementation process. However, while the experience of the teachers did not reveal any meaningful results in the mentoring process, it was also found that the pre-service teachers preferred to be autonomous in the implementation process. In addition, it was concluded that male and female students had different expectation from their mentor teachers (i.e., male pre-service teachers preferred *modelling, feedback*, and *pedagogical knowledge*). All in all, in this study, it is shown that mentoring preferences and attributes of mentor teachers could affect not only mentor teachers but also pre-service early childhood teachers' expectations and qualifications in such a theme, science education.

Limitations

One of the main limitations of the current study is number of participants. Although the Q methodology meets the assumptions of number of participants in the current study, the number of participants affects the generalizability of the findings of the study. Moreover, in this study, mentor teachers focused on their mentoring related with science teaching in the practice process. However, pre-service teachers may have different expectations for other themes (mathematics, language art, and music) in pre-school education. Therefore, the fact that the study is limited to only science teaching is another limitation. In addition, the fact that the distribution of male and female students in the number of participants is not homogeneous can be said as another limitation.

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Implications

Based on the results obtained in the study, it is recommended to form the practice groups by considering teacher's mentoring attributes and practices and student expectations in the process of determining mentors in pre-school teacher science teaching. In addition, mentors should give pre-service teachers more time and opportunity to apply their original teaching models during the practice. The pre-service teachers should share their expectations with mentors in the process of science teaching and establish their practices in a way that supports their personal development. Moreover, further researchers may work on the mentoring attributes and practices for different subjects such as teaching mathematics, languages, and arts. Working with subject based mentoring practices may help the educators of teachers while creating their practicum lesson.

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