An Analysis on the Cognitive Structure and Opinions of Pre-Service Science Teachers on the Concept of Micro Teaching

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Abstract
In this study, it is aimed to examine the cognitive structures of pre-service science teachers regarding the concept of "micro teaching". The study was carried out with 25 teacher candidates studying in the 4th grade of science teaching at Alanya Alaaddin Keykubat University Faculty of Education in a 4-week period within the scope of the teacher practice course in the fall semester of the 2021-2022 academic year. In the study, since it was aimed to reveal the cognitive structures of pre-service science teachers regarding the concept of "micro teaching", screening method was used. In the collection of the study data, "independent word association test, drawing-writing and concept map" were used. Content analysis was performed in the analysis of the data obtained from the study. When the findings obtained as a result of the study were examined, the categories obtained from three different measurement tools had features that support and explain each other. "Part of micro teaching, teaching practice, self-assessment and tools used in micro teaching" obtained from all three measurement tools emerged as common and dominant categories. The most commonly used answer words by pre-service teachers for the category of "part of micro teaching" were determined as "pre-service teacher, planning, presentation, group work, lesson, student, teaching, information, education, registration, teaching, self-evaluation, class, re-teach and re-plan". The most commonly used answer words for the category of "teaching practice" by pre-service teachers were determined as "skill, development, experience, technique, experimentation, performance, ability, observation, reducing anxiety and practice". The most commonly used answer words by pre-service teachers for the category of "self-evaluation" were determined as "evaluation, review, feedback, monitoring and feedback". The most common answer words used by teacher candidates for the category of "tools used in micro teaching" were determined as "video, camera and tape". When the drawings made by the pre-service teachers for approximately micro teaching are examined according to the levels, the drawings of 50% of them are partial drawings and conceptual representative drawings. They explained the concept of micro teaching in ways related to scientific facts. This situation can be evaluated as the cognitive structures of pre-service science teachers related to the concept of micro teaching are sufficient.
Keywords: Cognitive Structure, Micro-Teaching, Independent Word Association Test, Draw-Write Technique, Concept Mapping.

Introduction

Today, in the fields of informatics, technology, health and other fields, society needs to train qualified people in order for countries to develop and catch up with the era. The need of societies for qualified labor force can be realized with qualified educational institutions. These educational institutions are pre-service teachers trained by the faculties of education in universities. The contribution of the pre-service teacher who is trained at the desired level to future generations and countries will not be denied. The factors in teacher

training, which are the cornerstone of education, are of great importance for future generations, that is, for students. Each element of the training is knotted and evaluated by the teacher. Achieving the desired gains in the desired direction in the students raised in schools is directly proportional to the presence of well-trained teachers. The teacher is the planner, implementer and evaluator of the process of training. Determining the objectives in the environment in question, creating the desired actions, planning the environment in which they will take place and being trained at a level to evaluate these achievements are related to the quality and skills of pre-service education (Polat & Bahar, 2009) It is possible for the pre-service teachers trained in educational institutions to put theoretical knowledge into practice. No knowledge or acquisition that will not be put into practice will be sufficient in teacher training.

Scientists have cared about how students shape this information in their minds along with the information they have. For this, they wondered in their minds how concepts were learned and how they were formed. In recent years, studies in which the mental structures of students are revealed have gained importance. In the studies carried out, different techniques were used to reveal the cognitive structures of the students. Some of these are independent word association test, drawing-writing technique, concept maps, structured grid, Vee diagrams and diagnostic branched tree (Kaya & Taşdere, 2016).

Word association tests (WAT) are an alternative measurement technique that enables students to determine their mental structure and whether the connections established between the concepts in their memories are meaningful (Özatlı & Bahar, 2010). Another effective technique used in revealing cognitive structures is the drawing-writing technique. This technique allows uncovered thoughts, perceptions, and understandings to be revealed in students without being limited to words (White & Gunstone, 2000). One of the techniques used to determine the cognitive networks in the mental structures of the students is concept maps. The concept map technique is based on meaningful learning theory. Fraser (1994) defined meaningful learning as a mental process that links students' newly learned information with information that was previously present in their minds. The concept map was defined by Nakiboğlu and Ertem (2010) as the visual reflection of the schemas in the cognitive structures of the students towards the concepts.

Research Problem

The problem sentence of this research can be expressed as; What are the cognitive structures of pre-service science teachers for the concept of micro teaching? In the research, within the framework of the basic problem, the following sub-problems are sought to be answered. These sub-problems are as follows:

- What are the cognitive structures of pre-service science teachers determined by the "independent word association test"?
- What are the cognitive structures of pre-service science teachers determined by the "drawing-writing" technique?
- What are the cognitive structures of pre-service science teachers determined by "concept maps"?

Literature

Micro teaching was first developed in the 1960s by a group of educators such as Dwight Allen, David Young, Robert Bush, Frederic McDonald, in order to improve the quality of teacher education at Stanford University in the USA. Micro teaching is one of the efforts of the candidates to transfer the knowledge and skills they have acquired to practice, that is, to build a bridge between theory and practice (Bilici & Yamak, 2014). In micro teaching, pre-service experience is obtained by offering candidates a more controlled teaching environment than the normal class. Lessons recorded with the camera are stored in portable memories. At the end of the course, the candidate watches and hears as the third eye. At the same time, he collects criticism and suggestions from the tutor and other viewers. Then, comparing the teaching skill in that lesson with the first one, preparing for progress in 15 to 20 minutes, s/he re-teaches the same lesson to another small group in the same amount of time. Based on the repetition of the selected behavior until it reaches the desired level in micro teaching, the number of repetitions of the micro course depends on the tutor (Bilici & Yamak, 2014).

It is necessary to reveal the information, thoughts, opinions and understandings in the cognitive structures of the students (Kurt & Ekici, 2013). Before defining the cognitive structure, it is necessary to explain the concept of cognition. According to another definition, it is the cognitive activities that enable an individual to understand and interpret themselves and their environment (Beydoğan & Hayran, 2016). Gilbert and Watts (1983) defined cognitive structure as a structure based on the interconnections of concepts stored in our memory. Davidson (1977) stresses out that cognitive structure is the interrelated categories that an individual uses to distinguish between the stimuli that come to them. A number of techniques are used to reveal cognitive structures. Flow maps, word association test, concept maps, structured grid and Vee diagram are some of them (Kaya & Taşdere, 2016).

The word association test, discovered by Galton (1879), is a technique that reveals the cognitive structures of individuals and the relationships between the concepts found in these structures. The word association test is an effective technique used to examine the level of concepts and relationships between concepts in the minds of students (Johnstone & Moynihan, 1985; Bahar & Özatlı, 2003). In this technique, students write down the concepts that pass through their minds for a stimulating concept as answer words for 30 to 60 seconds. The reason for giving time to students is to minimize the risk of chain responses (Bahar & Özatlı 2003).

The drawing-writing technique is a very useful technique for obtaining real and reliable results about unrevealed understandings and perceptions of concepts (Backett-Milburn & Mckie, 1999; White & Gunstone, 2000). The drawing-writing technique reveals different and qualified findings that are difficult to determine with detailed examination of the mental structures of students and other techniques (White & Gunstone, 2000). The drawing-writing technique also provides students who have difficulty expressing themselves with the opportunity to express themselves.

Concept maps were first developed by Novak and Gowin (1984) as part of a project. One of the techniques used to determine the cognitive networks in the mental structures of the students is concept maps. Concept map is defined as the visual reflection of the schemas in the cognitive structures of the students for the concepts (Nakiboğlu & Ertem, 2010).

Research Method

The research is a descriptive study in the screening model. In screening models, the individual or object subject to research is tried to be defined within its own conditions and as it is (Karasar, 2006; Gay et al., 2006). No intervention was made to the students in this research. First of all, it is aimed to reveal the network structure, that is, the cognitive structure, in the minds of the students regarding the concept of micro teaching, and then to describe the situation.

Research Sample

In this study, appropriate sample was used. Researchers may prefer individuals who are easily accessible for their studies (Yıldırım & Şimşek, 2011). This study was carried out in the fall semester of the 2021-2022 academic year with a total of 25 students who took the "Teaching practice" course in the 4th grade of the Science Teaching Department of Alanya Alaaddin Keykubat University.

Research Process

This study was carried out over a four-week period during the theoretical course hours of the teaching practice course. In order to reveal what the cognitive structures of pre-service science teachers are regarding the concept of "micro teaching", it is important that they know what micro teaching is. In the teaching practice course, the researcher gave information about "word association test (WAT), drawing-writing technique and concept maps", which are the techniques used to reveal the cognitive structure of the pre-service teachers in the first week. In the second and third weeks, pre-service teachers made micro teaching practice for 20 minutes related to the subjects they have chosen in their fields in the teaching practice course. In the last week's teaching practice course, pre-service teachers were given "WAT, drawing-writing and concept map" forms prepared for the concept of "micro teaching" and asked to fill them out.

Data Collection Tool

In this study, in order to reveal the cognitive structures of spre-service science teachers in detail about the concept of "micro teaching", the relevant literature was examined by the researcher and three separate data collection tools were prepared as "independent word association test, drawing-writing and concept map".

Independent Word Association Test

In this study, pre-service science teachers were asked the concept of "micro teaching" to complete the independent word association test. The word association test consists of 2 parts. In the first part, pre-service science teachers were asked to write the first ten words that came to their minds within 40 seconds when they read or heard the concept of "micro teaching", and in the second part, the pre-service teachers were asked to write sentences about the key concept within 20 seconds. Some WAT samples (S2, S3) collected from pre-service science teachers with independent word association test are given in Figure 1.

S21

S14
Figure 1 "WAT" Examples of Teacher Candidates

Drawing-Writing

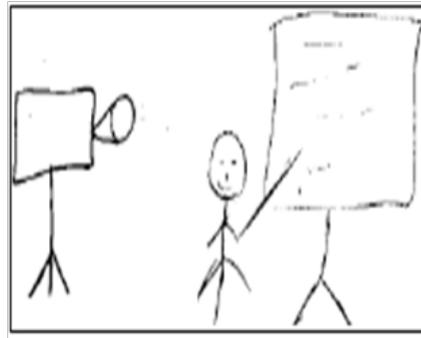In this study, pre-service science teachers were asked the question "Draw a shape describing Micro teaching in 5 minutes?" Pre-service teachers were told that they could make their drawings as they wished. Some sample drawings of pre-service science teachers collected by drawing-writing technique (S20, S24) are given in Figure 2.
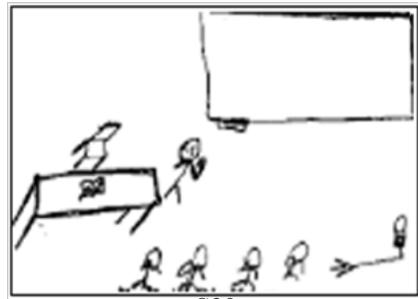
S20

S24
Figure 2 Drawing-Writing Examples of Teacher Candidates

Concept Map

Pre-service science teachers were asked to create a concept map using the concept of "micro teaching". Teacher candidates were not limited to certain concepts related to the subject and freely created their concept maps with the concepts they determined. Some examples of concept maps of pre-service science teachers collected by concept maps technique (S4, S30) are given in Figure 3.6.
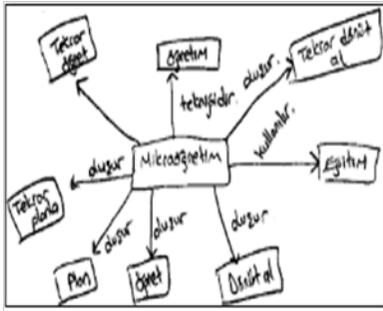
S4
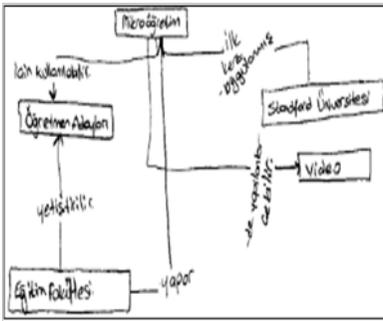
S30
Figure 3 Concept Map Examples of Teacher Candidates

Data Analysis

The data collected from the teacher candidates were numbered from 1 to 25 and a code was created for the pre-service teachers. For example, the pre-service teacher 1 is expressed as S1. In the analysis of the data obtained from the three measurement tools used in this study, the stages of content analysis were followed and a framework for data analysis was created based on the conceptual framework of the research. Content analysis is to bring together similar data within the framework of certain concepts and themes and to interpret them by arranging them in a format that the reader can understand (Yıldırım & Şimşek, 2011). The answer obtained from independent word association test, drawing-writing and concept maps was analyzed as the number of words under the most frequently repeated words in words and by using semantic relationship technique in sentences (Atasoy, 2004; Kostova & Radoynovska, 2010). As a result of the content analysis, the frequency values of the categories and the answer words in the categories were written and made into tables. In order to compare whether the categories in which the codes reached in the study were similar, the codes and the categories determined by two separate researchers were examined. After the research data were coded separately by two separate teachers, the resulting code and category list was finalized. The reliability of the data analysis performed in this way was calculated using the formula [Consensus / (Consensus + Disagreement) x 100] developed by Miles and Huberman (1994) and the average reliability was found to be 95%.

Results

The findings obtained with independent word association test, drawing-writing and concept maps are shown in the form of frequency tables.

Findings for the Independent Word Association Test

As a result of the analysis of the data obtained from the cognitive structures of the teacher candidates related to the concept of micro teaching, a total of 4 categories were created from the specified words. These are listed as "part of micro teaching, teaching practice, self-assessment and tools used in micro teaching". These categories and the words mentioned in each category are listed. If these words were repeated 1 time, they were not combined with other words and were not included in the categories (Kostova & Radoynovska, 2010; Kurt, 2013). These words are omitted from Table 1 for the nature of the research, but are indicated in the relevant comments section at the end of each category evaluated.

Table 1 Distribution of Cognitive Structures for Independent Word Association Test by Category

Categories	Answers Given	Frequency
Part of micro teaching	"pre-service teacher" (14)	63
	"planning" (10)	
	"presentation" (10)	
	"group work" (4)	
	"lesson" (3)	
	"student" (3)	
	"teaching" (3)	

Part of micro teaching	"information" (2)	63
	"education" (2)	
	"recording" (2)	
	"teaching" (2)	
	"self-assessment" (2)	
	"class" (2)	
	"re-teach" (2)	
	"re-plan" (2)	
Teaching practice	"skill" (6)	35
	"development" (6)	
	"experience" (4)	
	"technics" (4)	
	"trial" (3)	
	"performance" (3)	
	"ability" (3)	
	"observation" (3)	
	"reducing anxiety" (2)	
	"application" (2)	
Self-assessment	"assessment" (9)	26
	"review" (5)	
	"feedback" (5)	
	"revision" (3)	
	"monitoring" (4)	
Tools used in micro teaching	"video" (13)	24
	"camera" (9)	
	"tape" (2)	
Total	**(33)**	**148**

When Table 1 is examined, as a result of the analysis of the data obtained about the cognitive structures of the pre-service teachers related to the concept of micro teaching, the related responses of the pre-service science teachers to the concept of micro teaching in the first category were most intensely collected in the category of "part of micro teaching" and emerged as the dominant category (f=63). In the micro teaching part category, the answers given by the pre-service teachers to the concept of micro teaching are mostly *"pre-service teacher* (f=14)", *"planning* (f=10)", *"presentation* (f=10)", *"group work* (f=4)", *"lesson* (f=3)", *"student* (f=3)", *"teaching* (f=3)", *"information* (f=2)", *"education* (f=2)", *"registration* (f=2)", *"teach* (f=2)", *"self-*

assessment (f=2)", *"class* (f=2)", *"re-teach* (f=2)", *and "re-plan* (f=2)"*. Some words written by pre-service teachers but not included in this category because they were repeated 1 time are *"narrative* (f=1)", *"certain criteria* (f=1)", *"live* (f=1)", *"work* (f=1)", *"solution* (f=1)", *"behavior* (f=1)", *"criticism* (f=1)", *"noticing* (f=1)", *"photography* (f=1)", *"safe* (f=1)", *"target* (f=1)", *"pre-service* (f=1)", *"principles* (f=1)", *"investigation* (f=1)", *"human perception* (f=1)", *"permanent trait* (f=1)", *"comprehension* (f=1)", *"self-discovery* (f=1)", *"short-term* (f=1)* , *"chemistry* (f=1)", *"controlled instruction* (f=1)", *"laboratory* (f=1)", *"laboratory teaching* (f=1)", *"vocational training* (f=1)", *"quality increase* (f=1)", *"learning* (f=1)", *"slide* (f=1)", *"drawing conclusions* (f=1)", *"board* (f=1)", *"recognition* (f=1)", *"telephone* (f=1)", *"reflection* (f=1)* , *"useful* (f=1)", *"interpretation* (f=1)", *and "face-to-face* (f=1)"*.

In the second category, the related responses of pre-service science teachers to the concept of micro teaching were mostly collected in the category of "teaching practice" (f=35). In the teaching practice category, the answers given by the pre-service teachers to the concept of micro teaching were mostly *"skill* (f=6)", *"development* (f=6)", *"experience* (f=4)", *"technique* (f=4)", *"trial* (f=3)", *"performance* (f=3)", *"ability* (f=3)", *"observation* (f=3)", *"reducing anxiety* (f=2)* and *"practice* (f=2)" have been the words. Some words written by pre-service teachers but not included in this category because they were repeated 1 time are "narrative (f=1)", *"certain criteria* (f=1)", *"live* (f=1)", *"work* (f=1)", *"solution* (f=1)", "behavior (f=1)", *"criticism* (f=1)", *"noticing* (f=1)", *"photography* (f=1)", *"safe* (f=1)", *"target* (f=1)", *"pre-service* (f=1)", *"principles* (f=1)", *"investigation* (f=1)", *"human perception* (f=1)", *"permanent trait* (f=1)", "comprehension (f=1)", *"self-discovery* (f=1)", *"short-term* (f=1)* , "chemistry (f=1)", *"controlled instruction* (f=1)", *"laboratory* (f=1)", "laboratory teaching* (f=1)", *"vocational training* (f=1)", "quality increase (f=1)", "learning (f=1)", *"slide* (f=1)", "drawing conclusions (f=1)", "board (f=1)", *"recognition* (f=1*)", "telephone* (f=1)", *"reflection* (f=1)", "useful* (f=1)", *"interpretation* (f=1)", and "face-to-face (f=1)".

In the third category, the related responses of pre-service science teachers to the concept of micro teaching were mostly collected in the "self-evaluation" category (f=26). In the self-evaluation category, the answers given by the pre-service teachers to the concept of micro teaching were mostly *"evaluation* (f=9)", *"review* (f=5)", *"feedback* (f=5)", *"revision* (f=3)" and *"monitoring* (f=4)". Some words written by pre-service teachers but not included in this category because they were repeated 1 time are *"narrative* (f=1)", *"certain criteria* (f=1)", *"live* (f=1)", *"work* (f=1)", *"solution* (f=1)", *"behavior* (f=1)", *"criticism* (f=1)", *"noticing* (f=1)", *"photography* (f=1)", *"safe* (f=1)", *"target* (f=1)", *"pre-service* (f=1)", *" principles* (f=1)", *"investigation* (f=1)", *"human perception* (f=1)", *"permanent trait* (f=1)", *"comprehension* (f=1)", *"self-discovery* (f=1)", *"short-term* (f=1)", *"chemistry* (f=1)", *"controlled instruction* (f=1)", *"laboratory* (f=1)", *"laboratory teaching* (f=1)", *"vocational training* (f=1)", *"quality increase* (f=1)", *"learning* (f=1)", *"slide* (f=1)", *"drawing conclusions* (f=1)", *"board* (f=1)", *"recognition* (f=1)", *"telephone* (f=1)", *"reflection* (f=1)", *"useful* (f=1)", *"interpretation* (f=1)", and *"face-to-face* (f=1)" .

In the fourth category, the words that pre-service science teachers responded to the concept of micro teaching were collected in the category of "tools used in micro teaching" (f=24). In the category of tools used in micro teaching, the answers given by the pre-service teachers to the concept of micro teaching were mostly the words *"video* (f=13)", *"camera* (f=9)" and *"tape* (f=2)". Some words written by pre-service teachers but not included in this category because they were repeated 1 time are *"narrative* (f=1)", *"certain criteria* (f=1)", *"live* (f=1)", *"work* (f=1)", *"solution* (f=1)", *"behavior* (f=1)", *"criticism* (f=1)", *"noticing* (f=1)", *"photography* (f=1)", *"safe* (f=1)", *"target* (f=1)", *"pre-service* (f=1)", *" principles* (f=1) "*, "investigation* (f=1)", *"human perception* (f=1)", *"permanent trait* (f=1)", *"comprehension* (f=1)", *"self-discovery* (f=1)", *"short-term* (f=1)", *"chemistry* (f=1)", *"controlled*

instruction (f=1)", *"laboratory* (f=1)", *"laboratory teaching* (f=1)", *"vocational training* (f=1)", *"quality increase* (f=1)", *"learning* (f=1)", *"slide* (f=1)", *"drawing conclusions* (f=1)", *"board* (f=1)", *"recognition* (f=1)", *"telephone* (f=1)", *"reflection* (f=1)* , *"useful* (f=1)", *"interpretation* (f=1)", and *"face-to-face* (f=1)* .

Some examples of the explanations of pre-service science teachers about the concept of micro teaching are given under the determined categories and sentence analyzes are presented in Table 2.
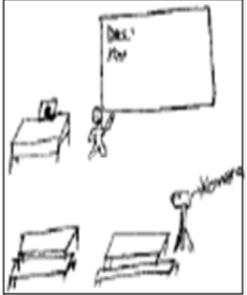
Table 2 Categories Obtained by Sentence Analyses of the Concept of Micro-Teaching

Categories	Explanations about categories
Micro teaching application	*"It is a method used to improve knowledge, skills, abilities and reduce anxiety by taking videos of pre-service teachers' lectures with a camera."* (S1, S2, S3, S4, S5, S6, S7, S8, S9)
Teaching practice	*"Micro teaching gives pre-service teachers the opportunity to experience to overcome their deficiencies.",* *"Professional experience develops the skills of practice, reflection and criticism."* (S10, S11, S12, S13, S14, S15, S16, S17)
Self-assessment	*"It is the recording and evaluation of the pre-planned presentation with the camera." "It allows pre-service teachers to re-monitor themselves later and do their own self-assessment."* (S18, S19, S20, S21)

Findings for Drawing-Writing Technique

The data obtained by using the drawing-writing technique of the conceptual structures of pre-service science teachers related to the concept of micro teaching were collected under 3 categories in total. These are determined respectively from drawing data as part of micro teaching (25), tools used in micro teaching (25), self-evaluation (4), and from writing data as tools used in micro teaching (8), part of micro teaching (1), self-assessment (1) (Table 3).

Table 3 Distribution of Cognitive Structures for Drawing-Writing Technique by Category

Main categories	Subcategories	Drawing (f)	Writing (f)	Drawing example
Part of micro teaching	pre-service teacher	15	0	
	Students	4	0	
	class	3	0	
	teaching	2	0	
	plan	1	1	
	Total	25	1	**S23**
Tools used in micro teaching	board	13	1	
	camera	10	5	
	desk	2	2	
	Total	25	8	**S5**
Self-assessment	mirror	1	1	
	the teacher who monitors himself/ herself from the recording	1	0	
	feedback	2	0	
	Total	*4*	*1*	**S22**
Total		*54*	*10*	

When Table 3 is examined, pre-service science teachers make intensely shaped explanations in the category of "part of micro teaching" in the drawing-writing technique. In addition, the analyses of the drawings of pre-service science teachers about the concept of micro teaching are presented in Table 4 under the relevant levels. In determining these levels, the data are grouped by dividing from level 1 to level 5 (Kurt & Ekici, 2013).
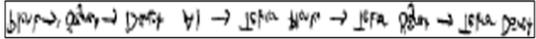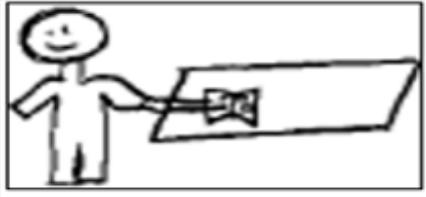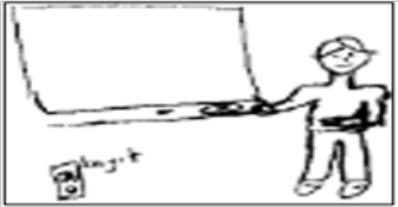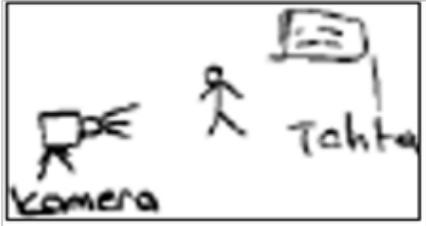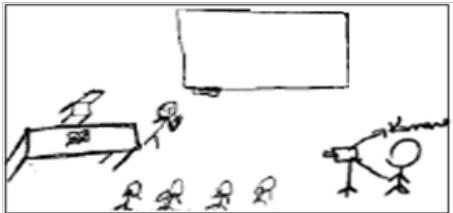
When Table 4 is examined, a total of 4 (S4, S7, S13, S14) pre-service teachers in Level 1 did not make any drawings on micro teaching. A total of 3 (S6, S9, S23) pre-service teachers made non-representative drawings in Level 2, a total of 5 (S1, S3, S8, S15, S21) pre-service teachers made drawings containing alternative concepts in Level 3, a total of 6 (S2, S10, S11, S12, S17, S19) pre-service teachers

made partial drawings in Level 4, and a total of 5 (S5, S16, S18, S20, S22, S24) pre-service teachers made conceptual representative drawings in Level 5. The drawings of approximately 50% of the pre-service teachers are partial drawings and conceptual representative drawings. They explained the concept of micro teaching in ways related to scientific facts.
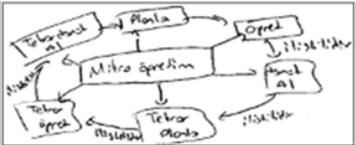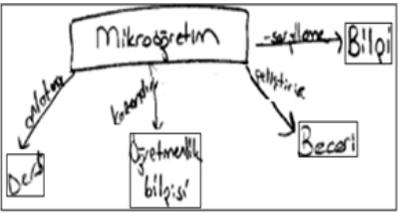
Findings for Concept Maps

The data obtained by using the concept map technique of the conceptual structures of pre-service science teachers related to the concept of micro teaching were collected under a total of 4 categories. These are part of micro teaching (41), self-assessment (29), teaching practice (20), tools used in micro teaching (13) (Table 5).

Table 4 Analysis of Drawing Findings of the Concept of Micro-Teaching According to Cognitive Levels

Levels	Drawing examples
S1-Non-drawings (f=4)	 **S4**
S2-Non-representative drawings (f=3)	 **S9**
S3-Drawings containing alternative concepts (f=5)	 **S23**
S4-Partial drawings (f=6)	 **S17** **S12**
S5-Conceptual representative drawings (f=6)	 **S20**

Table 5 Distribution of Cognitive Structures Obtained with Concept Maps According to Categories

Main categories	Subcategories	f	Excerpts from student concept maps
Part of micro teaching	planning	7	 **S6** **S3**
	"re-plan" (2)	7	
	teaching	6	
	re-teach	6	
	student	2	
	pre-service teachers	4	
	lesson	1	
	education	1	
	faculty of education	1	
	group assessment	1	
	recording	1	
	university	1	
	Total	38	
Self-assessment	feedback	14	 **S13**
	assessment	9	
	review	3	
	self-assessment	3	
	criticism	1	
	noticing the error	1	
	reflection	1	
	Total	32	
Teaching practice	skill	2	 **S22** **S23**
	knowledge	2	
	experience	2	
	self-development	2	
	teacher training	2	
	ability	2	
	live	1	
	observation technique	1	
	pre-service	1	
	reducing anxiety	1	
	short-term	1	
	lecture	1	
	presentation	1	
	application	1	
	Total	20	

Tools used in micro teaching	camera	6	
Tools used in micro teaching	video	6	
	phone	1	
	Total	13	
			S22
Total		**103**	
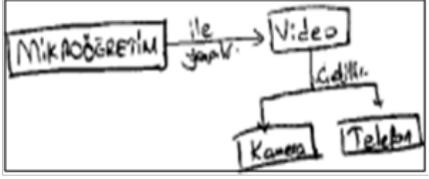
In order to reveal the cognitive structures of pre-service science teachers, in the concept maps examined in Table 5, pre-service teachers intensively linked the concept of micro teaching with the concepts in the category of "part of micro teaching" (f=41). In the micro teaching part category, pre-service teachers mostly associate the concept of micro teaching with the concepts of *"planning* (f=7)", *"re-plan* (f=7)", *"teaching* (f=6)", *"re-teach* (f=6)", *"self-evaluation* (f=3)", *"student* (f=2)", *"pre-service teachers* (f=4)", *"lesson* (f=1)", *"education* (f=1)", *"faculty of education* (f=1)* , *"group evaluation* (f=1)*, *"registration* (f=1)* and *"university* (f=1)* . In the second category, they connected with the concepts in the "self-evaluation" category the most (f=29). In the self-evaluation category, pre-service teachers mostly associate the concept of micro-teaching with the concepts of "*feedback* (f=14)", "*evaluation* (f=9)", "*review* (f=3)", "*criticism* (f=1)", *"recognizing the error* (f=1)" and "*reflection* (f=1)". In the third category, they associated with the concepts in the category of "teaching practice" at most (f=20). In the teaching practice category, pre-service teachers mostly associate the concept of micro teaching with the concepts of *"skill* (f=2)", "*knowledge* (f=2)", "*experience* (f=2)", *self development* (f=2)", "*teacher training* (f=2)", *"ability* (f=1)", "*live* (f=1)", "*observation ability* (f=1)", "*pre-service* (f=1)", "*reducing anxiety* (f=1)", "*short-term* (f=1)", "*lecture* (f=1)", "*presentation* (f=1)" and "practice (f=1)". In the fourth category, they associated with "tools used in micro teaching" (f=13). In the category of tools used in micro teaching, pre-service teachers mostly associate the concept of micro teaching with the concepts of "*camera* (f=6)", *"video* (f =6)" and "*telephone* (f=1)". The cognitive structures of pre-service science teachers related to the concept of micro teaching emerged in connection with a total of 4 categories (Figure 1).
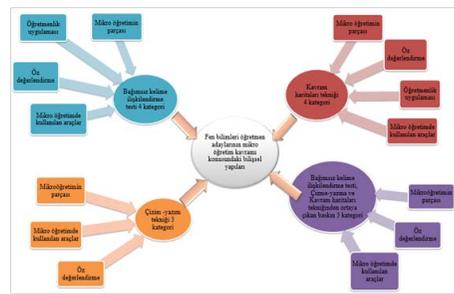
Figure 4 Cognitive Structures of Pre-Service Teachers Related to the Concept of Micro-Teaching

Discussion and Conclusion

In the study, when the WAT, drawing-writing and concept map findings of pre-service science teachers were examined, pre-service teachers were concentrated in the categories of "part of micro teaching, teaching practice, self-evaluation and tools used in micro teaching" respectively. The most answered words given by the pre-service teachers for the "part of micro teaching" category, which is the most concentrated, were determined as "teacher candidate, planning, presentation, group work, lesson, student, teaching, information, education, registration, teach, classroom, re-teach and re-plan". In the study, there were researches reflecting the answers reached in words. In Kılıç (2016)'s study on micro teaching, pre-service teachers know themselves with the micro teaching practice, see the difference between theory and practice, and have the opinions that they contribute to the candidate in classroom management. In the study of Aslan and Elmas (2019), pre-service teachers thought that micro teaching practice contributed a lot to them in the themes of lesson planning, time management and classroom management. In the study of Gürses, pre-service teachers gave answers such as benefiting from instructional technologies, exhibiting the roles

and behaviors required by the profession, making lesson, unit and daily plans related to micro teaching. In the study of Şahinkayası (2009), micro teaching activities improve the teaching skills of pre-service teachers in lesson planning and real classroom environment.

The answers given by the pre-service teachers for the second category of "teaching practice" were determined as "skill, development, experience, technique, experimentation, performance, ability, observation, reducing anxiety and practice". There is a great deal of research that reflects the answer words reached in the teaching practice category. In the study of Çakır (2010), pre-service teachers reported that micro teaching improves their teaching skills, gives experience, develops their creativity, and makes them realize the value and importance of the profession. In the study of Atav et al. (2014), the majority of pre-service teachers have positive views about micro teaching. The video recordings at the beginning of micro teaching caused excitement and stress in the pre-service teachers, but this negative effect decreased during the lecture. In line with the criticisms made after watching the video recordings about micro teaching, the pre-service teachers stated that they took care not to exhibit the errors and deficiencies of the first presentation in the second presentation and that they were more careful so that when they were given the chance to compensate for their mistakes, micro teaching helped them to exhibit qualified teacher behaviors. In the study of Erökten and Durkan (2009), micro teaching method is an effective method in teacher training. In his study of Çoban (2015), the use of micro teaching technique in teacher education gives self-confidence to pre-service teachers to be able to apply the profession and has a significant effect on transferring theoretical knowledge to practice. In the study of Dere (2019), micro teaching practice is important for teacher candidates to overcome their excitement and anxiety, to gain self-confidence, and to express themselves better by using body language and tone of voice correctly. In the study of Aslan and Elmas (2019), a large part of the pre-service teachers stated that micro teaching practice contributes more to the themes of gaining experience, understanding how to eliminate deficiencies by seeing them, developing

critical skills, making self-assessment, establishing self-confidence and creating awareness.

The most common response of the pre-service teachers to the third category of "self-evaluation" was determined as "evaluation, review, feedback, monitoring and feedback". There are researches that reflect the answers reached in the study. In the study of Sevim (2013), micro teaching application gives pre-service teachers the opportunity to see their own deficiencies, to evaluate themselves, to encourage them to take responsibility in learning and to evaluate pre-service teachers better than traditional practices. In the study of Dere (2019), the most important advantage of micro teaching allows pre-service teachers to discover their own weaknesses and strengths.

The response of the pre-service teachers to the fourth and final category, "tools used in micro teaching", was determined as "video, camera and tape" when the words were examined. In the study of Bilici and Yamak (2014), in which the micro teaching application was evaluated within the scope of pedagogical field knowledge, pre-service teachers made statements that using technological tools and materials in teaching was effective in learning a certain science subject and technology-supported teaching was effective in increasing pedagogical field knowledge.

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