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Pre-service Science and Technology Teachers' Mental Images of Science Teaching

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Abstract

Problem Statement: The constructivist reorganization of the elementary education programs in Turkey has revealed the importance of training skilled teachers who are familiar with both constructivist theory and the educational programs. In this way, teachers can adapt to their new roles, learn how to guide students, and prepare the best learning environment. Therefore, the determination of the pre-service science and technology teachers' mental images of science teaching is assumed to provide great insight for the teacher training institutions into pre-service teachers' perceptions of the teaching profession and of their students.

Purpose of Study: The purpose of this study is to determine the mental images of science teaching of the students of the Department of Science and Technology Education of Education Faculty at the University of Mersin and present the differences in their mental images in terms of certain variables.

Methods: This study is based on descriptive methods, and the universe consists of students of the Department of Science and Technology Education of Education Faculty at the University of Mersin in 2009-2010. 113 students were randomly selected for this study. The Draw-A-Science-Teacher-Test Checklist (DASTT-C) is one of the tools that can be used to measure pre-service teachers' perceptions of teaching science. Variables such as gender and the year of study were covered in the sub-problems of the research. T-test and one way analysis of variance were carried out by using SPSS-15.

Findings and Results: As a result of this study, it was found that 13.08% of the pre-service teachers of science and technology courses had student-centered images (exploratory teaching style), 62.62% had mental images

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positioned between student-centered science teaching and traditional science teaching (conceptual teaching style), and 24.30% had traditional science teaching images (explicit teaching style).

Conclusions and Recommendations: In practical courses, such as school experience and teaching practice, pre-service teachers can be provided with opportunities to conduct observations and teach. Academic staff can act as a model by including student-centered activities in their courses.

Keywords: Pre-service science and technology teachers, constructivist theory, science teaching, mental images

The aim of science courses in elementary schools is to ensure that students

- feel curious about the environment that they live in,
- observe and explore their environment and transform their experiences into organized knowledge,
- develop technical and mental skills for their prospective scientific studies,
- are provided with opportunities to carry out hands-on activities so that they can understand the importance of science and its concepts,
- associate what they learn at school with their own lives,
- enjoy science and develop positive attitudes towards school,
- are raised as conscious citizens,
- develop an understanding of science so as to understand the problems covered in contemporary media and the causes of these problems,
- and understand the history of scientific development, the relationship between science and technology, and the social, cultural, and historical background of these developments (Trowbridge, Bybee & Powell, 2004; Howe, 2002; De Boer, 2000).

Considering these objectives, it is clear that elementary school science programs, as well as all other subject areas, need to be capable of developing students' basic knowledge and critical thinking skills. These programs should also guide the students through developing the basic knowledge, skills, and thinking habits required to comprehend the subjects that they will study in detail in their following years of school (NRC, 2006). Programs designed in accordance with constructivist theory have these qualities. The main actors who implement constructivist programs in classrooms are science teachers who are able to communicate efficiently with the children, They are knowledgeable about child psychology and theories of learning, creating a dynamic learning environment in the classroom, and managing and directing this learning environment. This requires significant amount of effort and responsibility by teachers (Akcadag, 2012; Mui-So, 2002; Bağcı-Kılıç, 2001). Teachers

who hold beliefs that are in concert with constructivist approaches are more likely to teach their own students accordingly. The teachers who feel that they can teach with a constructivist understanding are people who have positive attitudes towards science and science teaching. These teachers are also effective science teachers and have students who can learn science efficiently from them (Finson, Thomas & Pedersen, 2006).

Science teachers' perceptions of science teaching really do matter. How they conceptualize themselves teaching science, or, in other words, their mental images of teaching, can indicate their perceptions of teaching. Perceptions of ability and capability depend heavily on one's prior conceptualizations. These perceptions form via internal, mental models of interaction (Khanthavy & Yuenyong, 2009). According to Norman, mental models provide the following: (a) a belief system, reflecting beliefs acquired through observation, instruction, or inference; (b) a mode of observation, providing correspondence between the mental model and the physical world; and (c) predictability, allowing a person to understand and anticipate the behavior of a physical system (Thomas, Pederson & Finson, 2001).

Pre-service teachers' mental images of teaching are associated with their previous experiences in their school years as students. The main factors affecting to their self-images as science teachers are prior teaching-learning experiences and/or the limitations in the real situations (Kang, Shin, Cha, Han & Noh, 2007). These experiences are significant because they establish knowledge and shape teaching practices (Finson et al., 2006). Therefore, pre-service teachers' mental models may determine their pedagogical understanding regarding what to teach about science, how to perform this teaching, and which activities to use while teaching. The examination of pre-service teachers' mental models may reveal their action agenda or personal pedagogical system that can ultimately impact what science they teach and how they go about teaching it. Drawings allow one to consider the setting, the arrangement of objects in physical space, and implicit interactions. They represent vivid images of interior understandings that can be captured rather quickly (Minogue, 2010). Drawings and pictures are helpful instruments to evaluate teaching identities that are often unseen, influenced through by past and present stereotypes, and can be used to encourage pre-service teachers to explore their beliefs (Cullen, 2006; Markic, Eilks & Valanides, 2008). According to Weber and Mitchell (1996), images are constructed to make sense of human experiences and communicate that sense to others. The role of images cannot be understood if they are not explored and examined (Uner, Akkuş & Turan, 2012).

An instrument was developed by Thomas and colleagues to determine pre-service teachers' mental images of science teaching and predict what kind of a science teaching they are likely to present in the future. This instrument, DAST-C, was further modified to include characteristics of science classrooms and science teachers, and it was renamed as Draw-A-Science-Teacher Teaching Checklist (DASTT-C) by Thomas and Pedersen in 1998. This instrument was modified again by Thomas, Pedersen, and Finson in 2001.They expected to illuminate the knowledge and beliefs of pre-service elementary teachers prior to their coursework in

elementary science teaching methods. The main concept of DASTT-C is a listing of the teacher-centered and the student-centered attributes of an elementary science teacher, as opposed to a scientist (Yılmaz, Türkmen, Pedersen & Huyugüzel Çavaş, 2007). The DASTT-C is one of the essential instruments for developing techniques and procedures that promote reflection and analysis of pre-service teachers' thinking or mental models.

A brief review of the relevant literature shows that the DASTT-C test is employed by some studies as a measurement instrument for determining pre-service teachers' mental images of science teaching (Whyte & Ellis, 2002-2003; Yılmaz et al., 2007; Markic et al., 2008; Yılmaz, Türkmen & Pedersen, 2008; Demirdöğen & Elmas, 2009; Markic & Eilks, 2010; Markic & Eilks, 2010b; Tatar, Yıldız, Buldur & Akpınar, 2010, Al-Amoush, Markic, Abu-Hola & Eilks, 2011; Elmas, Demirdöğen & Geban, 2011; Markic & Eilks, 2011; Uner et al., 2012; Markic & Eilks, 2012). On the other hand, in some of the studies, DASTT-C is used before and after a science teaching practice course to determine whether the course makes a change in pre-service teachers' mental images of science teaching (Finson, 2001; Louca, Rigas & Valanides, 2003; Thomas & Pedersen, 2003; El-Deghaidy, 2006; Talsma, 2007; Minogue, 2010; Ambusaidi & Al-Balushi, 2012).

A reorganization of the elementary education programs in Turkey, based on the constructivist theory, has revealed the importance of training skilled teachers who are familiar with the constructivist theory and the educational programs. In this way, teachers can adapt to their new roles, learn how to guide students, and prepare the best learning environment. Since pre-service teachers are the ones who are going to implement the new programs, how pre-service teachers see themselves in their future classrooms has a great significance and value (Elmas et al., 2011). Thus teacher educators may utilize their reflections as a basis for reviewing and reflecting on the efficiency of science teaching method courses. An examination of their mental images of teaching can also provide opportunities for pre-service teachers to examine their beliefs, personal theories, and the personal knowledge they bring, as well as critically examine what images are reinforced during teacher education programs (Thomas et al., 2001; Thomas & Pedersen, 2003). Therefore, a determination of the pre-service science and technology teachers' mental images of science teaching is assumed to provide great insight into pre-service teachers' perceptions of the teaching profession and students for the teacher training institutions and teacher trainers. This research was performed with this objective in mind.

The purpose of this study is to determine the mental images of science teaching of the students of Department of Science and Technology Education of Education Faculty at the University of Mersin and to present the differences in their mental images in terms of certain variables. To this end, this study sought to answer to the following questions:

1. What mental images of science teaching do the students of the Department of Science and Technology Education like?

2. Do the mental images of science teaching of the students of the Department of Science and Technology Education exhibit significant differences in terms of their gender?
3. Do the mental images of science teaching of the students of the Department of Science and Technology Education exhibit significant differences in terms of year of study?

Method

Sample

This study is based on the descriptive methods, and the universe consists of students of Department of Science and Technology Education of Education Faculty at the University of Mersin in 2009-2010. There were 113 randomly selected students in this study.

Research Instrument

In this study, the DASTT-C was used as a data collection instrument. The students were instructed to draw a picture of themselves as a science teacher at work on a paper that was supplied to them. At the bottom of the page, the students were instructed to write a brief explanation, describing their drawings and specifically answering the questions "What is the teacher doing?" and "What are the students doing?" regarding their drawings. Although DASTT-C developers Thomas et al. (2001) reported the instrument's reliability to be KR-20 = 0.82, the instrument's reliability was found to be KR-20 = 0.72 in this research. This instrument was applied through the end of the fall semester.

The developers of the DASTT-C (Thomas et al., 2001) classified drawings of school practice along a continuum, with scores of 0-4 representative of the *student-centered (exploratory)* teaching style, 10-13 representative of the *teacher-centered (explicit)* teaching style, and 5-9 representative of *neither the student-centered nor the teacher-centered (conceptual)* teaching style. The characteristics of the three teaching styles are as follows (Minogue, 2010; Yılmaz et al, 2007; Finson et al, 2006; Whyte & Ellis, 2002-2003):

Explicit teaching: This is a didactic model for transmitting algorithmic or factual information. The teacher is the central image and the one who is predominantly a distributer of information, while students are relatively passive and often in desks arranged in rows. Student assignments may be written on the blackboard. Students may be looking at texts or working with pencil / pen and paper.

Conceptual teaching: This is a model that is didactic and at the same time constructivist. The tasks assigned to students are non-routine tasks that teach a concept central to an academic discipline. The teacher specifies the concept that is being taught through simultaneous, conceptually redundant activities. Tasks involve investigation, discovery, and open-ended problem-solving. In representations of conceptual teaching, typically, the students are carrying out hands-on, multiple-

media activities in interdependent small groups; student-to-student task-related talk may also be represented.

Exploratory teaching: This is a Maieutic model for teaching concepts. What makes exploratory teaching Maieutic is that the curricular content arises in response to students' interests and decisions rather than occurring through specification of which disciplinary concepts will be taught. In representations of exploratory teaching, the teacher may be represented observing students who are working together or actively orchestrating students' movements as students work individually, in pairs, or in small groups.

Data Analyses

The Draw-A-Science-Teacher-Test Checklist (DASTT-C) is one tool that can be used to measure pre-service teachers' perceptions of teaching science. The DASTT-C score sheet (for the test administrator) has three sections, including teacher, students, and environment. Each section is scored in a dichotomous fashion with an indication of "present" or "not present" in the picture.

The "Teacher" section of the instrument is divided into two subsections that focus on the teacher's activity (demonstrating, lecturing, using visual aids, etc.) and the teacher's position (posture, and location with respect to students, such as at the head of the classroom). The "Students" section of the instrument is likewise divided into two subsections that focus on the activities of students (passively receiving information, responding to the teacher, etc.) and students' positions (how they are seated within the classroom). The third section, "Environment," consists of elements typically found inside the classrooms, such as desks arranged in rows, the symbols of teaching (e.g. chalkboards), and the symbols of science (e.g. science equipment). Each element in each section of the instrument is considered by the instrument's developers to depict teacher-centered elements of teaching and classroom images. If a teacher-centered element appears in a subject's drawing, the scorer simply marks that element on the checklist. Marks can later be added to derive both sub-scores for each section as well as an overall checklist score. Total checklist scores can range from 0 to 13 (the higher the score, the more teacher-centered the image). Given this score, students can place themselves on a continuum from the student-centered (0) to the more teacher-centered (13), as indicated by the DASTT-C measure (Thomas et al., 2001).

By using a predetermined coding system, the author and a field expert analyzed the drawings and descriptions, following what Patton (2002) refers to as analyst triangulation. First, each drawing was coded as male, female, or unidentified gender. Second, each drawing by pre-service teachers was coded with a number from 1 to 113. Third, since six papers did not have clear drawings, they were excluded from the sample. A total of 107 tests were examined and then scored according to DASTT-C. Then the author and the expert independently examined and scored the drawings. They discussed the issues on which there was "agreement" and "disagreement" in all of the scored drawings. For the reliability test of the study, the reliability formula

suggested by Miles and Huberman (1994) was used: Reliability = Agreement / (Agreement + Disagreement).

If reliability calculation is above 70%, this result is regarded as reliable for the research (Miles and Huberman, 1994). As a result of the calculation, the reliability of the research was found to be 90% for the drawings in the DASTT-C test. This result was regarded as reliable for the research. On the other hand, for the gender and year of study variables covered in the sub-problems of the research, t-test and one way analysis of variance were carried out by using SPSS-15.

Results

The DASTT-C test scores of the pre-service teachers involved in the study are shown in Table 1 based on their gender and year of study as intervals indicating learning styles preferences.

Table 1.

Distribution of Frequency of Pre-service Science Teachers.

Year of Study	*Gender*	*0-4 score*	*5-9 score*	*10-13 score*
First Year	Female	0	8	5
	Male	0	10	6
Second Year	Female	1	12	4
	Male	1	11	2
Third Year	Female	3	8	4
	Male	0	5	2
Fourth Year	Female	6	3	1
	Male	3	10	2
	Total	14	67	26

The score intervals and frequencies in Table 1 are illustrated in Figure 1.

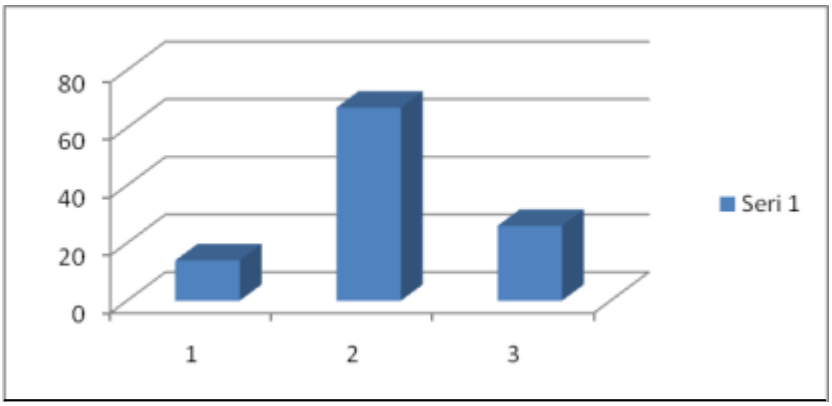

Figure 1. Relation between frequency and scores

As can be seen in Figure 1, according to the DASTT-C test scores of the pre-service teachers, the first bar represents those students with 0-4 points (those having a student-centered teaching style-Exploratory), the second bar represents those students with 5-9 points (those having neither a student-centered nor a teacher-centered teaching style-Conceptual) and the third bar represents those students with 10-13 points (those having a teacher-centered teaching style-Explicit). The graphic shows that among the pre-service teachers, 13.08% had exploratory, 62.62% had conceptual, and 24.30% had explicit teaching styles.

Below. sample drawings are given as indicators of the mental images of the pre-service teachers with exploratory, conceptual, and explicit teaching styles. In order to obtain data about their mental images of science teaching, the behaviors of the teacher and students were stated by the pre-service teachers in writing, in addition to their visual presentation of student-teacher and learning environment.

A drawing by one of the pre-service teachers with an exploratory teaching style is given below as a sample (Figure 2). The pre-service teacher, who was determined to have student-centered teaching style with a score of 2 points, explained the drawing by stating *"The teacher is making the students carry out independent experiments (student-centered education)"* and *"The students are performing a hands-on learning activity far from memorizing based on experiment and observation"*.

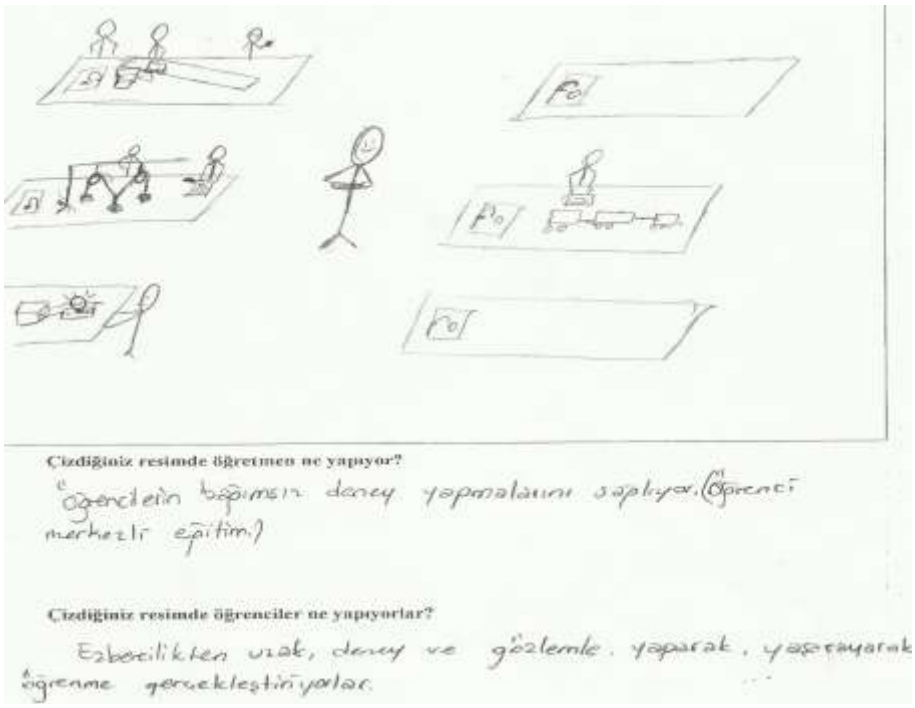

Figure 2. Exploratory DASTT-C picture and explanation

A teacher whose drawing showed one of the teaching styles (with a score of 7 points) explained the drawing by saying, *"At the end of the subject, the teacher is showing the students a crossword puzzle to be solved with relevant science vocabulary"* and the pre-service teachers with conceptual teaching styles are given below as a sample (Figure 3). The pre-service teacher was determined to stand somewhere between student-centered and teacher-centered *"students are answering one by one"* and *"the students are curious to solve the crossword puzzle"*.

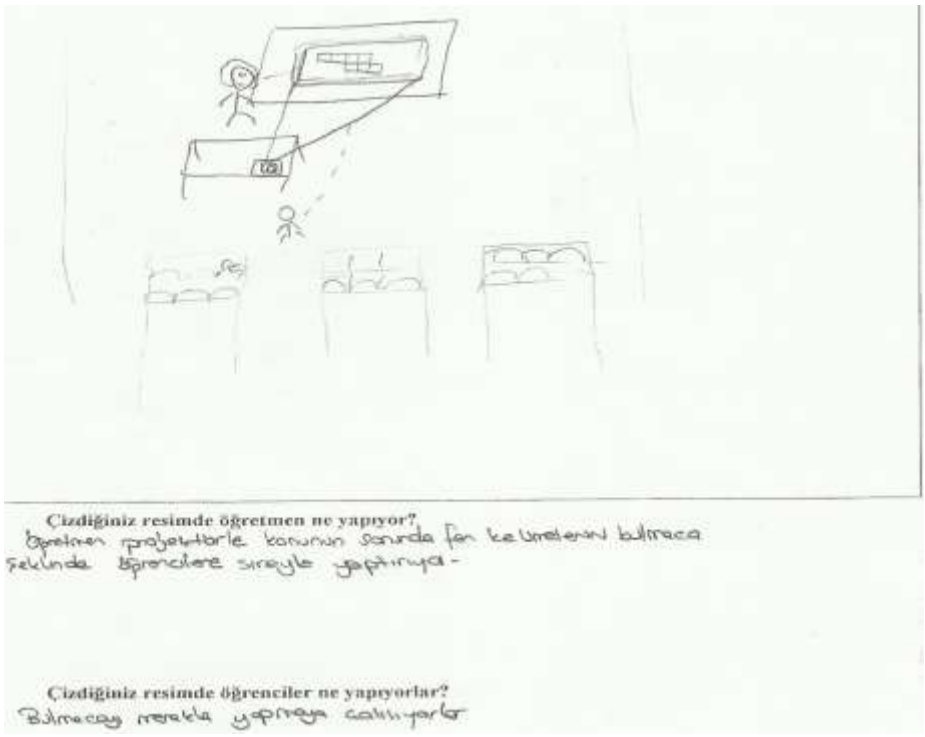

Figure 3. Conceptual DASTT-C picture and explanation

As an example, a drawing is shown in Figure 4 which was drawn by one of the pre-service teachers with an explicit teaching style. The pre-service teacher, who was determined to have a teacher-centered teaching style with a score of 11 points, explained the drawing by stating, *"The teacher is telling students about the concept of velocity in a Science and Technology course by giving examples on the board"*, and, *"The students are taking notes about the subject first and then they are trying to solve the sample problems. One of the students is in front of the board answering a sample question".*

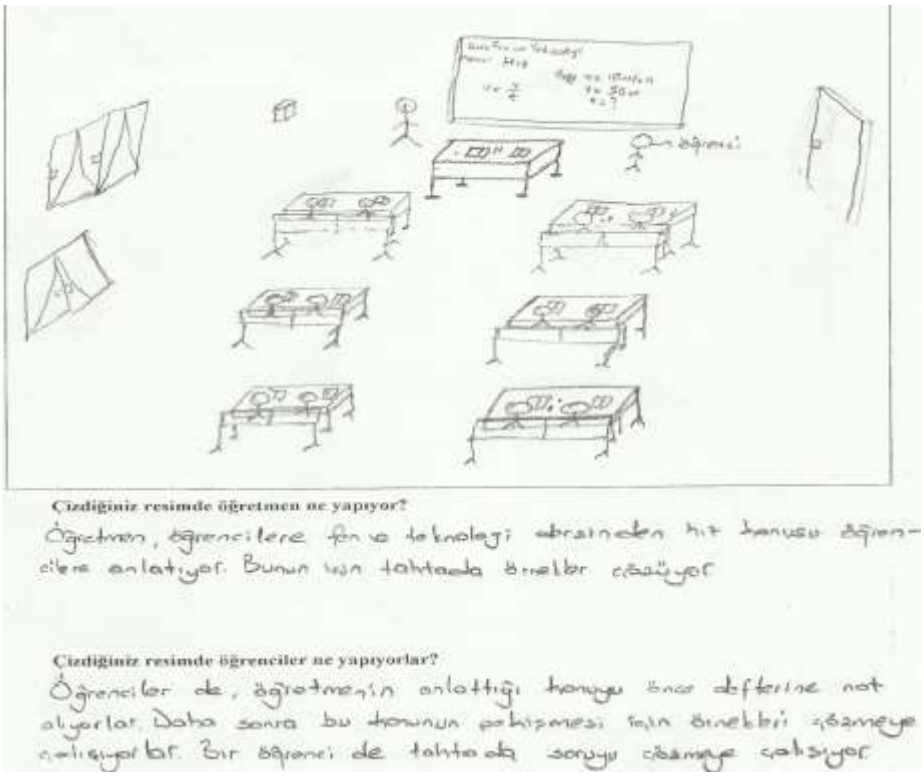

Figure 4. Explicit DASTT-C picture and explanation

Based on the second sub-problem of the research, an independent t-test was conducted to evaluate any statistical differences between DASTT-C mean scores of pre-service students with regard to gender.

Table 2.

Gender Differences

Gender	*N*	*Mean*	*SD*	*df*	*t*	*p*
Female	57	7,4737	2,82909	105	-1,522	0,131
Male	50	8,2000	2,08982			

*p<0.05

As seen in Table 2, the results show no significant difference between females and males' DASTT-C mean scores [$t_{(107)}$= 1,52, p>05].

Intra-group multiple comparisons were performed based on the third sub-problem of the research, using one-way analysis of variance (ANOVA) to determine if the pre-service teachers' mental images exhibit any differences in terms of year of study.

Table 3.

Results of the One Way Analysis of Variance Regarding Differences, According to Year of Study.

	SS	df	X^2	F	P
Between groups	88,474	3	29,493	5,168	,002
Within groups	587,783	103	5,707		
Total					

P<0,05

As can be seen in Table 3, the results show a significant difference between years of study and DASTT-C mean scores [$F_{(3\text{-}103)}$=5,16, p<.01]. Post-hoc correlation analysis was performed to identify the source group of the difference. First, the homogeneity of the variance was checked to determine which correlation technique to choose, and Tamhane's test was then selected after concluding that variance wasn't homogeneous [$L_{F(3\text{-}103)}$=7.906, p<.01].

Table 4

Result of the Post-hoc Test Among the Years of Study

I	J	Mean difference (I-J)	p
First Year	Fourth Year	2,50207*	,009

P<0,05

As can be seen in Table 4, there was a significant difference between the first and fourth year students. Indeed, it was found that the scores received by the fourth year students were significantly lower than those of the first year students. The higher the score according to the DASTT-C test, the more teacher-centered the mental image (Thomas et al., 2001). Therefore, the fourth year students had far more student-oriented results on the DASTT-C test.

Discussion and Conclusion

The aim of this research was to determine pre-service science and technology course teachers' mental images of science teaching and to learn whether these images exhibited differences with regard to gender and year of study. As a result of this study, it was found that 13.08% of the pre-service teachers of science and technology courses had student-centered images (exploratory teaching style), 62.62% had mental images positioned between student-centered science teaching and traditional science teaching (conceptual teaching style), and 24.30% had traditional science teaching images (explicit teaching style). This finding suggests that a new trend has emerged with pre-service teachers, whose notions of the teaching process have become more student-centered in line with the constructivist changes to the elementary educational system.

These findings of the research are similar to the findings of studies by Demirdöğen and Elmas (2009), who report that 42.9% of the pre-service teachers in their study had conceptual styles; this also matches the study of Elmas et al. (2011), who report that 39.4% of the pre-service teachers in their study had mental images connected with conceptual teaching styles. In studies by Yılmaz et al. (2008), Ambusaidi and Al-Balushi (2012), and Uner et al. (2012), more than half of the respondents described a situation in-between a student-centered approach and traditional science teaching in their drawings about the learning environment in science and technology courses. On the other hand, Louca et al. (2003) and Yılmaz et al. (2007) state that nearly half of pre-service teacher possessed teacher-centered science teaching images. The results of the research of Kang et al. (2007) revealed that pre-service science teachers' self-images as science teachers were more 'teacher-centered' than 'student-centered'. According to the results of their study, Al-Amoush et al. (2011) state that pre-service and in-service teachers' mental images were mostly teacher-centered. Markic and Eilks (2012) state that freshman biology and primary school student teachers expressed beliefs about their subjects which are more in line with modern educational theory, while conversely, physics and chemistry student teachers profess quite traditional beliefs about science teaching and learning. Markic et al. (2008), however, state that the mental images of pre-service teachers regarding science teaching were mostly student-centered.

Another finding of this research is that the pre-teachers' mental images of science teaching did not exhibit any differences in terms of gender, which is similar to the findings of studies by Yılmaz et al. (2007) and Tatar et al. (2010). On the other hand, in a study by Elmas et al. (2011), a significant association was found between gender and instructional style. In that study, female pre-service teachers were more willing to use student-centered approaches than male pre-service teachers.

Finally, this research identified a difference in favor of senior students with regard to having student-centered science teaching images (exploratory teaching style) between the science teaching mental images of the students in their first year and those of students in their fourth year, which suggests that pre-service teachers have moved away from traditional science teaching (in which they were educated)

and towards the constructivist science teaching (in which the student is active). The difference between the first and fourth year students could be attributed to the educational courses taken by senior students due to their study for four years. During their education, pre-service teachers learn about the constructivist theory of teaching and become familiar with student-centered teaching applications. Finally, the "School experience" and "Teaching practice" courses, offered from the beginning of the second term of the third year, could have an impact on pre-service teachers' mental images of science teaching. According to Anderson and Mitchener (1994), field experience in schools is an opportunity for students to experiment with who they are as professional educators and what they are learning in their courses (Yılmaz-Tuzun, 2008). This finding is similar to the finding of Tatar et al. (2010) that the higher the year of study, the greater the increase in pre-service teachers' "exploratory" teaching style. The findings are also similar to the findings of Finson (2001), Louca et al. (2003), El-Deghaidy (2006), Talsma (2007), and Minogue (2010), that the pedagogical courses, which pre-service teachers have taken during their time as faculty, make changes in pre-service teachers' mental images of science teaching.

There is a great emphasis on constructivist theory in the reform of the elementary school curriculum in Turkey. Nevertheless, there is also a need for the teacher education system to engage pre-service teachers with these new educational trends. This study has contributed to our understanding of current pre-service teachers' assimilation of constructivist theories of education. According to the results of the current study, the researchers recommend the following:

- Teaching practices recommended by constructivist theory should be covered more in "courses on education" in order to increase pre-service teachers' knowledge of student-centered science teaching.
- During the micro-teaching activities in Science Teaching Methods courses, pre-service teachers should be encouraged to create a constructivist education environment and to carry out student-centered teaching implementations.
- In practical courses such as "School experience" and "Teaching practice", pre-service teachers should be provided with opportunities to conduct observations and teach.
- Academic staff should act as models by including student-centered activities in their faculty courses.

For future research:

- The "Science Teaching Efficacy Belief Instrument" (STEBI) or "Science Teaching Efficacy Belief Scale" (STEBS) can be use with the DASTT-C test.
- A mixed method can be use to determine pre-service or in-service teachers' mental images of science teaching by using both the DASTT-C test and interviews.

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Fen ve Teknoloji Öğretmen Adaylarının Fen Öğretimine Yönelik Zihinsel İmgeleri

Atıf:

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(Özet)

Problem Durumu

Fen ve Teknoloji dersi öğretmenlerinin fen öğretimine ilişkin algıları büyük önem taşımaktadır. Zihinlerinde kendilerini fen öğretirken nasıl tasarladıkları yani zihinsel imgeleri onların bu algılarının göstergesi olabilmektedir. Öğretmen adaylarının zihinlerindeki öğretime yönelik imgeleri öğrenciyken yaşadıkları deneyimlerle bağlantılıdır. Bu deneyimler onların bilgiyi dönüştürüp öğretim uygulamalarını tasarlamalarında etkilidir. Böylece, öğretmen adaylarının zihinsel modelleri; onların fenle ilgili ne öğreteceklerine ve bu öğretimi nasıl gerçekleştireceklerine ilişkin kişisel pedagojik anlayışlarını ve süreçte kullanacakları etkinlikleri ortaya çıkarabilmektedir. Ülkemizde ilköğretim programlarının yapılandırmacı kurama göre hazırlanmasıyla birlikte; yapılandırmacı kuramı ve onun ışığında hazırlanan öğretim programlarını tanıyarak yeni rollerini benimseyen, öğrenciye nasıl rehberlik edeceğini ve hangi tür öğrenme ortamları hazırlaması gerektiğini bilen öğretmenler yetiştirmek önem kazanmıştır. Bu bağlamda, eğitim fakültesinde öğrenim görmekte olan fen ve teknoloji dersi öğretmen adaylarının fen öğretimine ilişkin zihinlerindeki imgelerinin belirlenmesinin; onların öğretmenliğe, öğrenciye ve öğrenme ortamlarına yönelik algıları konusunda öğretmen yetiştiren kurumlara ve öğretim elemanlarına katkı getireceği düşünülmektedir. Bu düşünceden yola çıkılarak bu araştırma desenlenmiştir.

Araştırmanın Amacı

Bu araştırmanın amacı, Mersin Üniversitesi Eğitim Fakültesi İlköğretim Bölümü Fen Bilgisi ABD öğrencilerinin fen öğretimine yönelik zihinsel imgelerini belirlemek ve çeşitli değişkenler açısından bu imgelerinde farklılık olup olmadığını ortaya çıkarmaktır. Bu amaç doğrultusunda şu sorulara yanıt aranmıştır:

1. Mersin Üniversitesi Eğitim Fakültesi İlköğretim Bölümü Fen Bilgisi ABD öğrencilerinin fen öğretimine yönelik zihinsel imgeleri nasıldır?
2. Mersin Üniversitesi Eğitim Fakültesi İlköğretim Bölümü Fen Bilgisi ABD öğrencilerinin fen öğretimine yönelik zihinsel imgeleri cinsiyetlerine göre anlamlı bir farklılık göstermekte midir?
3. Mersin Üniversitesi Eğitim Fakültesi İlköğretim Bölümü Fen Bilgisi ABD öğrencilerinin fen öğretimine yönelik zihinsel imgeleri sınıf düzeylerine göre anlamlı bir farklılık göstermekte midir?

Araştırmanın Yöntemi

Genel tarama yönteminin kullanıldığı bu araştırmanın çalışma evrenini 2009-2010 öğretim yılı güz döneminde Mersin Üniversitesi Eğitim Fakültesi Fen Bilgisi Öğretmenliğinde öğrenim gören öğretmen adayları oluşturmakta olup, bu adaylardan 113'ü seçkisiz olarak örnekleme alınmışlardır. Araştırmada ölçme aracı olarak The Draw-A-Science-Teacher-Test Checklist (DASTT-C) kullanılmıştır. Thomas ve arkadaşları (2001) tarafından yapılan güvenirlik çalışmasında KR-20 değeri .82; bu çalışmada ise KR-20 değeri .72 olarak hesaplanmıştır.

DASTT-C testi ile toplanan veriler Thomas ve arkadaşları (2001) tarafından hazırlanan 13 maddelik ölçüt çizelgesi (checklist) kullanılarak puanlanmıştır. Bu çizelge; öğretmen, öğrenci ve çevre olmak üzere üç ana bölümden oluşmaktadır. Her bir bölüm de alt bölümlere ayrılmaktadır. Öğretmen bölümü "etkinlikler" (gösteri, düz anlatım, görsellerden yararlanma) ve "öğretmenin pozisyonu" (sınıfın merkezinde olma, ayakta dikilme) olarak iki alt bölümde incelenmektedir. Öğrenci bölümü de benzer biçimde "etkinlikler" (pasif bilgi alma, öğretmenin sorularını yanıtlama) ve "öğrenci pozisyonu" (sırada oturma) olarak iki alt bölüme sahiptir. Çevre başlığı altında incelenen bölümde ise öğretmen masası ve öğrenci sıralarının dizilişi, laboratuar malzemelerinin konumu, öğretme sürecine ve fene yönelik sembollerin sınıftaki varlığına değinilmektedir. Bu ölçütlere göre yapılan değerlendirmede puanlar 0-13 arasında yer almaktadır. 10-13 puan arası öğretmen merkezli bir anlayışın hakim olduğunu, 5-9 puan aralığı öğretmen-öğrenci merkezliliğinin arasında kalınmış bir durumu, 0-4 puan aralığı ise öğrenci merkezli anlayışın var olduğunu göstermektedir.

Araştırmada öğretmen adaylarının yaptıkları çizimler birden 113'e kadar numaralandırılmıştır. Çizimleri anlaşılmayan altı kağıt örneklem dışı kaldığı için 107 test incelenip DASTT-C'ye göre puanlanmıştır. Bu çalışma kapsamında araştırmacı dışında bir alan uzmanı daha çizimleri bağımsız olarak inceleyip puanlamıştır. Araştırmacı ve alan uzmanı tarafından incelenip puanlanan tüm çizimlerde "görüş birliği" ve "görüş ayrılığı" olan konular tartışılmış ve gerekli düzenlemeler yapılmıştır. Araştırmanın güvenilirlik hesaplaması için Miles ve Huberman'ın (1994) önerdiği güvenirlik formülü (Güvenirlik = Görüş Birliği/ (Görüş Birliği + Görüş Ayrılığı)) kullanılmıştır. Güvenirlik hesaplarının %70'in üzerinde çıkması, araştırma için güvenilir kabul edilmektedir (Miles ve Huberman, 1994). Hesaplama sonucunda araştırmanın güvenirliği DASTT-C testindeki çizimler için % 90 olarak hesaplanmıştır. Burada elde edilen sonuç, araştırma için güvenilir kabul edilmiştir. Araştırmanın alt problemlerinde yer alan çeşitli değişkenler açısından istatistiksel farklılıkların hesaplanmasında t testi, tek yönlü varyans analizi (ANOVA) ve Tamhane testleri kullanılmıştır.

Araştırmanın Bulguları

Araştırma bulgularına göre, öğretmen adaylarının % 13,08'inin öğrenci merkezli öğretim stiline sahip oldukları, % 62,62'sinin öğrenci merkezli öğretim stili ile öğretmen merkezli öğretim stilinin arasında kaldıkları ve % 24,30'unun ise öğretmen merkezli öğretim stiline sahip oldukları ortaya çıkmıştır. Cinsiyet değişkenine göre,

kadın ve erkek öğretmen adayları arasında fen öğretimine yönelik zihinsel imgeler açısından anlamlı bir farklılık görülmemiştir. Sınıf düzeylerine göre öğretmen adaylarının fen öğretimine yönelik zihinsel imgeleri arasında farklılık olup olmadığını belirlemek için yapılan analizler sonunda, birinci sınıflar ile dördüncü sınıflar arasında bir farklılık olduğu ortaya çıkmış ve dördüncü sınıftaki öğrencilerin puanlarının birinci sınıflara nazaran anlamlı derecede düşük olduğu sonucuna ulaşılmıştır. Başka bir deyişle, öğrenci merkezli sınıf imgesi açısından elde edilen sonuç dördüncü sınıfların lehinedir.

Araştırmanın Sonuçları ve Önerileri

Araştırmanın sonucunda örneklemdeki öğretmen adaylarının yarısından fazlasının öğrenci merkezli bir fen öğretimi anlayışı ile öğretmen merkezli bir anlayış arasında oldukları, cinsiyetlere göre fen öğretimine yönelik zihinsel imgelerin farklılaşmadığı ve dördüncü sınıftaki öğrencilerin fen öğretimine yönelik zihinsel imgelerinin birinci sınıftakilere göre daha öğrenci merkezli olduğu görülmüştür. Bu sonuca dayanılarak, özel öğretim yöntemleri derslerinde öğretmen adaylarının mikro öğretim uygulamalarında yapılandırmacı ortam oluşturmaları konusunda yardımcı olunup ve onlara bu konuda fırsat sunulması önerilebilir. Öğretim elemanları da kendi derslerinde yapılandırmacı öğrenme ortamları düzenleyerek öğretmen adaylarına model olabilirler.

Anahtar Sözcükler: Fen ve teknoloji öğretmen adayı, fen öğretimi, yapılandırmacı kuram, zihinsel imge