THE INTERRELATION BETWEEN PRE-SERVICE SCIENCE TEACHERS' CONCEPTIONS OF TEACHING AND LEARNING, LEARNING APPROACHES AND SELF-EFFICACY BELIEFS

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
THE DEPARTMENT OF ELEMENTARY SCIENCE AND MATHEMATICS EDUCATION

JANUARY 2013

Approval of the Graduate School of Social Sciences

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ABSTRACT

THE INTERRELATION BETWEEN PRE-SERVICE SCIENCE TEACHERS' CONCEPTIONS OF TEACHING AND LEARNING, LEARNING APPROACHES AND SELF-EFFICACY BELIEFS

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January 2013, 108 pages

This study examined preservice science teachers' conceptions about teaching and learning, self-efficacy beliefs, learning approaches and images of themselves as a science teachers. The study was also interested in examining the possible relationships among preservice science teachers' conceptions about teaching and learning, learning approaches and self-efficacy beliefs.

The study was carried out during 2011-2012 spring semester at three different public universities in Ankara. A total of 208 senior preservice science teachers who were volunteers involved. Data were collected through Draw-A-Science-Teacher-Test Checklist, Teaching and Learning Conceptions Questionnaire, Science Teaching Efficacy Belief Instrument, and The Learning Approach Questionnaire and analyzed by descriptive statistics, paired-sample t-test and canonical correlation analysis.

Paired-sample t-test analyses results showed that preservice science teachers prefer constructivist conception more than traditional conception; and meaningful learning approaches more than rote learning approaches. Besides, preservice science teachers were also found to have generally high sense of self-efficacy beliefs in science teaching. Moreover, the results of the DASTT-C showed that preservice science teachers' perspectives of science teaching conception is 42.7% student-centered, 7.0% teacher-centered and 50.3% neither student-centered nor teacher-centered. Furthermore, the canonical correlation analysis revealed that the first canonical variate demonstrated that preservice science teachers' constructivist conception and traditional conception are associated with their self-efficacy beliefs and learning approaches.

Keywords: Conceptions about Teaching and Learning, DASTT-C, Learning Approaches, Preservice Science Teachers, Self-Efficacy Beliefs,

ÖZ

FEN BİLGİSİ ÖĞRETMEN ADAYLARININ ÖĞRETME VE ÖĞRENME KAVRAMLARI, ÖĞRENME YAKLAŞIMLARI VE ÖZ-YETERLİK İNANÇLARI ARASINDAKİ İLİŞKİ

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Ocak 2013, 108 sayfa

Bu çalışmanın amacı fen bilgisi öğretmen adaylarının öğrenme yaklaşımları, öz-yeterlik inançları ve kendilerinin fen bilgisi öğretmeni olarak görüntülerini ilgilendiren bir profil oluşturmayı amaçlamaktadır. Bu çalışma aynı zamanda fen bilgisi öğretmen adaylarının öğretme ve öğrenme kavramları, öğrenme yaklaşımları ve öz-yeterlik inançları arasındaki ilişkiyi araştırmaktır.

Bu çalışma, 2011-2012 öğretim yılı bahar döneminde Ankara ilinde bulunan 3 farklı devlet üniversitesinde gerçekleştirilmiştir. Çalışmaya gönüllü olarak 208 fen bilgisi öğretmen adayı katılmıştır. Veriler, “Draw-A-Science-Teacher-Test / Bir Fen Öğretmeni Çiz”, “Öğretme ve Öğrenme Anlayışları Ölçeği”, “Öğrenme Yaklaşımları Anketi” ve “Fen Bilgisi Öğretimine Yönelik İnançlar Anketi” ile elde edilmiş ve eşleştirilmiş örneklem t-testi ve Kanonik Korelâsyon analizleri kullanılarak değerlendirilmiştir.

Fen bilgisi öğretmen adaylarının yapılandırmacı anlayışı, geleneksel anlayışa oranla daha fazla tercih ettiği görülmüştür. Aynı şekilde, anlamlı öğrenme yaklaşımlarının fen bilgisi öğretmen adayları tarafından, ezberci öğrenme yaklaşımlarına oranla daha fazla tercih edildiği belirlendi. Ayrıca, fen bilgisi öğretmen adaylarının fen bilgisi öğretimine yönelik öz-yeterlik inançlarının genellikle yüksek düzeyde olduğu tespit edilmiştir. Bununla beraber, fen bilgisi öğretmeni çizimi belirtke tablosu (DASTT-C, The Draw a Science Teacher Test Checklist) sonuçları fen bilgisi öğretmen adaylarının bakış açılarının %42.7 öğrenci-merkezli, %7.0 öğretmen-merkezli ve %50.3 ne öğrenci-merkezli ne de öğretmen-merkezli olduğunu göstermiştir. Ayrıca, birinci kanonik olasılıksal değişken çifti incelendiğinde fen bilgisi öğretmen adaylarının geleneksel ve yapılandırmacı anlayışlarının; onların öğrenme yaklaşımları ve fen bilgisi öğretimine yönelik inançları ile ilişkili olduğunu göstermiştir.

Anahtar Kelimeler: Fen Bilgisi Öğretmen Adayları, Fen Bilgisi Öğretimine Yönelik İnançlar, DASTT-C, Öğretme ve Öğrenme Anlayışları, Öğrenme Yaklaşımları,

To My Parents and My Fiance

ACKNOWLEDGMENTS

I would like to express my deepest gratitude to my supervisor Prof. Dr. Jale ÇAKIROĞLU for her invaluable suggestions, encouragement, motivation, patience, and guidance throughout this study. Thank you sincerely.

I would also like to thank my co-supervisor Prof. Dr. Ceren ÖZTEKİN TEKKAYA for her invaluable suggestions, guidance and knowledgeable recommendations throughout this study. Thank you sincerely.

I would also like to thank to Assoc. Prof. Dr. Semra SUNGUR VURAL, Assoc. Prof. Dr. Yezdan BOZ, and Assist. Prof. Dr. Elvan ŞAHİN for their invaluable comments on the committee. I am very thankful to my parents Nihal and Yılmaz SAÇICI, my brother Emrah SAÇICI and my sister Nihal SAÇICI for their encouragement and moral support. I would also like to send a special thank to my fiance, Mehmet Ali TAHANCALIO for his infinite moral support. My parents and my fiance always believed in me.

I would also like to thank Res. Assist. Eray ŞENTÜRK, Res. Assist. Gülsüm AKYOL, Res. Assist. Ayşe YENİLMEZ TÜRKOĞLU and Esra ÇİMEN for their suggestions and comments.

I would also would like to thank Prof. Dr. Jon PEDERSEN and Assoc. Prof. Dr. Ayşe AYPAY for their help.

I need to acknowledge to TÜBİTAK for financial support during my master's education.

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LIST OF ABBREVIATIONS

ABCC	Attitudes and Beliefs on Classroom Control Inventory
DAST-C	Draw-a-Scientist-Test Checklist
DASTT-C	Draw-a-Science-Teacher-Test Checklist
ERIC	Educational Resources Information Center
LAQ	Learning Approach Questionnaire
LAQ-M	Meaningful Learning Approach Questionnaire
LAQ-R	Rote Learning Approach Questionnaire
PSTE	Personal Science Teaching Efficacy
SPQ	Study Process Questionnaire
SSCI	Social Science Citation Index
STAD	Student Teams Achievement Divisions
STEBI-B	Science Teaching Efficacy Beliefs Instrument
STOE	Science Teaching Outcome Expectancy
TES	Teacher Efficacy Scale
TLCQ	Teaching and Learning Conception Questionnaire

CHAPTER 1

INTRODUCTION

The effects of teachers' beliefs on their instructional practices in science have attracted attention of researchers in the area of science education for many years. For instance, Pajares (1992) asserts that "beliefs teachers hold influence their perceptions and judgements, which, in turn affect their behavior in classrooms" (p. 307). Similarly, van Driel, Verloop and de Vos (1998) stated that science teachers' epistemologies including beliefs about science, teaching and learning science influence the type of their instructional behaviors in the science classrooms. For example, a science teacher's beliefs about teaching science, learning science, and his self-efficacy beliefs may not be hold apart from his beliefs about applying cooperative learning in the science classroom (Jones & Carter, 2007). Therefore, as a way to yield definitive conclusions, researchers saw promise in examining and understanding teachers' beliefs involving beliefs about teaching and learning, which influence and form teachers' conceptions about teaching and learning, (Aypay, 2011; Chan & Elliott, 2004; Cheng, Chan, Tang, & Cheng, 2009), about approaches to learning (Christensen, Massey, Isaacs, & Synott, 1995; Novak & Gowin, 1984; Saunders, 1998; Trigwell, Prosser, & Waterhouse, 1999), and about teachers' self-efficacy beliefs (Czerniak, 1990; Finson, Riggs, & Jesunathadas 1999; Enochs & Riggs, 1990; Savran-Gencer & Cakiroglu, 2007; Tschannen-Moran & Woolfolk Hoy, 2007).

The conceptions about teaching and learning defined "as the beliefs held by teachers about their preferred ways of teaching and learning. These include the meaning of teaching and learning and the roles of teacher and pupils" (Chan & Elliott, 2004, p. 819). Several researchers categorized the conceptions about teaching and learning in two dimensions: traditional/teacher-centered, and constructivist/student-centered (Aypay, 2011; Chan & Elliott, 2004; Cheng et al., 2009). The traditional conception, also referred to teacher-centered instruction, stresses learning by getting information from teachers and textbooks by considering teacher as transmitter of the knowledge as well as student as the recipient of the knowledge or passive learner (Chan & Elliott, 2004). On the other hand, the constructivist conception, also referred to student-centered instruction, stresses the importance of experience and active learning process that encourages discovery, collaboration and critical thinking by considering teacher as a counselor as well as student as an active participant (Chan & Elliott, 2004). Moreover, researches highlighted that there is huge shift from traditional conceptions to constructivist conceptions in education context (Aypay, 2011; Chan, Tan & Khoo, 2007; Eren, 2010; Isikoglu, Basturk & Karaca, 2009). Therefore, in recent years, research on teachers' conceptions about teaching and learning has attracted attention in the literature (Aypay, 2011; Chan, 2003; Chan & Elliott, 2004; Pajares, 1992). Accordingly, numerous studies disclosed that teachers' conceptions about teaching and learning have been associated to *teachers' images of themselves as a science teacher* (El-Deghaidy, 2006; Elmas, Demirdogen & Geban, 2011; Thomas & Pedersen, 1998a; Thomas, Pederson, & Finson, 2001; Yilmaz, Turkmen, Pedersen & Cavas, 2007), *approaches to learning* (Christensen et al., 1995; Gow & Kember, 1993; Trigwell et al., 1999), *and self-efficacy beliefs* (Czerniak, 1990; Finson et al., 1999; Gurbuzturk & Sad, 2009).

Teachers' images of themselves as a science teacher, for example, were used as an indication of their conceptions about teaching and learning –whether they are traditional or constructivist-based. The images can be defined as "an idea or mental representation, a conception with a visual or physical flavour, an experiential meaning, a context or history, and a metaphorical, generative potential" (Weber, Mitchell, & Nicolai, 1996, p. 6). According to Pajares (1992) lifestyle of teachers affects their images and beliefs about teaching and learning. Particularly, preservice science teachers develop their teaching images originated from their experiences during years of student (Calderhead & Robson, 1991). To determine teachers' images about science teaching and learning, the increasing number of researchers has taken advantage of their drawings (Finson, 2001; Finson et al., 1999; Thomas & Pedersen, 2003; Thomas et al., 2001; Yilmaz et al., 2007) since their personal experiences, theories, and perceptions of science teaching could be examined through their drawings (El-Deghaidy, 2006; Elmas et al., 2011; Thomas, & Pedersen, 1998a; Thomas et al., 2001; Yilmaz et al., 2007). In 2001, Thomas et al. developed the Draw-A-Science-Teacher-Test Checklist (DASTT-C) to enlighten the preservice elementary teachers' unforgettable episodes within their conceptions about how to teach elementary science. It provides a reflective opportunity for elementary preservice teachers to "picture themselves as elementary science teachers; place themselves along a teaching theory continuum; and consider the ways in which they develop their own science teaching beliefs" (Thomas et al., 2001, p. 298). The study revealed that drawings reflecting belief systems of teacher candidates can be used as an alternative measurement tool.

In addition to teachers' images of themselves as a science teacher, conceptions about teaching and learning is related to another variable called as learning approaches. Learning approach can be defined as "… the ways in which students go about their academic tasks, thereby affecting the nature of the learning outcome" (Biggs, 1994, p. 318). However, according to Saunders (1998), learning orientation, or approach, is seen as an extent to which students adopt rote/surface or meaningful/deep learning approaches while learning new concepts, ideas. According to Novak and Gowin (1984), meaningful learners refer to individuals who associate new knowledge to related concepts and their existing propositions. In contrast, rote learners refer to individuals who get new knowledge by rote memorization and arbitrarily integrate this new knowledge into their knowledge structures without interacting with existing one (Novak & Gowin, 1984). According to Gow and Kember (1993), teachers' conceptions of teaching had a considerable impact on their students' learning approaches. Similarly, Trigwell et al.'s (1999) study revealed that when teachers chose student-centered teaching approach, their students tended more potentially to choose deep learning approach and less potentially to choose surface learning approach. Correspondingly, it might be concluded that learning is seen as a process related to students and the tasks they involved in during instruction. At this point, it should be questioned: "What happens when the teacher is seen as the learner?" (Ciminelli, 2009). In the view of Watters and Watters (2007), deep understanding is an essential purpose of science teaching. For this reason, determining teachers' approaches to learning is important.

Self-efficacy beliefs are another important variable as it plays a role in teaching and learning conceptions of teachers. Teachers' self-efficacy beliefs can be defined as "a teacher's judgement of his or her capabilities to bring about desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated" (Tschannen-Moran & Woolfolk Hoy, 2001, p. 783). Moreover, teachers' self-efficacy beliefs became the focus of many research studies in the literature. For instance, Finson et al. (1999) claimed that low efficacious teachers tended to teach in an authoritative way and with teacher-centered thought. In contrast, when teachers have high sense of self-efficacy, their teaching tends to be characterized by more student-centered thought, the use of more inquiry approaches and the beliefs that they can help their students to succeed (Finson et al., 1999). Correspondingly, Czerniak (1990) claimed that while high efficacious teachers tend to use student-centered conception, low efficacious teachers are more potentially to use teacher-centered conception. In the same manner, Gurbuzturk and Sad (2009) investigated the relationships between preservice teachers' traditional vs. constructivist educational beliefs and self-efficacy beliefs. The researchers found that as preservice teachers' self-efficacy beliefs about student engagement to the lesson increased, their constructivist teacher beliefs increased. On the other hand, as preservice teachers' general self-efficacy beliefs and self-efficacy beliefs about classroom management and using instructional strategies increased, their traditional teacher beliefs increased (Gurbuzturk & Sad, 2009). Based on the aforementioned literature, determining teachers' self-efficacy beliefs regarding science teaching is also important.

All in all, the review of the related literature showed the importance of the teachers' conceptions about teaching and learning, their approaches to learning, and their self-efficacy beliefs. In this aspect, the following research questions were explored in the present study:

1. What images do preservice science teachers have of themselves as science teachers?
2. What are the preservice science teachers' self-efficacy beliefs regarding science teaching?
3. What are the teaching and learning conceptions adopted by preservice science teachers?
4. What is the learning approach adopted by preservice science teachers?
5. What is the relationship between preservice science teachers' teaching and learning conceptions self-efficacy beliefs, and learning approaches?

1.1 Significance of the Study

The previous research examined the variables of the present study including teaching and learning conceptions, self-efficacy beliefs and learning approaches of preservice science teachers. In the light of these studies, it can be concluded that the variables of the present study play important roles in preservice teachers' future classroom behavior and instruction. Although there used to be traditional classrooms in Turkey, as of the year 2004, constructivist classrooms in which students construct their own knowledge by the assistance of their teachers have been emphasized within the science and techonology curriculum (Kızılgunes, 2007). Similarly, teacher education programs were restructured according to constructivist theory, multiple-intelligence theory and student-centered teaching approaches (Yılmaz et al., 2007). Consequently, preservice teachers have been educated in and encouraged to apply teaching strategies depends on constructivism and inquiry (Yılmaz et al., 2007). However, Pajares (1992) asserted that teachers are more likely to adopt curriculum reforms if such reforms consistent with their instructional beliefs and maintained that "unexplored entering beliefs may be responsible for the perpetuation of antiquated and ineffectual teaching practices" (Pajares, 1992, p. 328). Similarly, in the view of Prawat (1992), if teachers are encouraged to rethink and reexamine their existing beliefs, many problems related with the implemantation of student-centered approach could be overwhelmed. Since teachers are central to science education and also the leading actor/actress performing new curricular reform in their classrooms, the success of such curricular reforms in education depends mostly upon teachers. Moreover, it has been claimed that it is not an easy process to change preservice teachers' conceptions about teaching and learning, especially preservice teacher with low sense of self-efficacy beliefs (Gurbuzturk, Duruhan, & Sad, 2009). Since teachers' self-efficacy beliefs, while strong sense of self-efficacy beliefs is a desired characteristics of a teacher (Savran & Cakiroglu, 2007), are once established, they usually are difficult to change (Tschannen-Moran, Woolfolk Hoy, & Hoy, 1998). Furthermore, Thomas et al. (2001) claimed that there is a powerful effect of traditional science learning experiences on elementary teachers' preferred way of science teaching: student-centered or teacher-centered. As a result, all of these might raise a new problem that is the lack of teachers adopting new curricular reform, having strong sense of self-efficacy beliefs, and also having meaningful approaches to learning to meet the criteria of science and techonology curriculum in 2004. Therefore, determining the relationship between preservice science teachers' conceptions about teaching and learning, self-efficacy beliefs, and learning approaches, before their graduation, is gaining a vital importance since a well-prepared teaching force is necessary for effective science education (Weiss, Banilower, McMahon & Smith, 2001). Considering the importance, just as Gurbuzturk et al. (2009) pointed out that teacher education can be seen as composition of belief systems. Thus, it directs science teacher educators ,firstly, to take pre-existing preservice science teachers' self-efficacy beliefs, conceptions and approaches to learning into consideration and then modify, or develop them further (Gurbuzturk et al., 2009). Therefore, the current study was useful and base for making developments in science teacher education programs, contributing the judgements and decisions of science teacher educators. Consequently, science teacher educators could help preservice science teachers to become aware of their beliefs and conceptions (Chan & Elliott, 2004) and how these conceptions about teaching and learning are applied in classroom settings. Regarding these important variables of the present study, the majority of previous studies concentrated on the relation between teachers' images about themselves as science teachers and their science teaching efficacy; or the relation between preservice teachers' teaching and learning conceptions and their students' approaches to learning. However, there is no research investigating the relationship among preservice science teachers' learning approaches, their science teaching self-efficacy beliefs and their conceptions about teaching and learning, simultaneously. So, current study attempted to extend the related literature and provide more detailed picture on these variables.

1.2 Definition of the Important Terms

Image: "An idea or mental representation, a conception with a visual or physical flavour, an experiantial meaning, a context or history, and a metaphorical, generative potential" (Weber et al., 1996, p. 6).

The conceptions about teaching and learning: "The beliefs held by teachers about their preferred ways of teaching and learning. These include the meaning of teaching and learning and the roles of teacher and pupils" (Chan & Elliott, 2004, p.819).

The constructivist conception: "It emphasizes the creation of active learning environments that permit critical thinking, discovery and collaboration" (Chan & Elliott, 2004, p.819).

The traditional conception: "The teacher acts as the source of knowledge and students as passive recipient of knowledge. Such model/conception emphasizes learning by receiving information, especially from the teacher and from textbooks, to help students encounter and learn well-defined concepts" (Chan & Elliott, 2004, p.819).

Preservice science teachers: Student teachers who are studying at the elementary science teacher education department of the universities.

Learning approaches: "The ways in which students go about their academic tasks, thereby affecting the nature of the learning outcome" (Biggs, 1994, p. 318).

Meaningful learners: Individuals who associate new knowledge to related concepts and their existing propositions. (Novak & Gowin, 1984).

Rote learners: Individuals who get new knowledge by rote memorization and integrate this new knowledge into their knowledge structures without interacting with existing one (Novak & Gowin, 1984).

Self-efficacy: "Beliefs in one's capabilities to organize and execute the courses of action required to produce given attainment" (Bandura, 1997, p. 3).

Teacher self-efficacy: "A teacher's judgement of his or her capabilities to bring about desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated" (Tschannen-Moran & Woolfolk Hoy, 2001, p. 783).

CHAPTER 2

LITERATURE REVIEW

The purpose of this literature review is to provide framework for the investigation of the relationships among preservice science teachers' conceptions about teaching and learning, learning approach and science teaching self-efficacy beliefs. For this specified purpose, related literature are reviewed and presented in four main sections. The first section reports preservice elementary science teachers' conceptions about teaching and learning within historical perspective. Also, the subtopic of the first section includes information about the use of mental models within the perspective of teaching and learning conceptions. The second section presents the learning approaches. The third section is about the conceptualization of self-efficacy beliefs. The fourth section of the review focuses on the relationships between preservice teachers' conceptions about teaching and learning, learning approaches and self-efficacy beliefs.

2.1 Teachers' Conceptions about Teaching and Learning

Conceptions were defined in the literature as "Conceptions are specific meanings attached to phenomena which then mediate our response to situations involving those phenomena…In effect, we view the world through the lenses of our conceptions, interpreting and acting in accordance with our understanding of the world." (Pratt, 1992, p. 204). Numerous studies in teacher education have suggested that teachers' beliefs have an impact on their conceptions in classroom teaching (Aypay 2011; Chan & Elliott, 2004; Cheng et al., 2009). The conceptions about teaching and learning refer to "the beliefs held by teachers about their preferred ways of teaching and learning. These include the meaning of teaching and learning and the roles of teacher and pupils" (Chan & Elliott, 2004, p. 819). The review of the related literature showed that conceptions about teaching and learning have been categorized under two dimensions: traditional teaching/learning model and constructivist teaching/learning model. However, there are various names used for categories of the conceptions about teaching and learning such as teacher-centered, student-centered (Kember, 1997), learning-centered, teaching-centered (Samuelowicz & Bain, 2001), and traditional teaching/learning model, constructivist teaching/learning model (Chan & Elliott, 2004). Although the names and the categories of the conceptions about teaching and learning changed time to time or study to study, these categories refers same meaning. For example, Chan and Elliott (2004) expressed that the traditional teaching/learning conception, also referred teacher-centered instruction, stresses learning by getting information from teachers and textbooks by considering teacher as transmitter of the knowledge as well as student as the recipient of the knowledge or passive learner. On the other hand, the constructivist teaching/learning conception, also called student-centered instruction, stresses the importance of experience and active learning process that encourage critical thinking, discovery and cooperation by considering teacher as counselor as well as student as active participant (Chan & Elliott, 2004). To avoid confusion, Chan and Elliott's terms were used for the categories of the conceptions about teaching and learning throughout the present study.

Numerous studies indicated that conceptions about teaching and learning have been linked to epistemological beliefs (Aypay 2011; Chan & Elliott, 2004; Cheng et al., 2009), nature of science (Tsai, 2002), teaching and learning environment (Struyven, Dochy,& Janssens, 2010), constructivism (Kabapınar, 2010; Plourde & Alawiye, 2003; Prawat, 1992; Uzuntiryaki, Boz, & Kirbulut, 2010), teachers' images of themselves as a science teacher (El-Deghaidy, 2006; Elmas, Demirdogen & Geban, 2011; Thomas & Pedersen, 1998a; Thomas, Pederson, & Finson, 2001; Yilmaz, Turkmen, Pedersen & Cavas, 2007), approaches to learning (Gow & Kember, 1993; Richardson, 2005; Trigwell, Prosser & Waterhouse, 1999), and self-efficacy beliefs (Czerniak, 1990; Finson et al., 1999; Gurbuzturk & Sad, 2009). For instance, Tsai (2002) investigated the relationship among teachers' beliefs about teaching science, learning science and nature of science. The researcher interviewed with thirty-seven secondary school science teachers, who study in physics and chemistry, in Twain. As a result of interviews, teachers' beliefs about teaching science, learning science and nature of science were classified as 'traditional', or 'process', or 'constructivist' respectively. In traditional category, teaching science was defined as knowledge transmission from teacher and learning science was defined as receiving knowledge from reliable sources. Process category includes both teaching and learning science as an activity focused the process of the science. In constructivist category, while teaching science was defined as assisting students to construct their knowledge, learning science was defined as constructing personal own meaning (Tsai, 2002). The researcher found that twenty one science teachers (57%) had traditional beliefs about teaching science, learning science and nature of science. Also, most teachers' (60%) beliefs about teaching, learning and science were congruous. Therefore, these congruent beliefs called as 'nested epistemologies' (Tsai, 2002). Based on the results, Tsai (2002) claimed that nested epistemologies had an effect on teachers' perceptions of the implementation of science in the classrooms. In another study, Chan (2004) examined the relationship between Hong Kong preservice teachers' (N=385) epistemological beliefs and their teaching and learning conceptions. In the analysis, Canonical Correlation showed that preservice teachers with low scores on epistemological beliefs subscales including Innate/Fixed Ability, Authority/Expert Knowledge and Certainty Knowledge would be potentially to have low scores for the Traditional Conception. Based on this analysis, the researcher concluded that teacher education students who have constructivist conceptions believe that knowledge is tentative and that one's ability is not innate. On the other hand, teacher education students who have traditional conceptions believe that knowledge is certain. In a separate study, Chan and Elliott (2004) conducted a study to give a detailed picture about the empirical research on the relationships between epistemological beliefs and teachers' conceptions about teaching and learning. Their study revealed that there was a positive relation among prospective teachers' traditional conceptions and innate/fixed ability beliefs (r=.395), authority/expert knowledge beliefs (r=.402), and certainty knowledge beliefs (r=.311). However, there was a negative relation among prospective teachers' constructivist conceptions and learning/effort process (r= -.392). Similarly, in Turkey, Aypay (2011) conducted a study about the relationships among the teaching-learning conceptions and epistemological beliefs of student teachers. The results of the study showed that the Turkish student teachers were strongly preferred constructivist conception (*M*=4.1) than to the traditional conception (*M*=2.7) in teaching and learning. According to Aypay, possible reason of this outcome was the recent reform in the curriculum and teaching-learning activities based on constructivism in the Turkish Education System. It was also found that teaching and learning conceptions differed based on the gender. The mean scores of female student teachers with the constructivist conception (*M*=4.23) was significantly higher than that of males while the scores of male student teachers with the traditional conception (*M*=2.91) was significantly higher than that of females (*M*=2.67). The findings on the relationship between epistemological beliefs and conceptions on teaching and learning indicated that student teachers' constructivist conception increased while their beliefs about learning/effort process increased and their beliefs about authority/expert knowledge decreased. On the other hand, while student teachers' beliefs about the certainty of knowledge increased, their scores on the constructivist conception decreased. According to the researcher, findings of the study revealed consistency with the constructivist approach.

On the other hand, some researchers focused on constructivism regarding teaching and learning conceptions in their study. For instance, Plourde and Alawiye (2003) investigated the correlation between preservice teachers' beliefs about personal knowledge of constructivism and personal application of constructivist teaching and learning with a sample of 511 student teachers who completed their student teaching experience. Data were collected through Student Attributes Form, which included three questions about constructivism regarding preservice teachers' knowledge and application beliefs. The results showed that there was a strong correlation (*r*=.76) between preservice teachers' constructivist knowledge, which means the construction of their own meaning associating what they already know and what they learn, and application. In other words, when constructivist knowledge of preservice teachers increased, they tended to believe that they are able to put constructivist principles into practice. Similarly, Uzuntiryaki, Boz and Kirbulut (2010) examined eight Turkish preservice chemistry teachers' beliefs regarding constructivism and the reflection of those beliefs in their teaching practice by means of semi-structured interviews, observation notes and lesson plans. In data analysis process, interviews were firstly transcribed and analyzed to find patterns about teachers' beliefs about constructivism, and researchers developed a category system. Then, preservice chemistry teachers' lesson plans were investigated and their practices were observed to see how preservice chemistry teachers transformed their beliefs into practice. It was found that most preservice teachers moderately or weakly adopt the conceptions of constructivism. Also, the study showed that there was no clear-cut relationship between beliefs and practice. For example, while preservice teachers with weak conception of constructivism successfully integrated traditional beliefs into their instructions, preservice teachers with strong or moderate conception of constructivism had some difficulties implementing their beliefs into their instruction. Therefore, they more likely to move from constructivist instruction to traditional instruction (Uzuntiryaki et al., 2010). According to Uzuntiryaki et al. (2010), the reasons behind the results might be lack of content knowledge, insufficient school facilities and the difficulty of putting constructivist principles into practice.

Another study which focused on the effect of teaching and learning settings in teaching approaches was conducted by Struyven, Dochy and Janssens (2010). The sample of the study consisted of 852 Flemish freshmen student teachers who took child development course. Data were collected by a pre-test/post-test experimental design using Approaches to Teaching Inventory. Preservice teachers in experimental group were instructed within student-activating learning environment setting whereas preservice teachers in control group were instructed within lecture-based learning environment setting. For the experimental group, the mean difference between the post-test and pre-test showed that student teachers' preference for student-centered approach to teaching increased after the course. In other words, student teachers within student-activating learning environment setting including problem-based learning activities, teamwork, role-plays and case studies were more likely to choose student-focused teaching approach. Moreover, student teachers in the control group developed both student-focused and teacher-centered approach to teaching. According to Struyven et al. (2010), it was not surprising since student teachers have minimally outlined teaching approaches when they entered teacher education. During their teacher education programmes, their teaching approaches gained more explicit and definite form. Therefore, it was seen that both categories of teaching approaches increased during the first year of teacher education (Struyven et al., 2010).

All in all, numerous studies showed the importance of teaching and learning conceptions studies in educational research. Studies related with conceptions about teaching and learning showed that teachers' classroom behaviors and actions are affected by their teaching and learning conceptions. Moreover, the relationship between teachers' images of themselves as a science teacher and their conceptions about teaching and learning are shown in the literature. In the following section, the use of mental models within the perspective of teaching and learning conceptions were examined in detail.

2.1.1 The Use of Mental Models within the Perspective of Teaching and Learning Conceptions

Image is literally defined as "an idea or mental representation, a conception with a visual or physical flavour, an experiential meaning, a context or history, and a metaphorical, generative potential" (Weber et al., 1996, p. 6). In 1983, Norman stated that people constitute "mental models of themselves and of things with which they are interacting" (p. 7) such as environment and the artifacts of technology. He defined mental model as "…are what people really have in their heads and what guides their use of things" (1983, p.12). To learn more about identity and mental models, drawings have been used as markers and mirrors because drawings give a chance to review deeply human sense-making unlike written or spoken texts do (Weber et al., 1996). Also, they tell things that can not be expressed in words such as the indescribable and the sub-conscious (Weber et al., 1996). Weber et al. (1996) claimed that our past experiences like what we have seen, thought, imagined and remembered reflect into our drawings automatically. Similarly, Calderhead and Robson (1991) remarked that preservice teachers develop their teaching images originated from their experiences during years of students such as an image of good teaching derived from teachers they knew. These images affect their knowledge transfer and practice as teachers. Therefore, several studies have focused on preservice teachers' drawings about science teaching and learning (Elmas et al., 2011; Minogue, 2010; Thomas & Pedersen, 2003; Thomas et al., 2001; Ucar, 2012; Yilmaz et al., 2007) and their relationship with different domains (Markic & Eilks, 2010); self-efficacy beliefs (El-Deghaidy, 2006; Finson, 2001; Finson et al., 1999); and perceptions of students held about scientists (Finson, Pedersen & Thomas, 2006). For instance, in one of the studies Thomas et al. (2001) aimed to enlighten the preservice elementary teachers' unforgettable episodes within their conceptions about how to teach elementary science using Draw-A-Science-Teacher-Test Checklist (DASTT-C). This instrument provided elementary preservice teachers an opportunity to "(a) picture themselves as elementary science teachers, (b) place themselves along a teaching theory continuum, (c) consider the ways in which they developed their own science teaching beliefs" (Thomas et al., 2001, p. 298). Using checklist, the researchers can decide what attributes of an elementary science teachers have: teacher-centered or student-centered. While students are passive receivers in teacher-centered classrooms, teachers are at the centre of the learning and instruction. However, students are active participants and at the centre of the learning in student-centered classrooms. Furthermore, the nature of classroom is open and encouraging where students do inquiry and exploration (Thomas et al., 2001). As a result of the study, the researchers concluded that preservice teachers develop elementary science teaching images from their experiences during years in elementary schools. Also, it was found that the strong memories of preservice teachers' own science learning experiences during elementary, high school and college science courses were correlated with their images. According to the researchers, these results supported the general idea that preservice teachers might have perceptions of themselves while teaching science that distinct from teachers' who actually get in touch with children in a classroom environment. In a similar study, Thomas and Pedersen (2003) studied on identification of preservice teachers' images and perceptions bringing to science method courses. They claimed that preservice teachers' prior knowledge and experiences acts as filter while they take action. The results showed that preservice teachers hold ideas and beliefs derived before college. So, they opened a door to these questions for future studies "How, then, can elementary science teacher preparation programs hold to the responsibility of bringing new teachers into new, reformed understanding? How can preparation programs be more directly involved in helping students reframe their thinking?” (p. 328). Apart from, Markic and Eilks (2010) examined first-year science education students’ beliefs about teaching and learning conceptions in different domains of the natural sciences (primary school science, secondary-level chemistry, physics and biology). Data were collected from 266 first-year science education students from four separate German universities by means of DASTT-C. The results revealed that most of the biology and primary school first-year science students inclined to draw classroom instruction which points out more student-centered beliefs. However, chemistry and physics first-year science students inclined to draw classroom instruction which points out teacher-centered beliefs. Moreover, t-tests analysis revealed that first-year physics students strongly adopted teacher-centered beliefs when compared to any other group and chemistry first-year science students strongly adopted teacher-centered beliefs on average when compared to other groups including biology and school science. According to Markic and Eilks (2010), one of the possibility of this result might be that preference for a specific teaching style changes with respect to specific discipline. For instance, while chemistry and physics subjects are organized using teacher-centered orientation, biology and primary school science subjects are taught in student-centered orientation (Markic & Eilks, 2010).

Another study which focused on the relationship between teachers’ teaching style (on a continuum from didactic to constructivist) and their students’ perceptions about science learning and scientists’ work was conducted by Finson, Pedersen and Thomas (2006). The researchers hypothesized that teachers who adopted constructivist teaching style were more potentially to have students whose perceptions of scientists are less stereotypical, i.e. working scientist in their laboratories or scientist with wearing white coat and lab glasses. Their sample consisted of two different groups; 9 classroom science teachers at middle grade level and 327 students (from 5 to 8th grade) in USA. Data collection procedure was carried out a period of time between 12 and 13 weeks in which students have been subjected to each of teachers’ science teaching. In the study, teachers’ teaching styles and the students' perceptions of scientists were assessed by means of DASTT-C and Draw-a-Scientist-Test (DAST-C) respectively. Nonparametric correlational results showed that there was no significant relationship between teachers' teaching style and their students' perceptions about science learning and scientists' work. As a result, Finson et al. (2006) concluded that students perceptions about science teaching and scientists' work are resistant to change.

On the other hand, considering the fact that Turkish science and technology curriculum in 2004 is based upon constructivism, Turkish science teachers should be motivated to use teaching approaches such as constructivist-based and inquiry method. To give a detailed picture about preservice elementary teachers' perceptions regarding science teaching in Turkey, Yılmaz et al. (2007) examined elementary preservice teachers' image of science teaching by means of DASTT-C. They found that Turkish elementary preservice teachers' science teaching style perception is 20% student-centered, 41% teacher-centered and 39% between student-centered and teacher-centered. According to the researchers, one of the possible reasons behind this might be that science teacher educators may not sufficiently provide the applicability of constructivism for instructional goals to their preservice elementary teachers in science courses. Similarly, Elmas et al. (2011) explored preservice chemistry teachers' images of science teaching in their future classrooms and association between instructional style and gender. They found that preservice chemistry teachers' science teaching style perception was 37.9% student-centered, 22.7% teacher-centered and 39.4% between student-centered and teacher-centered. They concluded that preservice chemistry teachers adopt both student-centered and teacher-centered instruction approaches. The researchers pointed out the reason behind this as restructured 2004 education reform in the science curriculum, that support the effectiveness of student-centered instructional pedagogies, and preservice chemistry teachers' teacher-centered school experiences as learners. There was also significant association between instructional style and gender. Male preservice chemistry teachers were found to be less willing to use student-centered instructional approach than female preservice chemistry teachers. According to the researchers, male could like to be authoritative figure accompanying to their social role in the

Turkish community. More recently, Ucar (2012) evaluated preservice science teachers' perspectives on science, scientists and science teaching by means of "Draw a Scientist Test", "Draw a Science Teacher Test" and "Students' Views about Science" tests. A cross-sectional study was conducted with a sample of 145 preservice elementary science teachers in their first, second, third and fourth years of education. One-way ANOVA showed that while preservice teachers in their second year were more likely to have stereotypical images of scientists, in the third and fourth years of education, they were less likely to have stereotypical images of scientists. The researcher came to conclusion that this was due to presence of the teacher education programs designed with more science-related activities. Moreover, preservice teachers' DASTT-C scores varied significantly by years of education. Preservice teachers' teacher-centered teaching style turned into student-centered teaching style throughout the years up to third year. According to Ucar (2012), the results were not surprising because science method courses in teacher education programs were framed to educate prospective teachers to adopt a constructivist approach and practice student-centered teaching style. Besides, preservice teachers might be affected from student-centered examplary teaching styles during practicum hours at schools (Ucar, 2012). No significant correlations, however, were found between DAST-C and DASTT-C scores of the preservice teachers. Ucar (2012) concluded that perceptions about science and science teaching did not parallelly develop.

To sum up, several studies showed that both preservice and inservice teachers' conceptions about teaching and learning can be assessed through the use of DASTT-C. Even so, it is known that conceptions about teaching and learning are related to other variables such as learning approaches. In the following section, learning approaches were examined in detail.

2.2 Learning Approaches

Learning approach, according to Biggs (1994), is defined as "… the ways in which students go about their academic tasks, thereby affecting the nature of the learning outcome" (p. 318). Historically, in 1976, Marton and Säljö, who are the pioneer of the researches on learning approaches, wanted Swedish university students to read substantial passages of prose. Students were interviewed about the meaning of the passages and also about how they approach to read the passages. At the end, different levels of processing information are categorized as; surface-level and deep-level processing, later called surface and deep approaches to learning (Marton & Säljö, 1984). In their study, individuals adopted surface approach concentrates on the surface features of text employed. On the contrary, those who seek the rudimentary knowledge prefered a deep approach. Correspondingly, in 1987, Biggs provided a general framework and summary of the characteristics of deep and surface approaches to learning (see Table 2.1). Nevertheless, in the view of Saunders (1998), learning orientation, or approach, is seen as an extent to which students adopt rote or meaningful learning approaches while learning new concepts or ideas. According to Novak and Gowin (1984), meaningful learners refer to individuals who associate new knowledge to related concepts and their existing propositions. In contrast, rote learners refer to individuals who get new knowledge by memorization and arbitrarily integrate this new knowledge into their knowledge structures without interacting with existing one (Novak & Gowin, 1984). To avoid confusion, the terms 'meaningful approach' and 'rote approach' were used for the dimensions of the learning approaches throughout the present study.

Since 1970s, the way students approach to their learning task, or their learning approaches have been focus of educational research. There are various researches in the literature generally focused on the relationships between students' approaches to learning and different factors such as perceptions of learning environment (Ozkal, Tekkaya, Cakiroglu, & Sungur, 2009), contextual and personological factors (Smith & Miller, 2005; Zeegers, 2001), eliminating misconceptions (BouJaoude, 1990), motivation and epistemological beliefs (Cavallo, Rozman, Walker, & Blickenstaff, 2003; Kizilgunes, Tekkaya, & Sungur, 2009), and academic achievement (Diseth & Martinsen, 2003) For instance, in 1992, BouJaoude investigated the relationship between the learning approaches of high school students, their prior knowledge and the change in their chemical misunderstandings and the differences between the responses of students of different learning approaches on the same test. The researcher concluded that students who see themselves as rote learners performed worse than meaningful learners on the misunderstandings posttest.

Table 2.1 Summary of The Characteristics of Deep and Surface Approaches to Learning (Biggs, 1987, p. 15)

Dimensions of Learning Approaches	
Deep Approach	**Surface Approach**
Student is interested in the academic task and derives enjoyment from carrying it out.	Student sees the task as a demand to be met, a necessary imposition if some other goal is to be reached (a qualification for instance).
Student searches for the meaning inherent in the task (if a prose passage, the intention of the author).	Student sees the aspects or parts of the task as discrete and unrelated either to each other or to other tasks.
Student personalises the task, making it meaningful to own experience and to the real world.	Student is worried about the time the task is taking.
Student integrates aspects or parts of task into a whole (for instance, relates evidence to a conclusion), sees relationships between this whole and previous knowledge.	Student avoids personal or other meanings the task may have.
Student tries to theorise about the task, forms hypotheses.	Student relies on memorisation, attempting to reproduce the surface aspects of the task (the words used, for example, or a diagram or mnemonic).

Another study which focused on the relationship between students' approaches to learning, contextual factors (e.g., teaching/learning activities, institutional values, assessment procedures) and personological factors (e.g, student age, sex, prior experiences) was conducted by Zeegers (2001). Researcher monitored the change in learning approaches more than a three-year period and examined the relation between age and sex of students and university entry mode on students' learning approaches with a sample of 200 commencing students who study in a science course at an Australian university. Paired sample t-tests and repeated-measures analysis of variance were used to evaluate the changes over time. The results showed that Australian tertiary science students' learning approaches was developed by the tertiary experience. Zeegers (2001) concluded that students' learning approaches is active and open to change as a result of their learning experiences. Also, there was no significant relationship between age and sex of students and university entry mode on students' learning approaches. Another evidence for the relation between students' approaches to learning and contextual factors and personological factors was provided by the study of Smith and Miller (2005). In an attempt to provide evidence on how assessment type (multiple-choice and essay type) may have an effect on student learning and investigate whether discipline of study may have an impact on student learning and relationship between gender and learning approaches, Smith and Miller (2005) conducted a study with a sample of 248 Australian university students, enrolled in economics, computing and psychology. According to them, students more inclined to adopt surface approach in a multiple-choice type of assessment. However, essay type of assessment can be seen to affect the students to employ a deep approach to learning. After all, the results showed that there was no significant impact of assessment type on how students approach their learning, and female students were higher than male students in achieving strategy. There was also significant impact of discipline on learning approaches. Business students get lower scores on deep strategy and higher scores on surface strategy than psychology students.

The study of Ozkal et al. (2009) was aimed to propose a conceptual model of relationships between learning approach, constructivist learning environment perceptions and epistemological beliefs. The data were obtained from eight grade elemantary school students by means of Constructivist Learning Environment Survey (CLES), Scientific Epistemological Beliefs (SEB) and Learning Approach Questionnaire (LAQ). The resarchers found that learning approach of students were predicted directly and indirectly through tentative beliefs by all constructivist learning environment variables (Uncertainty, Shared Control, Personal Relevance, Critical Voice and Student Negotiation). Students who hold tentative beliefs about knowledge tended to learn in line with meaningful orientation. Also, students with constructivist learning environment perceptions were more potentially to adopt meaningful learning approaches while studying science. On the other hand, Schommer (1990) claimed that learning approaches were affected by students' epistemological beliefs. For instance, Kizilgunes et al. (2009) presented a model to explain the relationship between sixth grade students' epistemological beliefs (source, certainty, development and justification), learning approach (meaningful and rote learning), motivation (learning goal, self-efficacy and performance goal) and achievement. The results of the path analysis indicated that students' learning approach was directly affected by their epistemological beliefs. Furthermore, epistemological beliefs of students, indirectly, affect their learning approaches through their direct influence on achievement motivation. In other words, when students believed that knowledge is developing and handed down by authorities, they tended to be self-efficacious in their learning and have higher levels of learning. Moreover, it was found that students who assumed that knowledge is certain and developing adopted meaningful-learning strategy. In contrast, students who assumed that knowledge is handed down by authorities prefer to use rote-learning strategy. Similarly, Ozkan (2008) investigated the interrelationship between epistemological beliefs (certainty, source, justification, and development), learning approach (meaningful learning and rote learning), self-regulated learning strategies and science achievement with a sample of 1240 seventh grade students. The results of the structural equation modeling indicated that major contributors of learning approaches and science achievement were epistemological beliefs. It was also found that students' self-regulated learning strategies, which in turn affect their science achievement were predicted by their adopted learning strategies. Correspondingly, Cavallo et al. (2003) stated that it is necessary that college professors should attempt to comprehend how students learn science and how learning skills and strategies contribute for students' understanding of the subject. Therefore, they investigated learning approaches, motivational goals, epistemological beliefs and reasoning abilities of college students regarding science concept understanding and course achievement with a sample of sophomore and junior majors. For this purpose, the learning approach questionnaire, the achievement motivation questionnaire, the reasoning ability test and the science knowledge questionnaire were used to measure the understanding of how students learn science. The findings showed that for biology students, there was a significant correlation between meaningful learning and learning goals (r=.46). In contrast, rote learning was positively correlated with performance goals (*r*=.37). They found that most of the students, especially biology students believed that the only way to learn science is rote learning. Regarding the other related variables to learning approaches, Yenilmez (2006) explored the predictive effects of eighth grade students' meaningful learning orientation, prior knowledge, reasoning ability and mode of instruction on their comprehension in the concepts of photosynthesis and respiration in plants. Data collection was done through a pre-test/post-test experimental design using two-tier multiple choice diagnostic test, Test of Logical Thinking and Learning Approach Questionnaire. Students in experimental group (*N*=117) were exposed to conceptual change instruction while students in control group (*N*=116) were exposed to traditional instructon. The pre-test scores of students were accepted as their prior knowledge. The results of the study showed that in experimental group, students' prior knowledge was the best predictor of achievement, while in control group, students' reasoning ability was the best predictor of achievement. Moreoever, in traditional classrooms, it was found that students' reasoning abilities and prior knowledge significantly contributed to their comprehension in the concepts of photosynthesis and respiration in plants. However, in conceptual change classrooms, it was found that students' reasoning abilities, prior knowledge, meaningful learning approach and gender significantly contributed to their understanding the concepts.

In another study, Diseth and Martinsen (2003) examined the relationship between approaches to learning (deep, strategic and surface), motives, cognitive style and academic achievement. The data were obtained from 192 undergraduate psychology students by means of 'Approaches and Study Skills Inventory for Students' to measure the learning approaches; 'Need for Cognition' to determine the cognitive styles; 'Assimilator-explorer styles' to characterize the students with assimilator style and explorer style; and 'Achievement Motivation Scales' to determine the Academic Achievements of the students. In the study, deep learning approach refers to the intent to comprehend the meaning of learning material. However, surface learning approach indicates to the intention to replicate the given learning material. On the other hand, the intention of getting the best grades by adjusting their learning orientation to the assessment demands refers to the strategic learning approach

(Diseth & Martinsen, 2003). The results of the study revelead that both surface approach, strategic approach and cognitive styles were significantly related with achievement. Moreover, it was found that the best predictors of academic performance were surface and strategic approaches to learning. However, deep approach did not predict achievement.

In the literature, there are also various researches focused on the relationships between teachers' approaches to learning and different factors such as epistemological beliefs (Chan, 2003), approaches to teaching (Christensen et al., 1995; Trigwell & Prosser, 1996; Trigwell et al., 1999), preferences for learning environment (Van Petegem, Donche & Vanhoof, 2005), personological factors (Tural Dincer & Akdeniz, 2008), academic performance and satisfaction (Yilmaz & Orhan, 2010) and nature of knowledge about learning (Brownlee, Purdie, & Boulton-Lewis, 2003). For instance, Chan (2003) examined the relation between epistemological beliefs and study approaches with a sample comprising 292 Hong Kong preservice teachers. The researcher found a positive correlation between surface approach and innate/fixed ability (r=.21), authority/expert knowledge (r=.19), and certainty knowledge (r=.18). Based on the results, the researcher concluded that students with naive epistemological beliefs tended to adopt surface approach.

The study of Tural Dincer and Akdeniz (2008) aimed to determine science student teachers' learning approaches and investigate the relationship between learning approaches and other variables including class level and gender. The data were collected from 108 student teachers by means of Revised Two-factor Study Process Questionnaire. The results of the study revelead that science student teachers generally adopt deep learning approaches. Regarding class level, it was found that science student teachers' preference for the use of deep approach to learning decreased from the first year to third year; increased from the third year to fourth year. Accordingly Tural Dincer and Akdeniz (2008), the reason behind the declining use of deep approach might be the heavy workloads of student teachers which discourage their positive attitudes toward science learning. The increase in the use of deep approach might result from using process based educational approaches, in which students construct their own knowledge through questioning, exploration and using problem-solving skills with the guidance of their teacher, instead of knowledge based educational approaches in the university. However, there was no relationship between science student teachers' learning approaches and their gender.

Regarding other contributor variables to learning approaches, Van Petegem et al. (2005) investigated the relationship between the learning styles and choice of learning environments of Flemish student teachers. The results indicated that student teachers' approaches to learning regarding the construction of knowledge were predictors of their constructivist learning environment choice. In other words, student teachers who experienced learning as a construction of their own meaning are likely to prepare lessons in meaningful, strategic and discovery-oriented environment (Van Petegem et al., 2005). Apart from that, to explore the relationship between the learning approaches and learning environments, Yilmaz and Orhan (2010) examined preservice English teachers' achievement and satisfaction regarding their approaches to learning in the blended learning environment. Blended learning environments refer to learning environments in which web-based and face-to-face methods are integrated (Yilmaz & Orhan, 2010). The results of the study revealed that the academic scores of the preservice English teachers did not differ in respect to their learning approaches. That is, preservice English teachers who adopted surface or deep learning approaches had similar achievement level in blended learning environment. Moreoever, it was found that deep learner preservice English teachers' average satisfaction level in blended learning environment significantly higher than surface learner preservice English teachers. According to the researchers, this was not suprising result because blended learning environment requires to study from web material and in which the responsibility of learning belongs to learner. Therefore, deep learners got a chance to comprehend the learning material for themselves (Yilmaz & Orhan, 2010).

In another study, Brownlee et al. (2003) examined the nature of student teachers' knowledge about learning and changes of such knowledge through years. Twenty-nine student teachers were interviewed at the begining (Time 1) and end (Time 2) of a year-long graduate diploma in education. The definition of learning, learning approaches, and descriptions of learning outcomes were revealed under two different categories: transformative learning and reproductive learning. Transformative learning defined as the construction of personal meaning and understanding with the transformation of knowledge from the learners' prior knowledge (Brownlee et al., 2003). In contrast, reproductive learning refers to the comprehending in which learning was a replication process rather than transforming process of knowledge (Brownlee et al., 2003). The researchers found that at both time phases, most student teachers believed that learning should be meaningful and so, they adopted to use transformative learning approaches. However, if the task to be learnt was uninteresting or focused on examination-based assessment, students teachers were more likely to adopt reproductive learning approaches suggesting that their choice of learning strategies differed based on the specific learning situation. Moreover, it was revealed in the study that there were no changes in student teachers' knowledge about learning over the year.

In 1993, Gow and Kember stated that teachers' conceptions of teaching had a considerable impact on their students' learning approaches at the departmental level. The researchers reported that students in departments, with high scores on learning facilitation, were more likely to adopt deep approach to learning. In contrast, students in departments with a greater tendency towards knowledge transmission were more potentially to adopt surface approach to learning (Gow & Kember, 1993). Correspondingly, Trigwell et al. (1999) examined the association between teachers' teaching approaches and their students' learning approaches with a sample of 3956 science students and 46 science teachers in Australian universities. Their study showed that while students whose teachers chose a student-centered approach to teaching were more likely to choose a deep approach to learning and less likely to choose a surface approach than students whose teachers chose a teacher-centered approach to teaching. Unlike Trigwell et al.'s (1999) study, Christensen et al. (1995) interviewed with 20 preservice primary teachers to examine their approaches to learning and their conceptions of teaching. They claimed that approaches to learning and conceptions of teaching were inseparably linked such that one evolved from the other. In other words, conceptions of teaching are imbedded within some teachers' approaches to learning based on their own experiences as students (Christensen et al., 1995). Their results showed that surface learners were more likely to see teaching as a transmission of information. On the contrary, deep learners were more likely to see teaching as facilitation of learning and thinking (Christensen et al., 1995).

To be brief, the related studies reviewed have mainly focused on the relationships between students' approaches to learning and different variables such as perceptions of learning environment, contextual and personological factors and motivation and epistemological beliefs (Cavallo et al., 2003; Kizilgunes et al., 2008; Ozkal et al., 2009; Smith & Miller, 2005; Zeegers, 2001). As well as, the relationships between teachers' teaching approaches, their conceptions of teaching, and their teaching environment perceptions were disclosed. Although aforementioned literature so far indicated that conceptions about teaching and learning are related to learning approaches, another line of research concentrated on the relationship between conceptions about teaching and learning and self-efficacy beliefs. In the following section, self-efficacy beliefs were examined in detail.

2.3 Self-Efficacy Beliefs

Self-efficacy was literally defined as "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainment" (Bandura, 1997, p.3). In 1977, Bandura hypothesized that "expectations of personal efficacy determine whether coping behavior will be initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles and aversive experiences" (p. 191). For this purpose, he offered two-component model of personal efficacy expectations; outcome expectancy and efficacy expectancy (see Figure 2.1). An estimation of a person about a behavior that lead to certain outcomes was called as outcome expectancy (Bandura, 1977). Efficacy expectancy was the belief that one can efficiently perform the behavior necessary to produce the outcomes (Bandura, 1977). There is difference between outcome and efficacy expectancy, shown in the diagrammatic representation below, since "individuals can believe that a particular course of action will produce certain outcomes, but if they entertain serious doubts about whether they can perform the necessary activities such information does not influence their behavior" (Bandura, 1977, p. 193).

Figure 2.1 Diagrammatic representation of the difference between efficacy expectations and outcome expectations. Adapted from "Self-efficacy: Toward a unifying theory of behavioral change," by A. Bandura, 1977, Psychological *Review,84*(2), p. 193. Copyright 2013 by the American Psychological Association.

Moreover, Bandura (1977) pointed out that personal efficacy expectations were arised from four information principal sources: performance accomplishment (later called mastery experience, Bandura, 1997), vicarious experience, verbal persuasion (later called social persuasion, Bandura, 1997) and physiological states. The most powerful one is performance accomplishments because this source depends on personal mastery experiences and once established, enhanced self-efficacy is inclined to generalize to other situation, vice versa. In other words, mastery expectations is increased by successes, however, decreased by repeated failures. The less dependable information source about one's abilities is vicarious experience. The widely used one is verbal persuasion due to its ease and ready availability. That is, if a person is socially persuaded, s/he is likely to initiate task and put greater effort. Emotional arousals can influence perceived self-efficacy in dealing with threatening situations because people have confidence in their physiological states in an exposure to stress and judging their anxiety (Bandura, 1977).

Subsequently, teacher efficacy has come into notice as an important issue in teacher education. Based on the Bandura's self-efficacy definition, teacher efficacy was defined as "…a motivational construct, proposes that the level of efficacy affects the amount of effort a teacher will expend in a teaching situation and the persistance a teacher will show in face of obstacles" (Gibson & Dembo, 1984, p. 213), or as "a teacher's judgement of his or her capabilities to bring about desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated" (Tschannen-Moran & Woolfolk Hoy, 2001, p. 783). In 2001, Tschannen-Moran and Woolfolk Hoy suggested an integrated model. In this model, teachers' efficacy judgments are related to analysis of the teaching task and its context, and assessment of self-perceptions of teaching competence. Vicarious experiences, mastery experiences, emotional arousal and social persuasion contribute both the analysis of them. Moreover, the model implies that the higher teacher efficacy, the better teachers' performance and which in turn the higher teacher efficacy, vice versa.

Numerous studies showed that teachers' self-efficacy beliefs have been linked to other variables such as beliefs about classroom management (Savran-Gencer & Cakiroglu, 2007; Woolfolk & Hoy, 1990), epistemological beliefs and epistemological world view (Yilmaz-Tuzun & Topcu, 2007), conceptions about teaching and learning (Czerniak, 1990; Eren, 2009; Gurbuztuk & Sad, 2009; Nie, Tan, Liau, Lau & Chua, 2012), attitudes toward implementing new instructional practices (Ghaith & Yaghi, 1997), success in science learning (Bleicher & Lingren, 2005) and understanding of science concepts (Tekkaya, Cakiroglu & Ozkan, 2004). Moreover, research on teachers' self-efficacy beliefs gave decisive information regarding the comparison of teachers' teaching self-efficacy beliefs in different countries (Cakiroglu, 2008; Cakiroglu, Cakiroglu, & Boone, 2005), the comparison of teaching self-efficacy beliefs of novice and experienced teachers (Tschannen-Moran & Woolfolk Hoy, 2007), and the changes in teacher efficacy during the early years of teaching (Woolfolk Hoy, 2000). For example, Woolfolk Hoy (2000) compared and assessed the teaching efficacy of prospective and novice teachers at the beginning of their preparation program (Phase 1), at the end of student teaching program (Phase 2) and after their first year of employement as a teacher (Phase 3) through longitudinal study. T-test for paired samples revealed that there was a significant increase in teaching efficacy from the beginning of their preparation program to the end of student teaching program. However, the changes from the end of student teaching program to the end of their first year of employement as a teacher represented significant decreases in teaching efficacy. Woolfolk Hoy (2000) concluded that during their student teaching program, prospective teachers had buffering such as a year-long internship experience in the classroom not in their own actual class as an employed teacher have. Therefore, there was a decrease in efficacy when this buffering was drawn back.

In another study, Savran-Gencer and Cakiroglu (2007) explored preservice science teachers' (N=584) classroom management and their efficacy beliefs in science teaching by means of Science Teaching Efficacy Beliefs Instrument (STEBI-B) and the Attitudes and Beliefs on Classroom Control (ABCC) inventory. The results showed that preservice teachers had generally positive sense of science teaching efficacy beliefs. Moreover, pearson product-moment correlation analysis revealed that instructional management subscale of ABCC inventory was positively and significantly correlated with both personal science teaching efficacy (r=.143, p<.01) and science teaching outcome expectancy (r=.135, p<.01). That is, preservice teachers, who believed in ability their teaching science and their students to learn science, were more likely to put controlling on instructional management (Savran-Gencer & Cakiroglu, 2007). On the other hand, people management subscale of ABCC inventory was negatively and significantly correlated with both personal science teaching efficacy (r= -.339, p<.01) and science teaching outcome expectancy (r= -.299, p<.01). In other words, preservice teachers who believed their ability in teaching science and their students to learn science were less likely to put controlling on people management (Savran-Gencer & Cakiroglu, 2007).

Furthermore, Bleicher and Lindgren (2005) investigated the relationships between conceptual understanding, self-efficacy and outcome expectancy beliefs as preservice teachers learned science in a constructivist-oriented methods class with a sample of 49 preservice elementary teachers. Bleicher and Lindgren (2005) hypothesized that "if preservice teacher have personal success learning science, they will then be more confident to teach it" (p. 206). In their study, the 6-week summer course was offered participating preservice teachers in hands-on activities, discussion and minds-on activities. The researchers used a mixed-method design consisting of both quantitative and qualitative research, for which preservice teachers kept reflective journals during semester. Two-tailed paired-sample t-test and correlation analysis were used to compare means of pre- and posttest administrations and associations between conceptual understanding, self-efficacy and outcome expectancy variables. Analysis showed that self-efficacy, outcome expectancy, and conceptual understanding of participants increased. Moreover, it was found that preconceptual understanding and pretest self-efficacy as well as postconceptual understanding and posttest self-efficacy were significantly correlated. According to the results of the study, the researchers pointed out that if there is an effort to develop science conceptual understanding for preservice elementary teachers, there will be positive correlation between their success in learning and self-efficacy in science teaching. Similarly, Turkish preservice science teachers' understanding of science concepts and their confidence in science teaching (N=299) were examined by Tekkaya et al. (2004). Their findings showed that personal science teaching efficacy (PSTE) scores of preservice science teachers correlated significantly and with the number of science courses completed in the university (r=.14, p<.05) and their conceptual understanding (r=.12, p<.05). The researchers concluded that preservice science teachers' ability to teach science effectively is related to the number of science courses completed and the level of conceptual understanding, positively.

The study of Yilmaz-Tuzun and Topcu (2007) aimed to investigate the relationship between four hundred and twenty-nine preservice elementary science teachers' (PSTs) epistemological beliefs, epistemological world views and self-efficacy beliefs. Multiple regression analysis was used to explain the contribution of self-efficacy beliefs (self-efficacy, outcome expectancy) and epistemological world view (realist, contextualist, and relativist) on preservice science teachers' epistemological beliefs (simple knowledge, innate ability, omniscient authority and certain knowledge). It was found that self-efficacy, outcome expectancy and epistemological world view significantly and negatively contributed to innate ability factor scores. That is, if PSTs accepted their students' learning ability is not fixed at birth, they could teach science effectively (Yilmaz-Tuzun & Topcu, 2007). For certain knowledge factor scores, it was found that there was a significant negative relationship between outcome expectancy and this factor scores suggesting that only when PSTs accept the scientific knowledge they teach as unchanging, they believe in affecting outcome expectancy. Also, it was found that only world view (realistic world view) significantly and positively related to simple knowledge factor scores. That is, PSTs prefered to use of student-centered teaching approaches (realistic world view) when students get the scientific knowledge by memorization (simple knowledge) (Yilmaz-Tuzun & Topcu, 2007). According to the researchers, PSTs in their study might assume that their students as static learners, who learn science effcetively by memorizing facts, when they teach scienctific concepts.

In another study, Ghaith and Yaghi (1997) explored the relationship between teachers' efficacy, experience and attitudes toward implementing new instructional practices. Data were collected from 16 middle school teachers and 9 high school teachers immediately after a four-day staff development programme on cooperative learning method of Student Teams Achievement Divisons (STAD) as the form of instructional innovation. The results revealed that teachers' attitudes toward implementing new instructional practices were negatively correlated with experience and positively correlated with personal teaching efficacy beliefs. That is, teachers with high sense of personal teaching efficacy tended to put instructional innovations into practice (Ghaith & Yaghi, 1997). The results also showed that more experienced teachers were less likely to use STAD as the form of instructional innovation. One of the possible reasons behind this might be corrosion of teachers' enthusiasm for adapting instructional innovation due to more years of experience in teaching (Ghaith & Yaghi, 1997).

Based on the relational analysis of student teachers' efficacy beliefs, achievement goals and their conceptions about teaching and learning, Eren (2009) found that there were two predictors of student teachers' conceptions about teaching and learning, which were their efficacy beliefs and achievement goals. Specifically, there was a significant and positive relationship among student teachers' constructivist conception and their self-efficacy beliefs (r=.12, p<.05). On the other hand, there was no significant correlation between student teachers' traditional conception and their self-efficacy beliefs. As a result of the study, Eren (2009) concluded that the main characteristics of student teachers who adopted constructivist conception were high self-efficacy beliefs, and high mastery-approach goal orientation.

In a study focused on the comparison of teachers' teaching self-efficacy beliefs in different countries, Cakiroglu et al. (2005) investigated preservice teachers' self efficacy beliefs regarding science teaching at a Turkish university and at a major American university. There were 100 preservice elementary teachers in Turkish sample and 79 preservice elementary teachers in American sample. The data were collected by means of STEBI-B. The results revealed that personal science teaching efficacy beliefs of USA preservice teachers were stronger than those of Turkish preservice elementary teachers. However, there was no significant difference in outcome expectancy beliefs of preservice elementary teachers in both countries.

To sum up, studies related with self-efficacy beliefs takes an important part in teacher education researches. These studies showed that self-efficacy beliefs have a powerful impact on teachers' behaviors in science classrooms (Czerniak, 1990; Eren, 2009; Ghaith & Yaghi, 1997; Gurbuztuk & Sad, 2009; Savran-Gencer & Cakiroglu, 2007).

2.4 Teachers' Conceptions about Teaching and Learning, Learning Approaches and Self-efficacy Beliefs

The National Science Education Standards in the US explained science learning as "Emphasizing active science learning means shifting away from teachers presenting information and covering science topics. The perceived need to include all the topics, vocabulary, and information in the textbooks is in direct conflict with the central goal of having students learn scientific knowledge with understanding" (National Research Council, 1996, p. 20). However, Thomas et al. (2001) believed that there is a powerful effect of traditional science learning experiences (in elementary school, high school and college) on elementary teachers' understanding of the nature of science and the way in which science should be taught.

On the other hand, it was anticipated that improvement in the teaching practices and self-confidence in the ability to manage teaching tasks appeared with high quality learning in a preservice teacher education program (as cited in Gordon & Debus, 2001, p. 4; Ross, 1998; Tschannen-Moran, Woolfolk-Hoy, & Hoy, 1998). Just because of this, it was expected to result in enhancements to teaching self-efficacy with an increased use of deep learning approaches (as cited in Gordon & Debus, 2001, p. 4; Ross, 1998; Tschannen-Moran, Woolfolk-Hoy, & Hoy, 1998). For example, Gordon and Debus (2001) claimed that preservice teachers who adopt surface approaches meet minimum requirements with minimum effort and repeat material without analysis and focus towards rote memorization. However, when difficulties arise, preservice teachers who follow surface approach couldn't find adequate solutions in these circumstances due to memorization. Thus, their teaching efficacy would be threatened and decline at lower levels. On the contrary, preservice teachers who adopt deep approaches to learning are able to resolve the problems with problem-solving skills since this approach requires the understanding of material being studied, as well as the active integration of new information with old one and improves their problem-solving skills. In order to design successful contexts for learning that may support preservice teachers to gradually leave surface approaches and adopt deep approaches in an undergraduate teacher education program, Gordon and Debus (2001) implemented contextual modifications in a preservice teacher education program. Development in personal teaching efficacy was expected for those preservice teachers who involved strongly in deep learning approaches. A longitudinal, quasi-experimental design with repeated measures on non-equivalent dependent variables was conducted with a sample of 197 preservice early childhood teachers through three cohorts. Cohort 1, Cohort 2 and Cohort 3 acted as contrast, treatment and comparison groups, respectively. Learning approaches, teaching efficacy beliefs and causal attributions for learning outcomes were repeatedly measured with the use of instruments including Study Process Questionnaire (SPQ; Biggs, 1987b), the Teacher Efficacy Scale (TES; Gibson & Dembo, 1984) and the

Achievement subscale of Multidimensional-Multiattributional Causality Scale (MMCS; Lefcourt, 1981), respectively. The results showed that in treatment group, the modifications to teaching methods, assessment processes and task requirements stimulated changes in students' approaches to learning by firstly decreasing their use of surface approaches and then increasing the use of deep approaches. According to the researchers, students learning approaches were malleable and so they were open to the modification through contextual features. Moreover, the equivalent increase in teaching efficacy was found in both treatment and contrast group.

Regarding the relationship between teaching and learning conceptions and self-efficacy beliefs, the following studies provided evidence for that high-efficacious teachers tend to use student-centered teaching approaches, while teachers with a low sense of efficacy are more likely to use teacher-centered strategies (Czerniak, 1990). For instance, Finson et al. (1999) claimed that self-efficacy is one of the reasons that the way preservice teachers view themselves and their roles in a teaching context. Teachers with low self-efficacy tended to teach in an authoritative way and with teacher-centered thought. In contrast, when teachers have high self-efficacy, their teaching is inclined to be characterized by more student-centered thought, the use of more inquiry approaches and the beliefs that they can help their students to succeed and were more knowledgeable of their students' developmental levels (Finson et al., 1999). The researchers found that teachers with high self-efficacy more likely to include expected happy or smiling looks, outdoor environments used for teaching, and group work activities in their drawings. According to the researchers, this result supported notion that teachers' beliefs in their capability to teach. Moreover, when teachers have high outcome expectancy, they more likely relinquished some of their own control of the classroom since they trust their students can learn. In contrast, teachers with low self-efficacy tended to exclude students, and be centered indoors in their drawings. In the view of the researchers, all of these results strengthened the notion that high self-efficacious teachers believe in their own ability to teach and apply teaching strategies giving students opportunities to have more variability in their classroom behavior. Based on this, Finson et al. (1999) hypothesized that preservice teachers with less stereotypical in their science teaching perceptions will develop high self-efficacy level. In other words, preservice teachers with low DASTT-C scores will see their teaching less stereotypical and should have higher PSTE (personal science teaching efficacy) scores on STEBI-B. In a separate study, Finson (2001) explored the possible relationship between preservice teachers' self-efficacy and perceptions of self as a science teacher. The researcher hypothesized that preservice teachers whose perceptions of science teaching indicates teachers as facilitators and students as active participants will more likely to have high sense of self-efficacy. In this instance, pretest and posttest data generated from both DASTT-C and STEBI-B instruments for a single elementary science methods class were compared. In addition, preservice teachers wrote brief narrative descriptions of their drawings. The results indicated that preservice teachers' drawings and narratives become less stereotypical from pretesting to post testing suggesting that their drawings include outdoor learning environments, hands-on activities done with students by assistance of their teacher. Also, it was found that preservice teachers' outcome expectancy and personal science teaching efficacy scores increased between pretesting and post testing. Pretest scores tended to support the hypothesis. Correspondingly, El-Deghaidy (2006) conducted a study to investigate the possible relationship between preservice teachers' self-efficacy and self-image of themselves as a science teacher and identify these two variables. Drawings of preservice teachers showed that they entered science class with pre-existing images of themselves as a science teacher in favor of 'teacher-centeredness' images. Also, STEBI-B results indicated that there is an increase in preservice teachers' efficacy beliefs after enrolling in science teaching methods course, underpinned by a constructivist approach to teaching and learning. The results of both drawing scores and self-efficacy scores suggested that there is a moderate correlation between preservice teachers' perceptions of themselves as science teachers and their self-efficacy beliefs. In the same manner, Gurbuzturk and Sad (2009) investigated the relationships between preservice teachers' traditional vs. constructivist educational beliefs and self-efficacy beliefs and found that as preservice teachers' self-efficacy beliefs about student engagement to the lesson increased, their constructivist teacher belief increased. On the other hand, as preservice teachers' general self-efficacy beliefs and self-efficacy beliefs about classroom management and using instructional strategies increased, their traditional teacher beliefs increased (Gurbuzturk & Sad, 2009). Furthermore, Nie, Tan, Liau, Lau and Chua (2012) claimed that the adoption of more student-centered constructivist instruction is seen as a challenge for teachers if they have been using more traditional approaches. They found that there was a stronger correlation between teacher efficacy and student-centered constructivist instruction than the correlation between teacher efficacy and teacher-centered didactic instruction. Therefore, the researchers assumed that teacher efficacy may have major function when they encountered with challenging tasks in classroom teaching (e.g. instructional innovation which requires adoption of constructivist instruction).

In the lights of the information given above, the majority of previous studies concentrated on the relation between teachers' images about themselves as science teachers and their science teaching efficacy; or the relation between preservice teachers' teaching and learning conceptions and their students' approaches to learning. However, there is no research investigating the relationship among preservice science teachers' learning approaches, their science teaching self-efficacy beliefs and their conceptions about teaching and learning, simultaneously. So, current study attempted to extend the related literature and provide more detailed picture on these variables.

CHAPTER 3

METHODOLOGY

This chapter aims to provide brief information about research design, sampling, instruments, applied data collection procedure, and statistical techniques utilized in the study.

3.1 Research Design

Correlational research design was adopted in the current study. Correlational research refers to the determination of relationship among two or more variables without influencing them (Fraenkel & Wallen, 2006). In this study, relationship between preservice science teachers' learning approaches, self-efficacy beliefs and conceptions about teaching and learning were examined by canonical correlational analysis. Moreover, both of the quantitative and qualitative approaches were used in the current study. One of the instruments of the research, DASTT-C including open-ended question, permitted qualitative approach. Three out of four instruments of the study (TLCQ, LAQ and STEBI-B), which consists of 'likert scale' type of questions, lend themselves to quantitative approach.

3.2 Sample

The target population of the study was all senior preservice science teachers in Ankara. The accessible population was identified as all senior preservice science teachers in the public universities of Ankara. There were about 340 fourth year preservice science teachers in the public universities of Ankara during the 2011/2012 school year. Convenient sampling method was used in the selection of the sample. The study was able to be applied to only 208 senior preservice science teachers. Of the participants, 156 were girls and 52 were boys. Most of the preservice science teachers were graduated from super high school. Besides, majority of the participants want to work as teacher in the future when they graduated. Moreover, most of the participants' mothers were graduated from primary school and fathers were graduated from high school. Table 3.1 gives detailed information related to preservice science teachers' gender, graduated high schools of participants, choice of working as a teacher when they graduated, mother's educational level, father's educational level.

Table 3.1 Background Characteristics of Preservice Science Teachers

	N	***Frequency (%)***
Gender		
Female	156	75
Male	52	25
Graduated High Schools		
Super High School	56	26.9
Anatolian High School	52	25.0
General High School	49	23.6
Anatolian Teacher Training High School	43	20.7
Science High School	4	1.9
Others	4	1.9
Choice of Working as a Teacher		
Yes	180	86.5
No	25	12.0
Mother's Educational Level		
Primary School	118	56.7
Secondary School	26	12.5
High School	39	18.8
College	20	9.6
Graduated School	-	-
Illiterate	4	1.9
Father's Educational Level		
Primary School	44	21.2
Secondary School	33	15.9
High School	67	32.2
College	62	29.8
Graduated School	1	.5
Illiterate	1	.5

3.3 Instruments

Four questionnaires were utilized in the current study. These were Draw-A-Science-Teacher-Test Checklist (DASTT-C; Thomas et al., 2001), Teaching and Learning

Conceptions Questionnaire (TLCQ; Chan & Elliott, 2004), Science Teaching Efficacy Belief Instrument (STEBI-B; Enochs & Riggs, 1990) and Learning Approach Questionnaire (LAQ; Cavallo, 1996). In following sections, DASTT-C, TLCQ, STEBI-B and LAQ were explained in details.

3.3.1 Draw-A-Science-Teacher-Test Checklist (DASTT-C)

The Draw-A-Science-Teacher-Test Checklist originally developed by Thomas et al. (2001). Preservice elementary teachers' unforgettable episodes within their conceptions about how to teach elementary science were expected to enlighten with the instrument. DASTT-C instrument sheet consists of an illustration part and a narrative data part in one page (see Appendix G). There is a square at the center of the instrument sheet, in which participants are requested to make their drawing regarding their conceptions about how to teach elementary science and response the following questions: (1) "What is teacher doing?", (2) "What are the students doing?". There are three different sections in DASTT-C score sheet: Teacher, Students and Environment (see Appendix H). The "Teacher" section includes two parts that center on the teacher's activity and position. The "Student" section includes two subsections that center on the student's activity and position. The "Environment" section is comprised of such elements as related desks arrangement, placement of teacher desk, lab organization, teaching symbols, and science knowledge symbols. According to the instrument's developers, each item in each section of the instrument arbitrarily indicates teacher-centered teaching elements and classroom images. If there is a teacher-centered instructional element in a preservice science teacher's drawing, the rater simply signs that element on the checklist. DASTT-C instrument's total checklist scores may range from 0-13 (the higher score, the more teacher-centered instruction). Table 3.2 gives the categorization of DASTT-C scores of preservice science teachers according to points received from items in DASTT-C score sheet (Elmas et al., 2011; Yılmaz et al., 2007).

Table 3.2 Categorization of DASTT-C scores of Preservice Science Teachers

Categorization	Scores (points)
Student-centered instruction	0-4
Neither student-centered nor teacher-centered instruction	5-9
Teacher-centered instruction	10-13

3.3.2 Teaching and Learning Conceptions Questionnaire (TLCQ)

TLCQ, originally developed by Chan and Elliott (2004), was designed to examine the conceptions about teaching and learning held by preservice teachers. The TLCQ consists of 30 items, and it is comprised of two subscales: constructivist conception including 12 items and traditional conception including 18 items. For each item, preservice science teachers rated their degree of agreement on scale ranges from strongly disagree to strongly agree (5=Strongly Agree and 1=Strongly Disagree). Aypay (2011) translated and validated the instrument into Turkish (see Appendix D). In Aypay's (2011) study, translation was conducted by two Turkish experts and translation into Turkish was compared by bilingual experts of the field. TLCQ was also piloted with 341 student teachers and similar results were found for factor analysis with Chan and Elliott's. The reliability analysis of the instrument conducted by Chan and Elliott (2004) reported as Cronbach Alphas equals to .84 for both constructivist and traditional conception. Besides, Aypay (2011) found reliability as Cronbach Alpha equals to .88 for constructivist conception and .83 for traditional conception. In the current study, the Cronbach Alpha reliability was reported as .89 for the constructivist conception, and .86 for the traditional conception and .71 for the overall instrument (see Table 3.3).

3.3.3 Science Teaching Efficacy Belief Instrument (STEBI-B)

STEBI-B, developed by Enochs and Riggs (1990), was designed to examine preservice elementary teachers' self-efficacy of teaching science. The STEBI-B consists of 23 items. The STEBI-B is consisted of two subscales: the personal science teaching efficacy beliefs (PSTE), indicating teachers' confidence in their capability to teach science, and the science teaching outcome expectancy (STOE), indicating their beliefs about the effectiveness of their teaching on students' learning. PSTE and STOE consist of 13 and 10 items, respectively. Preservice teachers, who get high scores on PSTE subscale, show more confidence in their own science teaching efficacy. Similarly, preservice teachers, who get high scores on STOE subscales, show greater expectancy related to the science teaching outcomes. For each item students rated their degree of agreement on scale ranges from strongly disagree to strongly agree (5=strongly agree – 1=strongly disagree). Possible scores on the PSTE and STOE subscale range from 13 to 65 and 10 to 50, respectively. The STEBI-B was first adapted and translated into Turkish by Tekkaya, Cakiroglu and Ozkan (2004) (see Appendix F). Researchers reported Cronbach Alpha of PSTE was .84; of STOE was .76. For the current study, the overall reliability analysis reported Cronbach Alpha of PSTE was .88; of STOE was .66 (see Table 3.3).

Table 3.3 Aim, Subscales, Number of Items and Reliability of TLCQ, STEBI-B and LAQ

Instrument	Aim	Subscales	Number of Items	Reliability (α)
TLCQ	Examine preservice science teachers' teaching and learning conceptions	Constructivist Conception	12	.89
		Traditional Conception	18	.86
STEBI-B	Examine preservice science teachers' science teaching self-efficacy beliefs	PSTE	13	.88
		STOE	10	.66
LAQ	Examine preservice science teachers' learning approaches	LAQ-M	11	.85
		LAQ-R	11	.67
DASTT-C	Examine preservice science teachers' science teaching beliefs	Teacher -centered Neither student-centered nor teacher-centered Student-centered		

3.3.4 The Learning Approach Questionnaire (LAQ)

LAQ was designed to measure learning approaches of students as meaningful or rote (Cavallo, 1996; Cavallo et al., 2003). LAQ consists of 22 items and it is comprised of two subscales: Meaningful Learning Approach Questionnaire (LAQ-M) including 11 items and Rote Learning Approach Questionnaire (LAQ-R) including 11 items. Preservice science teachers, who get high scores on meaningful scale, show a high meaningful learning approach. Likewise, Preservice science teachers, who get high scores on rote scale, show a high rote learning approach. For each item preservice science teachers rated their degree of agreement on scale ranges from strongly disagree to strongly agree (4=strongly agree – 1=strongly disagree). Both LAQ-M and LAQ-R scales have possible ranges of 11 – 44. The questionnaire was translated and adapted into Turkish by Yenilmez (2006) (see Appendix E). Researcher reported Cronbach Alpha of LAQ-M was .78; of LAQ-R was .62. In the current study, the reliability analysis reported Cronbach Alpha of LAQ-M was .85; of LAQ-R was .67 (see Table 3.3).

3.4 Procedure

In this research study, the research problem was firstly defined and then keyword list was formed the accordingly. Then, the related review of the literature was done in detail. Previous studies in the literature related to the study were searched from Educational Resources Information Center (ERIC), Social Science Citation Index (SSCI), Ebscohost, Science Direct, Internet (e.g., Google). The printed out of the appropriate documents were received from METU library, and Internet. First, all of the received documents were read and the results of the studies were compared.

After completing the literature review, research questions of the study was proposed. The most appropriate measurement instruments for the purpose and sample of the study were chosen based on detailed research. Then, the researcher decided on the universities to be included in the study and got required permission from Ethical Committee of universities for the administration of the measurement instruments (see

Appendix A). Three of public universities of Ankara that have elementary science education department were selected.

Data collection procedure was conducted during the spring semester 2011-2012 academic year. The purpose of the study was explained to the subjects and consent forms were distributed (See Appendix B). Four questionnaires of the research, DASTT-C, TLCQ, STEBI-B and LAQ, were administered to the subjects who were volunteer in classrooms environment. The data were collected by the researcher to ensure the consistency of data collection procedure. The instrument application time was lasted in 45 minutes.

3.5 Data Analysis

In the current study, the statistical analyses were done by using PASW Statistics 18. To analyze the obtained data, both descriptive and inferential statistics were used. Percentages, mean, range, standard deviation, minimum, maximum, skewness and kurtosis were used as descriptive statistics. The standard deviation, range, mean scores of STEBI-B, TLCQ and LAQ and paired-sample t-test were used to examine preservice science teachers' teaching and learning conceptions and learning approaches. Moreover, to see what images preservice science teachers have of themselves, percentage of categories along a continuum from student-centered to teacher-centered in orientation in DASTT-C images was calculated. As an inferential statistics, Canonical Correlation Analysis was used to investigate relationship between TLCQ, LAQ, and STEBI-B. Also, before conducting canonical correlation analysis, all assumptions of canonical correlation analysis were verified.

3.6 Assumptions and Limitations of the Research

3.6.1 Assumptions

1. Preservice science teachers participated in the study responded to the items of four questionnaires sincerely.

2. DASTT-C, TLCQ, LAQ and STEBI-B were administered under standard conditions.

3. The data were recorded and analyzed accurately.

3.6.2 Limitations

1. The study was limited to three public universities of Ankara, so results may not be generalized to entire country.
2. The study was limited to 208 senior preservice science teachers.
3. Since the survey includes many items, it might be too long for the preservice science teachers. As a result, this might cause to get unreliable answers from the participants.
4. The study was limited by its reliance on self-reported questionnaires.
5. Preservice science teachers might reflect their ideal images of themselves in their drawings instead of their real images of themselves as a science teacher.
6. Canonical correlation analysis, which does not establish a causal relationship, was used in data analyses. Therefore, future research is needed to determine whether there is a causal link between the variables of the current study.

3.7 Internal Validity of the Study

According to Fraenkel and Wallen (2006), subject characteristics threat defined as "the selection of people for a study may result in the individuals (or groups) differing from one another in unintended ways that are related to the variables to be studied." (p. 170). However, in the current study, no analysis conducted related with the subject characteristics such as gender, and age (grade levels) so subject characteristics was not considered as a threat to internal validity. Mortality also was not considered as a threat to internal validity of this study since the present study was not a longitudinal study. In addition, location would not be a threat to internal validity in the present study since the reseracher administered the questionnaires to all participants under similar conditions. Moreover, instrument decay could not be a threat to internal validity of the current study since there were no changes in the instrument during the study. The administration of the questionnaires was mostly done by the researcher, so data collector characteristics and data collector bias threat is minimized. Besides, testing could not be a threat to internal validity of the current study since the questionnaires were administered to all participants only one time. There also could not be history threat in the current study due to the fact that unexpected events did not occur during the periods of data collection that might affect the responses of subjects. Moreover, maturation could not be a threat to internal validity of the present study because the current study was not a longitudinal study and did not include factors regarding the passing of time. Furthermore, regression could not be a threat to internal validity of the current study because there was no intervention. Possibility of harm to the participants was not appeared to be a problem for this study. The participants were given the guarantee that the study did not give any physical and psychological harm or discomfort to them and they were informed about the actual purposes of the study. Also, deception was not required. All participants were assured that any data collected is held in confidence and names of the schools and subjects are not used in any kind of publication. Before the data entry, the researcher assigned a number to each of the questionnaire.

3.8 External Validity of the Study

External validity "refers to the extent that the results of a study can be generalized from a sample to a population." (Fraenkel & Wallen, 2006, p.108). The sample of the currrent study were 208 preservice science teachers who were selected conveniently from the population. Therefore, generalization of the current study was limited. The generalizability of this study could be acceptable for the preservice science teachers whose characteristics and backgrounds are similar to the sample of the current study.

CHAPTER 4

RESULTS

In this chapter, the results of the analyses to answer the research questions of the present study are presented. Therefore, this chapter is divided into three sections. In the first section, descriptive statistics are presented regarding research questions. Inferential statistics are presented regarding research questions in the second section. In the end, there are summaries of findings of the study.

4.1 Descriptive Statistics

In descriptive statistics parts, percentages, mean, standard deviation values for the variables of Draw-a-Science-Teacher-Test Checklist (DASTT-C), and Science Teaching Efficacy Beliefs Instrument (STEBI-B) were presented.

4.1.1 Research Question 1

What images do preservice teachers have of themselves as science teachers?

In the present study, 208 preservice science teachers' drawings regarding their conceptions about how to teach elementary science were assessed using Draw-a-Science-Teacher-Test Checklist (DASTT-C) and classified along a continuum from student-centered to teacher-centered instruction. Two researchers found that 13 drawings out of 208 drawings were inappropriate to be scored due to inadequate drawing and related narratives. Besides, ten participants did not draw anything. Therefore, 23 drawings were removed from the analysis and 185 drawings were assessed. In the present study, the two researchers seperately scored all of the drawings. The interrater reliability for the raters was found to be r= .97 (p=.01) indicating almost perfect agreement.

Descriptive statistics results showed that preservice science teachers' total mean score on DASTT-C was 5.46 that falls in the middle category--neither student-centered nor teacher-centered and represents an instructional method including both student-centered and teacher-centered instruction characteristics. Moreover, the results of the DASTT-C showed that 42.7% of preservice science teachers who got scores between 0-4 categorized as student-centered instruction regarding their perspectives of science teaching conception. Similarly, seven percentage of preservice science teachers who got scores between 10-13 categorized as teacher-centered. Moreover, preservice science teachers (50.3%) who got scores between 5-9 categorized as neither student-centered nor teacher-centered instruction (see Figure 4.1). Examples of drawings were given in the next parts of this section.

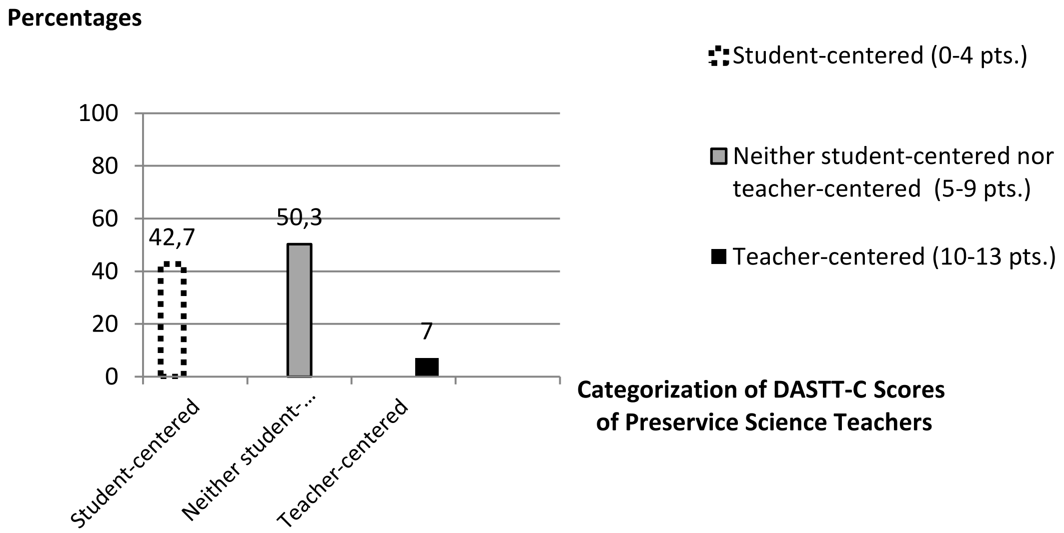


Figure 4.1 Results of DASTT-C Categorization in Percentage

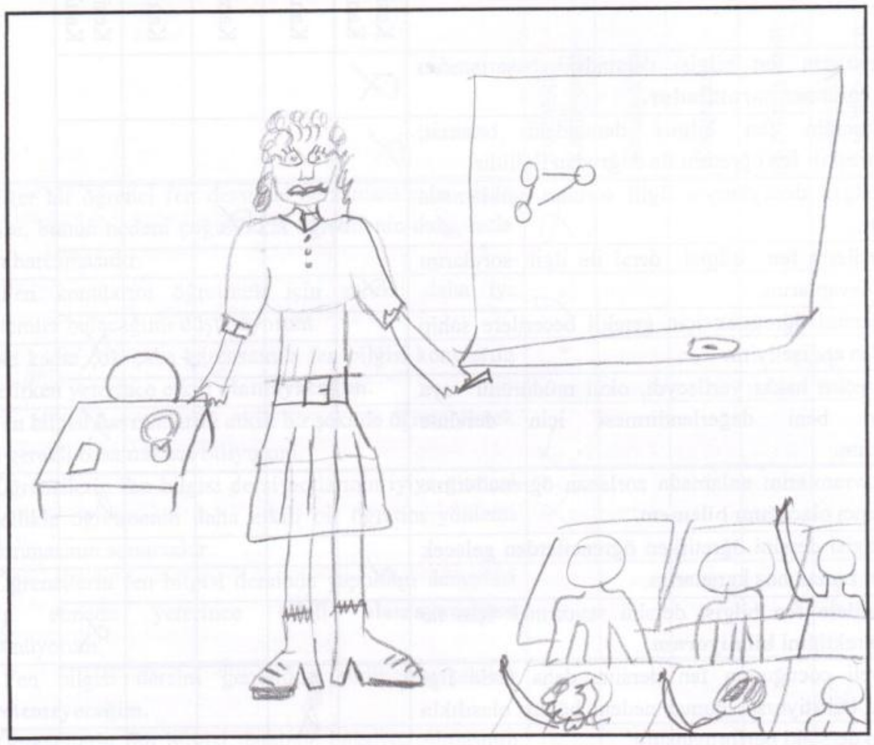
4.1.1.1 Analyzing the Categorization of DASTT-C Scores

Teacher-centered Drawings

In the teacher-centered images of the current study, teachers are demonstrating an experiment. They are usually head of the class. In other words, teachers are the leader of their classes. Moreover, teachers are often lecturing in front of the blackboard while students seems watching/listening their teacher. Also, students are seating on desks that are arranged in traditonal row. Furthermore, teacher desks are placed in front of the class. These images fit with teacher-centered instruction led by teacher who trasmits the knowledge and in which students receive information from their teachers as a passive learners. Some examples of teacher-centered drawings of preservice science teachers are shown in Figure 4.2.

Participant ID: 15

Draw a picture of yourself as a science teacher at work.



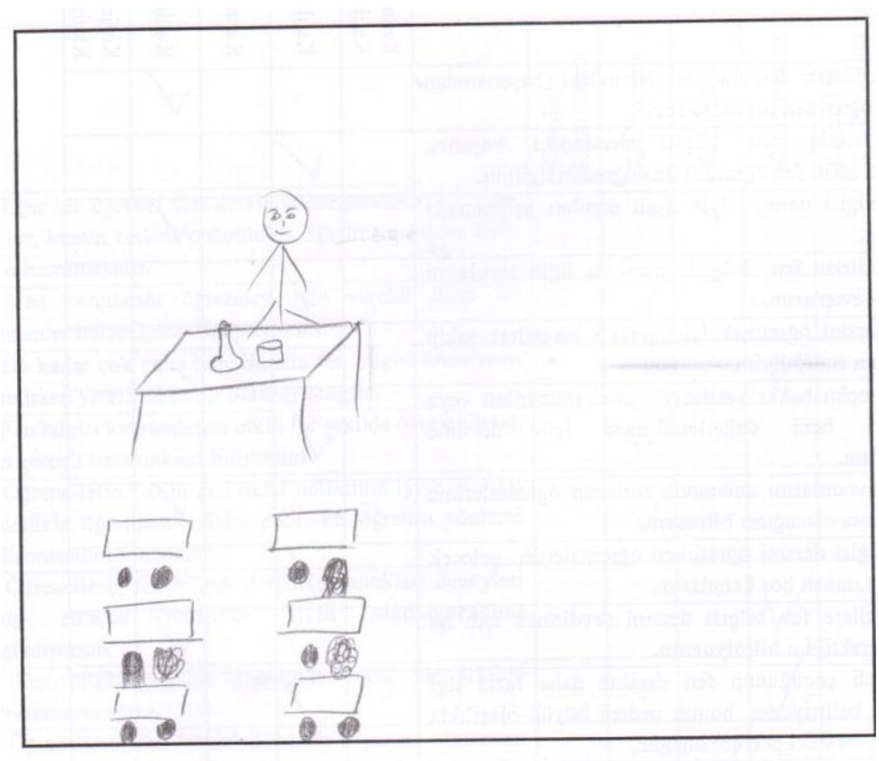
What is the teacher doing?
"Teacher is lecturing and asking questions to the students."
What are the students doing?
"Students are listening and they want to answer the questions."

Figure 4.2 Teacher-centered DASTT Picture and Preservice Science Teachers' Explanation

As shown in Figure 4.2, teacher is giving lecture in front of the blackboard and her desk is placed in front of the class. In this figure, teacher is the transmitter of knowledge from her minds to the minds of her students. Moreover, teacher is in static position in the class instead of walking around and she appears to have absolute authority. As understood from the narrative, students seems to watching/listening their teacher. Moreover, students answer the questions sitting on desks arranged in traditional row. All of these indications in the figure fit with the teacher-centered instruction.

Participant ID: 58

Draw a picture of yourself as a science teacher at work.



What is the teacher doing?
"Teacher is demonstrating an experiment about a topic."
What are the students doing?
"Students are watching the demonstration of the experiment."

Figure 4.2 (Continued) Teacher-centered DASTT Picture and Preservice Science Teachers' Explanation

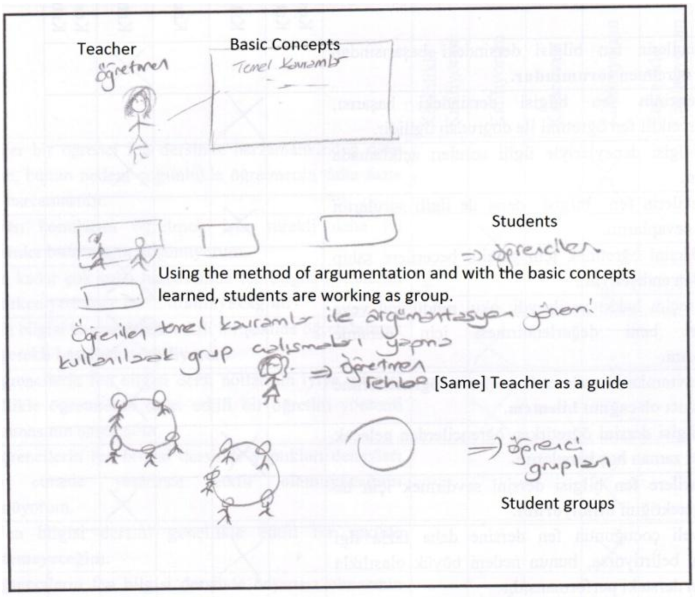
As shown in Figure 4.2 (Continued), teacher is demonstrating an experiment, which is conducted by himself, in front of the class. Again, his desk is placed in front of the class and students' desks are arranged in traditional row. In the figure above, it is assume that teacher is transmitting knowledge about a topic. Once again, teacher is in static position in the class instead of walking around. As understood from the narrative, students are doing nothing except watching their teacher as a passive learner. All of these indications in the figure fit with the teacher-centered instruction.

Middle Category Drawings --Neither Teacher-Centered nor Student-Centered—

In the middle-range-scored drawings, teachers' desks are placed in front of the class and they firstly introduce the topic to the students, usually in front of the blackboard. This part includes the characteristics of teacher-centered instruction. Then, teachers are leading and encouraging students to make experiment, and participate learning process with inquiry. Students are mostly studying as a group assisting by the teacher. They are also actively doing experiment and making research. There are not traditionally arranged rows in the classroom, instead usually arranged in U-shaped. Student-centered instruction's characteristics are seen in this part. Therefore, drawings including these kind of features labelled as middle category --neither teacher-centered nor student-centered-- instruction since both the teacher-centered techniques representing the transfer of knowledge and student-centered techniques representing the active participation of the students on an experiment could be seen in the drawings. Some examples of middle category drawings of preservice science teachers are indicated in Figure 4.3.

Participant ID: 93

Draw a picture of yourself as a science teacher at work.



What is the teacher doing?

"After introducing the basic concepts, teacher is dividing students into groups to construct the knowledge on their own using discussion method."

What are the students doing?

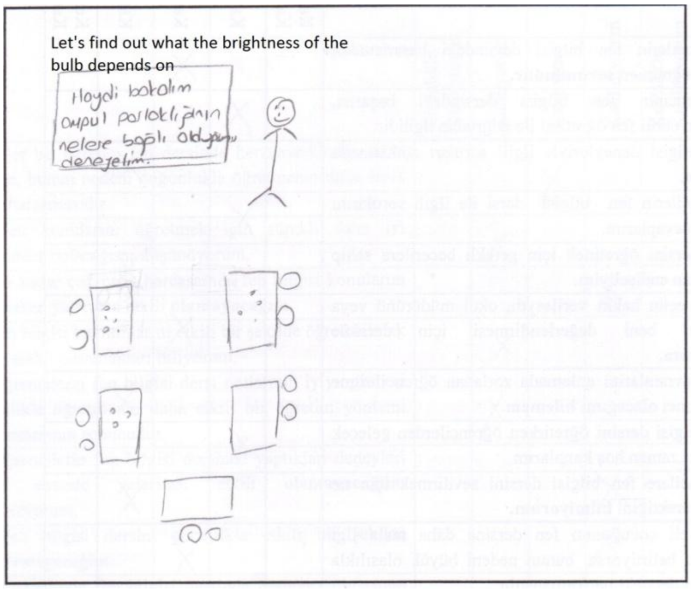
"Students are actively participating the learning process to make their knowledge permanent, being led by teacher."

Figure 4.3 Middle Category --Neither Teacher-centered nor Student-centered-- DASTT Picture and Preservice Science Teachers' Explanation

As shown in the Figure 4.3, teacher, as a transmitter of knowledge, is firstly introducing the basic concepts of a topic in front of the blackboard. At this part, she is in static position instead of walking around and students are sitting on desks arranged in traditional row. All of these indications in this part fit with the characteristics of teacher-centered instruction. However, in the second part of the figure (starts with the sentence "Using the method of…"), students are actively participating the learning process to construct their own knowledge with assistance of their teacher. They are also working as a group around circular arranged desks. Student-centered instruction characteristics are seen in this part. Since both the teacher-centered and student-centered instruction characteristics can be seen in the drawings, these kind of drawings were labelled as middle category --neither teacher-centered nor student-centered—instruction.

Participant ID: 141

Draw a picture of yourself as a science teacher at work.



What is the teacher doing?
"Teacher is giving information about purpose of the lesson. Then, teacher is encouraging students to do experiment."
What are the students doing?
"Students are actively doing an experiment assisting by the teacher."

Figure 4.3 (Continued) Middle Category --Neither Teacher-centered nor Student-centered-- DASTT Picture and Preservice Science Teachers' Explanation

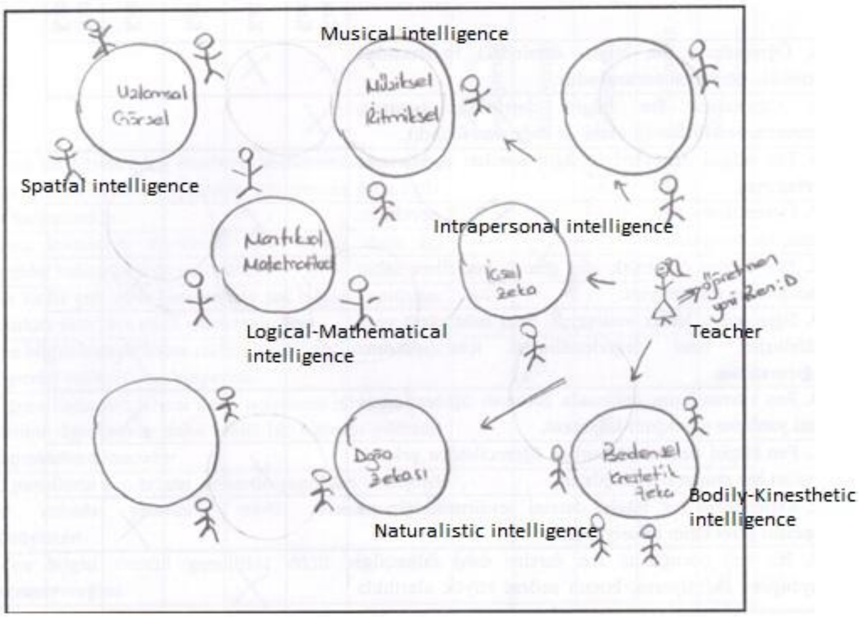
As understood from the Figure 4.3 (Continued) and its narrative part, again, teacher, is firstly introducing topic in front of the blackboard in a static position. He acts as a transmitter of knowledge at the beginning of the lesson. Also, it is assumed that students are listening their teacher as a passive learner at this part. Therefore, these are indications of the characteristics of teacher-centered instruction. However, after introducing the topic, teacher is acting as guide while his students are actively doing an experiment. Now, students are active participants of the lesson. Moreover, desk organization of the classroom is U-shaped, which fits with the student-centered instruction characteristics. Since both the teacher-centered and student-centered instruction characteristics could be seen in the drawings, these kind of drawings were labelled as middle category --neither teacher-centered nor student-centered— instruction.

Student-centered Drawings

Student-centered images, drawn by the preservice science teachers, indicate that the role of teacher is guidance and not transmission of knowledge. Teachers usually walk around the class (indicated by arrows), not stand in front of the blackboard. Morever, teachers are doing activities, such as taking a field trip, observation, with children in harmony. Besides, students are active participant of their learning process. In most pictures, they work in groups to get knowledge on their own. Also, laboratory equipment is mostly on students' desk and used by students. Morever, a few student-centered images include outdoor learning environment. These evidences indicate the characteristics of student-centered instruction that teachers generally prefer encouraging students to participate in learning process leading by students. Some examples of student-centered drawings of preservice science teachers are indicated in Figure 4.4.

Participant ID: 99

Draw a picture of yourself as a science teacher at work.



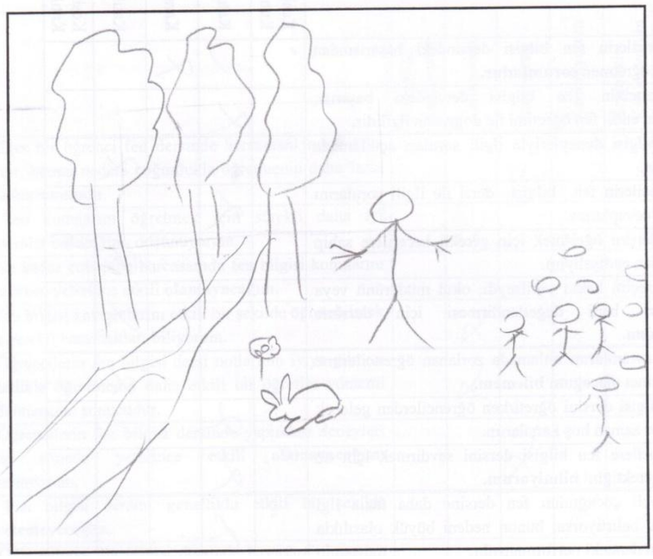
What is the teacher doing?
"I [teacher] act as a guide. I divided students into groups with respect to their intelligence type. I'm helping them to do different experiments about the same topic."
What are the students doing?
"Students are doing experiment."

Figure 4.4 Student-centered DASTT Picture and Preservice Science Teachers' Explanation

As shown in the Figure 4.4**,** teacher acts as a guide to faciltate the learning of her students**.** Also, there are serious of arrows around teacher to indicate her movement among students groups formed with respect to their intelligence type. This indicates that teacher utilizes from the Multiple Intelligence Theory (MIT) in her lesson. MIT provides teachers an opportunity to reach more students trying to learn important theories and concepts (Gardner, 1997). In a learning environment based on MIT, the emphasis is on the stimulation of active and individual learning process (Hopper & Hurry, 2000). As understood from the figure above, students are in the focus of the learning process and actively doing experiment with assistance of their teacher. Moreover, students' desks are not traditionally organized. All of these evidences indicate the characteristics of student-centered instruction in the drawing above.

Participant ID: 134

Draw a picture of yourself as a science teacher at work.



What is the teacher doing?
"Teacher is teaching living things in their natural environment to students."
What are the students doing?
"Students are exploring nature and living things."

Figure 4.4 (Continued) Student-centered DASTT Picture and Preservice Science Teachers' Explanation

Unlike other drawings, Figure 4.4 (continued) shown in above indicates an outdoor learning environment, which categorized in the student-centered drawings (Thomas et al., 2001). As understood from the figure, teacher took his students to a field trip to see things that can not be offered in school settings while teaching living things. It might be interpreted that during field trip, students get a chance to observe, touch, and explore living things in their natural environment so that they can easily construct their own scientific knowledge rather than directly receiving information from their teacher. Since teaching occurs in an outdoor learning environment following an exploratory learning approach which supports inquiry, these drawings fit with the characteristics of student-centered instruction.

To sum up, while in teacher-centered drawings, teachers appeared to be transmitter of information as well as students to be passive receivers of information, shown in the Figure 4.2; in student-centered drawings, teachers are considered as learning facilitator as well as students as active participants, shown in the Figure 4.3. Interestingly, unlike other drawing categories, there was a few student-centered drawings including outdoor learning environment. Moreover, drawings including both the teacher-centered instruction representing the transfer of knowledge and student-centered instruction representing the active participation of the students on an experiment labelled as middle category --neither teacher-centered nor student-centered—instruction, as shown in Figure 4.4.

4.1.2 Research Question 2

What are the preservice science teachers' efficacy beliefs regarding science teaching?

Preservice science teachers' responses to STEBI-B showed generally high sense of personal teaching efficacy (*M*=3.98, *SD*=.51) and outcome expectancy (*M*=3.71, *SD*=.41). These findings indicated that preservice science teachers were confident in their ability to teach science and generally convinced about the efficacy of their teaching on students' learning. For example, as shown in Table 4.1, majority of preservice science teachers showed confidence in their ability to teach science effectively (86%) and indicated that they comprehend science concepts well enough to be efficacious in science teaching (82%). Besides, preservice science teachers (87%) indicated that they usually welcome their students' questions during science teaching. Moreover, most of the preservice science teachers (84%) thought that when the students' science grades get better, it is often due to the fact that their teacher apply a more effective teaching approach. Eighty five percent of preservice science teachers agreed that students' science achievement is directly associated to their teacher's efficacy in science teaching. Preservice science teachers (91%) also believed that good teaching overcome the deficiencies in backgrounds of students.

These results confirmed that preservice science teachers in the current study generally have high sense of personal teaching efficacy and outcome expectancy.

Table 4.1 Distribution of Responses to STEBI-B Sample Items

	Percentage*				
Item	SA	A	U	D	SD
PSTE					
1. I will generally teach science ineffectively.	.5	7.8	4.4	47.6	38.8
2. I understand science concepts well enough to be effective in teaching science.	19.9	61.7	14.1	2.9	.5
3. I will continually find better ways to teach sceince.	22.3	67.5	6.8	1.9	.5
4. I will not be very effective in monitoring science experiments.	1.0	5.3	10.7	51.9	30.1
5. When teaching science, I usually welcome students questions.	31.6	55.8	6.3	3.9	1.0
STOE					
1. When the science grades of students improve, it is often due to their teacher having found a more effective teaching approach.	19.9	63.6	11.2	2.9	1.5
2. Students' achievement in science is directly related to their teacher's effectiveness in science teaching.	15.5	69.4	11.7	2.4	-
3. The inadequecy of a student's science background can be overcome by good teaching.	27.2	63.6	6.3	1.5	.5
4. The low science achievements of some students can not generally be blamed on their teachers.	1.9	12.6	19.4	52.4	12.6
5. The teacher is generally responsible for the achievement of students in science.	2.9	53.9	23.8	17.5	1.0

*SA=Strongly Agree; A=Agree; U=Undecided; D=Disagree; SD= Strongly Disagree.

4.2 Inferential Statistics

In this part, paired-sample t-test were used to examine preservice science teachers' teaching and learning conceptions and learning approaches. Moreover, canonical correlation was used to investigate relationship between preservice science teachers' conceptions about teaching and learning, self-efficacy beliefs, and learning approaches.

4.2.1 Research Question 3

What are the teaching and learning conceptions adopted by preservice science teachers?

The mean score of constructivist conception was *M*=4.38 (*SD*=.42) and the mean score of traditional conception was *M*=2.55 (*SD*=.55). To see whether there is a statistically significant difference in the mean scores for traditional conception and constructivist conception, a paired-sample t-test was conducted. As shown in Table 4.2, there was a statistically significant difference between the mean scores for traditional conception (*M*=2.55, *SD*=.55) and constructivist conception (*M*=4.38, *SD*=.42); *t*(205)=31.82, *p*=.00. The mean difference in preservice science teachers' teaching and learning conceptions was 1.83 with a 95% confidence interval ranging from 1.72 to 1.95. The eta squared statistic (.83) indicated large effect size. Therefore, it can be said that the mean of constructivist conception scores was significantly greater than the mean of traditional conception scores. In other words, this finding indicated that preservice science teachers prefer constructivist conception more than traditional conception.

Table 4.2 Results of the Paired-Sample t-test Regarding Constructivist Conception and Traditional Conception Scores

	Paired Differences							
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	95% Confidence Interval of the Difference Upper	t	df	Sig. (2-tailed)
Constructivist Conception Traditional Conception	1.83269	.82667	.05760	1.71913	1.94625	31.819	205	.000

Morever, as shown in Table 4.3, while majority of preservice science teachers (89%) thought that learning means providing students opportunities to explore, express and discuss their ideas, twenty five percent of preservice science teachers believed that recalling what the teacher has taught means learning. Also, while most of the preservice science teachers (84%) thought that teaching means to help students construct their own knowledge, twenty one percent thought that teaching is to teach accurate and complete knowledge to students.

Table 4.3 Distribution of Responses to TLCQ Sample Items

Item	Percentage*				
	SA	A	U	D	SD
Traditional Conception					
1. Teaching is to provide students with accurate and complete knowledge rather than encourage them to discover it.	6.3	15.0	12.6	55.3	10.7
2. Learning means remembering what the teacher has taught.	4.4	20.9	15.0	45.6	13.6
3. The traditional method for teaching is best because it covers more information.	2.4	6.8	10.2	48.5	31.6
4. Good teaching occurs when there is mostly teacher talk in the classroom.	1.0	4.9	5.8	44.7	43.7
5. Teachers should have control over what students do all the time.	10.7	36.4	28.2	17.5	6.8
Constructivist Conception					
1. Learning means students have ample opportunities to explore, discuss and express their ideas.	43.7	45.1	6.8	3.9	.5
2. The focus of teaching is to help students construct knowledge from their learning experience instead of knowledge communication.	33.5	50.0	8.3	6.8	1.0
3. In good classrooms there is a democratic and free atmosphere which stimulates students to think and interact.	56.8	37.9	4.4	1.0	-
4. Effective teaching encourages more discussion and hands on activities for students	48.5	45.6	4.4	1.5	-
5. Students should be given many opportunities to express their ideas.	62.1	34.0	2.4	1.5	-

*SA=Strongly Agree; A=Agree; U=Undecided; D=Disagree; SD= Strongly Disagree.

4.2.2 Research Question 4

What is the learning approach adopted by preservice science teachers?

To see whether there is a statistically significant difference in the mean scores for LAQ-M and LAQ-R, a paired-sample t-test was conducted. As shown in Table 4.4, there was a statistically significant difference between the mean scores for LAQ-M (*M*=3.12, *SD*=.41) and for LAQ-R (*M*=2.36, *SD*=.36); *t* (205)= -17.56, *p*=.00. The mean difference in preservice science teachers' learning approaches was .77 with a 95% confidence interval ranging from -.86 to -.68. The eta squared statistic (.60) indicated large effect size. Therefore, these results suggested that the mean of LAQ-M scores was significantly greater than the mean of LAQ-R scores. In other words, this finding indicates that preservice science teachers generally use meaningful approaches to learning rather than rote approaches to learning.

Table 4.4 Results of the Paired-Sample t-test Regarding LAQ-M and LAQ-R Scores

	Paired Differences							
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper	t	df	Sig. (2-tailed)
Rote Learning Approach Meaningful Learning Approach	-.77050	.62973	.04388	-.85700	-.68399	-17.56	205	.000

Morever, as shown in Table 4.5, majority of preservice science teachers (97%) tried to associate new knowledge with old one while studying a subject. However, fourteen percent of preservice science teachers often read subjects without really understanding.

Table 4.5 Distribution of Responses to LAQ Sample Items

Item	Percentage*			
	SA	A	D	SD
Rote Learning Approach				
1. I find I have to concentrate on memorizing good deal of what I have to learn.	5.8	43.7	39.3	10.7
2. Often I read things without having a chance to really really understand them.	1.5	12.6	59.2	25.2
3. The best way for me to understand what technical terms mean is to remember the textbook definition.	5.8	28.2	57.8	8.3
4. I learn things by rote	1.5	15.5	61.2	21.4
5. I find I tend to remember things best if I concentrate on the order in which teacher presented them.	14.6	47.1	32.0	5.8
Meaningful Learning Approach				
1. I try to relate new material, as I'm reading it, to what I already know on that topic.	40.8	55.8	2.4	.5
2. I often find myself questioning things that I hear in lectures or read in books.	19.5	57.3	20.4	1.5
3. I generally put a lot of effort into trying to understand things which initially seem difficult.	15.0	63.1	19.4	1.5
4. While I am studying, I often think of real life situations to which the material I'm learning would be useful.	34.0	57.3	6.8	1.5
5. I go over important topics until I understand them completely.	30.1	59.7	8.3	1.5

*SA=Strongly Agree; A=Agree; D=Disagree; SD= Strongly Disagree.

4.2.3 Research Question 5

What is the relationship between preservice science teachers' conceptions about teaching and learning, self-efficacy beliefs, and learning approaches?

Canonical correlation was performed between a set of preservice science teachers' conception about teaching and learning variables (SET 1) and a set of their self-efficacy beliefs and learning approaches variables (SET 2). SET 1 included constructivist conception and traditional conception, while SET 2 included meaningful learning approach (LAQ-M), rote learning approach (LAQ-R), personal science teaching efficacy (PSTE) and science teaching outcome expectancy (STOE). Before the conduction of Canonical Correlation Analysis, assumptions of analysis which are sample size, normality and outliers, absence of multicollinearity, linearity and homoscedasticy were checked.

Sample Size

Tabachnick and Fidell (2007) claimed that a ratio of about 10/1 (the number of subjects per variable) is enough for accurate interpretation of canonical correlation. According to this explanation, ratio of 208/6 is sufficient for current study. Therefore, sample size assumption was verified.

Normality and Outliers

Univariate and multivariate normalities were checked for the normality assumption. By means of skewness and kurtosis values, univariate normality was verified for each of the variables. The skewness and kurtosis values of the SET 1 and SET 2 variables were all in acceptable range being between -2 and +2 for a normal distribution (see Table 4.6). Moreover, histograms seem to be normally distributed for all variables (see Appendix I).

Table 4.6 Descriptive Statistics of the SET 1 and SET 2 Variables

	Mean	**Std. Deviation**	**Min.**	**Max.**	**Range**	**Skewness**	**Kurtosis**
SET 1							
Constructivist Conception	4.38	.42	3.00	5.00	2.00	-.53	.08
Traditional Conception	2.55	.55	1.28	4.06	2.78	.15	-.20
SET 2							
PSTE	3.98	.51	2.54	5.00	2.46	-.41	.32
STOE	3.71	.41	2.20	4.70	2.50	-.09	.41
LAQ-M	3.12	.41	2.09	4.00	1.91	.08	-.19
LAQ-R	2.36	.36	1.27	3.36	2.09	-.10	.71

Multivariate normality indicates the normal distribution of all variables and all linear combinations of variables (Tabachnick & Fidell, 2007). Multivariate normality was checked by calculating Mahalanobis Distance and comparing with the critical value obtained from the chi-square table (Pallant, 2007). According to chi-square table, the critical chi-square value was found to be 22.46. The maximum Mahalanobis Distance of the sample was 24.067. There was only one person whose score exceeded the critical value. Based on the one of the example in the Pallant's book (2007, p. 280), the researcher decided to left this person in the data file since there was one person and their score is not too high. If there had been a lot of outlying cases, the researcher might have considered removing the outlying case from the data (Pallant, 2007). To conclude, normality and outliers assumption were verified.

Absence of Multicollinearity

When the variables in each set and across sets are highly correlated (r=.9 and above), multicollinearity exists (Tabachnick & Fidell, 2007). The correlations between SET1 and SET2 variables are shown in Table 4.7. Correlations coefficients between the variables in each set and across sets are not higher than .7. Therefore, multicollinearity assumption was verified.

Table 4.7 Correlation Between the SET 1 and SET 2 Variables

	PSTE	STOE	LAQ-M	LAQ-R	Constructivist Conception	Traditional Conception
PSTE	-					
STOE	.324**	-				
LAQ-M	.435**	.275**	-			
LAQ-R	-.420**	-.088	-.353**	-		
Constructivist Conception	.475**	.389**	.457**	-333**	-	
Traditional Conception	-345**	-.029	-.196**	.452**	-.438**	-

** Correlation is significant at the .01 level (2-tailed).

Linearity and Homoscedasticity

To check linearity and homoscedasticity, the scatter plots were examined (see Appendix J). Scatter plots generally showed that there was no serious violation of linearity and homoscedasticity assumption for many pairs of SET 1 variables across SET 2 variables. So, linearity and homoscedasticity assumptions were verified.

4.2.3.1 Canonical Correlation Analysis

The first canonical correlation was .60 (36% overlapping variance); the second was .40 (16% overlapping variance). With all two canonical correlations included, $\chi^2(8)=124.87$, $p<.05$, and with the first canonical correlation removed, $\chi^2(3)=34.81$, $p<.05$.

Data on the first two pairs of canonical variates were shown in Table 4.8. Specifically, "correlations between the variables and the canonical variates, standardized canonical variate coefficients, within-set variance accounted for by the canonical (percent of variance), redundancies, and canonical correlations" (Tabachnick & Fidell, 2007, p. 603).

Table 4.8 Correlations, Standardized Canonical Coefficients for the First and Second Canonical Variates

	First Canonical Variate		**Second Canonical Variate**	
	Correlation	**Coefficient**	**Correlation**	**Coefficient**
SET 1				
Constructivist Conception	.98	.87	.22	.70
Traditional Conception	-.63	-.25	.78	1.08
Percent of Variance	.67		.33	
Redundancy	.24		.05	
SET 2				
PSTE	.83	.44	-.11	-.16
STOE	.57	.31	.60	.60
LAQ-M	.72	.33	.25	.43
LAQ-R	-.66	-.34	.65	.79
Percent of Variance	.49		.22	
Redundancy	.18		.03	
Canonical Correlation	.60		.40	

Using a cutoff correlation of .30, the first pair of canonical variates indicated that more constructivist conception (.98) and less traditional conception (-.63) were associated with high sense of personal science teaching efficacy (.83), high sense of science teaching outcome expectancy (.57), more meaningful learning approach (.72), and less rote learning approach (-.66). That is, preservice science teachers who have high sense of personal science teaching efficacy, high sense of science teaching outcome expectancy and adopt more meaningful learning approach and less rote learning approach were likely to prefer more constructivist conception and less traditional conception. Besides, the percentage of variance values revealed that first canonical variate pair extracts 67% of the variance from SET 1 and 49% of the variance from SET 2. Redundancy values indicated that the first canonical variate from SET 1 accounts for 18% of the variance in SET 2. Likewise, the first canonical variate from SET 2 accounts for 24% of the variance in SET 1.

On the other hand, the second pair of canonical variates indicated that more traditional conception (.78) were associated with high sense of science teaching outcome expectancy (.60) and more rote learning approach (.65). That is, preservice science teachers who have high sense of science teaching outcome expectancy and adopt more rote learning approach were likely to prefer traditional conception. Besides, the percentage of variance values revealed that second canonical variate pair extracts 33% of the variance from SET 1 and 22% of the variance from SET 2. Redundancy values indicated that the second canonical variate from SET 1 accounts for 3% of the variance in SET 2. Likewise, the second canonical variate from SET 2 accounts for 5% of the variance in SET 1.

4.3 Summary of the Results

The results of the present study can be summarized as follows:

1. The results of the DASTT-C showed that preservice science teachers' perspectives of science teaching conception is 42.7% student-centered, 7.0% teacher-centered and 50.3% neither student-centered nor teacher-centered representing an instructional method including both student-centered and teacher-centered instruction characteristics.
2. Preservice science teachers' total mean score on DASTT-C was 5.46 that falls in the middle category--neither student-centered nor teacher-centered.
3. As understood from the mean scores of the TLCQ preservice science teachers seemed to prefer constructivist conception (*M*=4.38, *SD*=.42) more than traditional conception (*M*=2.55, *SD*=.55).
4. Preservice science teachers' responses to STEBI-B showed generally high levels of personal teaching efficacy (*M*=3.98, *SD*=.51) and outcome expectancy (*M*=3.71, *SD*=.41).
5. The mean of meaningful learning scores (*M*=3.12, *SD*=.41) is higher than rote learning (*M*=2.36, *SD*=.36) which means that preservice science teachers generally use meaningful learning approaches rather than rote learning approaches.
6. The first pair of canonical variates demonstrated that preservice science teachers who have high sense of personal science teaching efficacy, high sense of science teaching outcome expectancy and adopt more meaningful learning approach and less rote learning approach were likely to prefer more constructivist conception and less traditional conception. Moreover, the second pair of canonical variates demonstrated that preservice science teachers who have high sense of science teaching outcome expectancy and adopt more rote learning approach were likely to prefer traditional conception.

CHAPTER 5

CONCLUSIONS, DISCUSSIONS, AND IMPLICATIONS

This chapter includes the conclusion and discussion of the findings of the present study, implications of the study and recommendations for future studies.

5.1 Conclusions and Discussions of the Results

The present study examined preservice science teachers' images of themselves as a science teacher, their teaching and learning conceptions, self-efficacy beliefs regarding teaching science, and learning approaches. This study also interested in investigating the possible relationships among preservice science teachers' conceptions about teaching and learning, learning approaches and self-efficacy beliefs.

The results of the current study revealed that preservice science teachers' perspective of teaching and learning conception as understood from their drawings on DASTT-C was 42.7% student-centered, 50.3% neither student-centered nor teacher-centered and 7.0% teacher-centered. In fact, preservice science teachers' mean of total DASTT-C scores was 5.46 that fell in the middle category--neither student or teacher-centered teaching and learning conception. These results might imply that preservice science teachers in this study might be still under the influence of their past both elementary and high school learning experiences, which is based on teacher-centered instruction. Moreover, preservice science teachers may be discouraged from using student-centered instruction in real classroom context during field experiences. For instance, preservice science teachers may encounter reality shock of a real classroom teaching when they consider crowded class size, insufficient equipments in classrooms, and lack of time for student-centered instruction. This might led them to include teacher-centered instruction characteristics in their drawings. However, preservice science teachers' current learning experiences in teacher education programs, which depends on student-centered instruction and constructivist theory, might also have an effect on their images of themselves as a science teacher. Therefore, there might be a conflict between preservice science teachers' past learning experiences and current learning experiences. Thus, preservice science teachers might reflect the intermingling of both the traditional and constructivist teaching and learning conceptions in their drawings on DASTT-C. Apart from, given that most of the preservice science teachers (50.3%) fell in neither student nor teacher-centered teaching and learning conception category, it could be thought that there is still a necessity to lead preservice science teachers to student-centered instruction with creating inquiry-based active learning environments in education faculties that permit more critical thinking, discovery and collaboration to get perspectives of teaching and learning in science education based on student-centeredness. Besides, preservice science teachers might need much more practice in method courses to learn how to apply student-centered instruction in classroom settings. Nevertheless, seven percent teacher-centered teaching and learning conception might be accepted as an indication that teacher education programs were promising in favor of student-centeredness. In other words, programs for science teacher preparation might become more influential and effective in favor of student-centeredness in recent years. Correspondingly, the findings of the current study were parallel to the studies conducted with preservice chemistry teachers (Elmas et al., 2011) and preservice elementary teachers (Yılmaz et al., 2007). For instance, Elmas et al. (2011) found that most of the preservice chemistry teachers (39.4%) teaching style perception was between student-centered and teacher-centered instruction. According to the researchers, the possible reason behind might be restructured 2004 education reform, that support the effectiveness of student-centered instructional pedagogies, and preservice chemistry teachers' school experiences as learners, which is based on teacher-centered instruction. Similarly, as a results of their study, Yılmaz et al. (2007) found that most of the preservice elementary teachers' (39%) perception of teaching was between student-centered and teacher-centered instruction. Consequently, the researchers argued that science teacher educators may not sufficiently provide the applicability of constructivism for instructional goals to preservice elementary teachers in science courses.

On the other hand, in the current study, preservice science teachers' teaching and learning conceptions were also measured with TLCQ, a self-reported instrument, in addition to DASTT-C instrument. According to TLCQ, preservice science teachers' conceptions about teaching and learning were examined in two categories: traditional and constructivist conception. However, preservice science teachers' conceptions about teaching and learning obtained through DASTT-C instrument were examined in three categories: teacher-centered which refers to traditional conception of TLCQ, student-centered which refers to constructivist conception of TLCQ, and neither student-centered nor teacher-centered. When the two different results from TLCQ and DASTT-C were analyzed, it was seen that TLCQ yielded somewhat contradicted results suggesting that participants in this study preferred to use constructivist conception (M=4.38) in their teaching. Besides, it is necessary to note that traditional conception mean value (M=2.55) was found quite low, as indicated in the results of DASTT-C. In their self-reports, there might be some preservice science teachers who wish to prefer 'neither student-centered nor teacher-centered' category related items. However, they could not do that since there was no 'neither student-centered nor teacher-centered' category related items in TLCQ. Therefore, it might be thought that TLCQ has some limitations regarding its two distinct dimensions, as compared with DASTT-C.

Moreover, in the current study, paired-sample t-test was used to examine preservice science teachers' teaching and learning conceptions obtained through TLCQ. Results revealed that there was a significant difference between mean scores for constructivist conception and traditional conception suggesting that preservice science teachers adopt constructivist conception more than traditional conception. In fact, while majority of preservice science teachers (84%) believed that teaching means to help students construct their own knowledge, twenty one percent preservice science teachers believed that the focus of teaching was to teach accurate and complete knowledge to students. Correspondingly, these results were consistent with the findings of Aypay's (2011). For instance, Aypay (2011) found that Turkish student teachers were strongly preferred constructivist conception to traditional conception. According to Aypay (2011), teaching-learning activities in Turkish Education System and science curriculum reform based on constructivism have positively influenced student teachers' beliefs regarding constructivist conception. However, there was an inconsistency with the findings of Eren's (2009). It was found in Eren's study (2009) that senior student teachers adopted traditional conceptions rather than constructivist conceptions. According to Eren (2009), the reason might be the teaching practice, in which student teachers experience a 'reality shock' (p.81) while facing with the experienced teachers' role demands and expectations. Reality shock was defined as "the collapse of the missionary ideals formed during teacher training by the harsh and rude reality of everyday classroom life" (Veenman,1984, p.143). Apart from, there were also consistencies and inconsistencies between the results of current study and studies conducted in abroad. For example, Cheng et al.'s study (2009) indicated that student-teachers in Hong Kong strongly believed that the best teaching strategy was the constructivist approach. According to the researchers, this result might be due to the influential and effective impact of the presentation of constructivism and critical thinking in all sectors of Hong Kong education. However, Chan and Elliott (2004) found that student-teachers in Hong Kong did not exclusively adopt one of the conception strongly. They claimed the one of the reasons behind this as the impact of Hong Kong student-teachers' past learning experience based on traditional way of teaching and an exposure to new perspectives in their teacher education program.

Regarding preservice science teachers' learning approaches, paired-sample t-test results indicated significant difference between mean scores for meaningful learning approach and rote learning approach suggesting that preservice science teachers generally try to learn new information relating to their pre-existing concepts rather than rote memorization. As a matter of the fact that majority of preservice science teachers (97%) believed that they learn by associating new knowledge with old one while seventeen percent preservice science teachers learn by memorizing facts. This finding was also parallel to study of Tural Dincer and Akdeniz (2008) and Chan (2003). For instance, Tural Dincer and Akdeniz (2008) examined the learning approaches of science student teachers and found that science student teachers generally have deep learning approaches. According to these researchers, using process based educational approaches, in which students construct their own knowledge through questioning, exploration and using problem-solving skills with the guidance of their teacher, instead of knowledge based educational approaches in the university might be reason behind this conclusion. It was known that education faculties in Turkey have adopted restructured teacher education programs based on constructivist theory, multiple-intelligence theory and student-centered teaching approaches, which center on the construction of knowledge, since 1998 (Yilmaz et al., 2007). Therefore, it could be said that preservice science teachers in the current study might generally adopt deep learning approach under the influence of these reforms in teacher education programs, as argued by Tural Dincer and Akdeniz (2008). Similarly, Chan (2003) found that Hong Kong teacher education students tended to prefer deep and achieving-oriented learning approaches. According to Chan (2003), this was due to Chinese culture, which may trigger the promotion of deep learning.

In the present study, Canonical Correlation Analysis was used to analyze the possible relationships among preservice science teachers' conceptions about teaching and learning, learning approaches and science teaching self-efficacy beliefs. Results revealed that the first canonical correlation was .60 (36% overlapping variance); the second was .40 (16% overlapping variance). For this reason, the first canonical correlation and its corresponding pair of canonical variates were used as a base in order to explain the relationship between pairs of canonical variates since they had more explanatory power than the second ones. Concerning preservice science teachers' self-efficacy beliefs in teaching science, it was seen that while constructivist conception positively related to personal science teaching efficacy beliefs and science teaching outcome expectancy beliefs, traditional conception negatively related to personal science teaching efficacy beliefs and science teaching outcome expectancy beliefs. That is, preservice science teachers who have greater confidence in their ability to teach science and their beliefs about the effectivess of their teaching on students' learning were likely to prefer more constructivist conception. In contrast, preservice science teachers who have less confidence in their ability to teach science and beliefs about the effectivess of their teaching on students' learning were likely to prefer more traditional conception. These results were not suprising as well as the notion of self-efficacy beliefs theory were considered. According to the theory, high self-efficacious teachers trust in their own ability to teach and apply teaching strategies giving students opportunities to have more variability in their classroom behaviors (Finson, 2001), such as engaging in group work, doing hands-on activities. As a matter of the fact that most of the preservice science teachers (82%) indicated a high confidence in their own capability to monitor science experiments effectively as well as majority of them (89%) believed that the focus of learning is to give students a chance to explore, express and discuss their ideas. The relationship between self-efficacy beliefs and conceptions about teaching and learning was also supported in the studies of Eren (2009) and Finson et al. (1999). For instance, Finson et al. (1999) found that low efficacious teachers tended to teach in an authoritative way and with teacher-centered thought. In contrast, when teachers have high self-efficacy, their teaching is inclined to be characterized by more student-centered thought, the use of more inquiry approaches (Finson et al., 1999) in which the teacher acts as a learning facilitator rather than knowledge provider (Chang, 2005). In another study, Eren (2009) indicated that student teachers with constructivist conception have high self-efficacy beliefs and high mastery-approach goal orientation. However, Bıkmaz (2006) found no relationship between preservice teachers' self-efficacy beliefs and their views about effective science course regarding traditional conception and constructivist conception. According to Bıkmaz (2006), it is reasonable to assume that even if one teacher has greater confidence in their ability to teach science, s/he might adopt teacher-centered instruction in teaching science. More research, however, is necessary to clarify the role of self-efficacy beliefs on preservice science teachers' teaching and learning conceptions.

Concerning preservice science teachers' learning approaches, Canonical Correlation Analysis indicated that constructivist conception positively related to meaningful learning approach and negatively related to rote learning approach. That is, preservice science teachers who try to learn new knowledge relating to their pre-existing concepts were likely to prefer more constructivist conception. On the other hand, it was seen that traditional conception positively related to rote learning approach and negatively related to meaningful learning approach. These mean that preservice science teachers who learn new knowledge by rote memorization were likely to prefer more traditional conception. These results were expected since teachers' beliefs about learning might be intertwined with their preferred way of science teaching, as argued by Christensen et al. (1995). It is reasonable to assume that if one teacher experienced learning as establishing relationship between new knowledge and what s/he already know, s/he was more likely to teach in the same way. Therefore, teacher might prefer to teach same as how they learnt in the past (see, Thomas et al., 2001). For instance, if one teacher experienced science learning as a construction of their own meaning, s/he was more likely to prepare lessons in line with constructivist orientation. Moreover, preservice science teachers adopted meaningful learning approach might believe that they understand science concepts well enough to teach science effectively and so they might prefer constructivist conception while teaching science since constructivist conception requires effective science teaching involving the encouragement of students to discuss and participate hands-on activities as well as teachers' deep knowledge in science. As a matter of the fact that the majority of preservice science teachers (82%) believed that they comprehend science concepts well enough to be effective in teaching. The relationship between learning approaches and teaching and learning conceptions was also supported with findings of previous studies reported in the literature. For instance, Christensen et al. (1995) argued that approaches to learning and conceptions of teaching were inseparably linked such that one evolved from the other. In other words, conceptions of teaching are imbedded within some teachers' approaches to learning based on their own experiences as students. Their results showed that surface learners were more likely to see teaching as a transmission of information. On the contrary, deep learners were more likely to see teaching as facilitation of thinking and learning (Christensen et al., 1995). Similarly, in their study, Van Petegem et al. (2005) indicated that student teachers' approaches to learning regarding the construction of knowledge were predictors of their constructivist learning environment choice. According to the results of the study, student teachers' who experienced learning as a construction of their own meaning are likely to prepare lessons in meaningful, strategic and discovery-oriented evironment. However, more research is necessary to clarify the role of learning approaches on teaching and learning conceptions and draw conclusive findings.

To sum up, the results of the present study is generally similar with the findings in the literature although there are some discrepancies for the results of current study and previous studies. The results of the present study showed that preservice science teachers adopt constructivist conception more than traditional conception as well as meaningful learning approaches rather than rote learning approaches. Furthermore, preservice science teachers' responses to STEBI-B showed generally high levels of personal teaching efficacy and outcome expectancy. Moreover, it was concluded that preservice science teachers who have high sense of personal science teaching efficacy beliefs and science teaching outcome expectancy beliefs; and try to relate new knowledge to their pre-existing concepts rather than getting new knowledge by rote memorization are likely to prefer more constructivist conception. On the other hand, preservice science teachers who have low sense of personal science teaching efficacy beliefs and science teaching outcome expectancy beliefs; and get new knowledge by rote memorization rather than relating new knowledge to their pre-existing concepts are likely to prefer more traditional conception.

5.2 Implications of the Study

The present study might be considered as an attempt to reveal senior preservice science teachers' beliefs about teaching and learning, self-efficacy beliefs in science teaching and learning approaches before graduation. When the results of the present study are taken into consideration, implications can be drawn for teacher educators and mentor teachers in the improvement of the quality of teacher education. To cause desired changes within preservice science teachers' beliefs about teaching and learning conceptions, science teaching self-efficacy beliefs and learning approaches, teacher educators can identify their those prior beliefs at the beginning of their education program and design education programs accordingly. For instance, if it is identified the undesired beliefs that preservice science teachers hold such as rote learning, low sense of science teaching self-efficacy beliefs and teacher-centered instruction, teacher educators may design a wide range of classroom experiences for preservice science teachers such as hands-on activities helping them to make a connection between scientific facts and their applications in daily life and microteaching experiences through which they learn how to apply student-centered instruction in classroom environment. These experiences may also help them to become aware of their beliefs about self-efficacy in science teaching and learning approaches, and conceptions about teaching and learning. Besides, teacher educators may provide a constructivist learning environment allowing construction of knowledge through exploration, questioning, experimentation, and active participation as well as appropriate role models employing student-centered instruction more often in their science education courses. Also, mentor teachers might take the science teaching self-efficacy beliefs of preservice science teachers into account when allocating their teaching duties not to face preservice science teachers with unexpected failure in teaching at the beginning of their professional life during field experience activities. Just as Poulou (2007) said "Successes raise efficacy appraisals, whereas repeated failures lower them, especially if the failures occur early in the course of events" (p. 193). Moreover, during field experiences, more opportunities in real teaching situations should be given preservice science teachers by mentors teachers since greater involvement with science teaching might improve preservice science teachers' instructional behaviors in the science classrooms. Consequently, teacher educators and mentor teachers may also make use of the relationship between learning approaches, self-efficacy beliefs and conceptions about teaching and learning to cause desirable changes within preservice science teachers.

5.3 Recommendations of the Study

In the present study, the relationships among preservice science teachers' conceptions about teaching and learning, learning approaches and self-efficacy beliefs were examined. However, there may be some suggestions for future research to illuminate the results of the current study. Since the study was limited by its reliance on self-reported data, further research through use of qualitative studies such as interviews with preservice science teachers and comparison of observations during their field experiences and microteaching experiences in the classroom, might be conducted to examine their learning approaches, self-efficacy beliefs, and conceptions about teaching and learning. Moreover, further research using qualitative approach could be useful to detect underlying causes of the relationship among variables of the current study. What is more, in the current study, data were collected at a single point in time. So, longitudinal studies might be conducted to see changes in learning approaches, self-efficacy beliefs, and conceptions about teaching and learning of preservice science teachers through transition from being a student teacher to professional teacher or to see whether the results of the current study revealed the real beliefs of preservice science teachers due to the fact that the study was limited by its reliance on self-reported data. Besides, further study can be conducted in different geographical region to make generalization for Turkey. In addition, cross-cultural studies might be performed to see differences between our preservice science teachers' learning approaches, self-efficacy beliefs, and conceptions about teaching and learning and that of other countries' preservice science teachers'. Since the results of the current study will be base for future studies, it is worthwhile to move on this line of research to extend related literature and provide more detailed picture on these variables.

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APPENDICES

APPENDIX A

PERMISSION OBTAINED FROM ETHICAL COMMITEE

1956

Orta Doğu Teknik Üniversitesi
Middle East Technical University

Öğrenci İşleri Daire Başkanlığı
Registrar's Office

06531 Ankara, Türkiye
Phone: +90 (312) 2103417
Fax: +90 (312) 2107960
www.oidb.metu.edu.tr

B.30.2.ODT.72.00.00 – 665 – 166

09/02/2012

İLKÖĞRETİM FEN BİLGİSİ ÖĞRETMENLİĞİ BÖLÜM BAŞKANLIĞINA

Üniversitemiz İlköğretim Fen ve Matematik Eğitimi Anabilim Dalı Yüksek Lisans Programı öğrencisi Semra Saçıcı'nın 2011-2012 Eğitim Öğretim Yılı II. Döneminde yüksek lisans tezi kapsamında *"Fen Bilgisi Öğretmen Adaylarının Öğretme ve Öğrenme Kavramları, Öğrenme Yaklaşımları ve Öz-Yeterlik İnançları Arasındaki İlişki"* başlıklı çalışmasına ilişkin hazırlanan anketi Üniversitemiz İlköğretim Fen Bilgisi Öğretmenliği Bölümü'nde öğrenim gören 4. sınıf öğrencilerine uygulama yapmak için, öğrencinin isteği doğrultusunda görevlendirilmesi Etik Komite onayı ile uygun görülmüştür.

Uygulamanın yapılabilmesi için gereğini arz ederim.

Saygılarımla.

Nesrin Ünsal
Öğrenci İşleri Daire Başkanı

Ekler:
1- Öğrencinin dilekçesi
2- Danışmanın dilekçesi
3- ODTÜ İAEK Başvuru Formu Proje Bilgi Formu
4- Uygulanacak Anket

1956

Orta Doğu Teknik Üniversitesi
Middle East Technical University

Öğrenci İşleri Daire Başkanlığı
Registrar's Office

06531 Ankara, Türkiye
Phone: +90 (312) 2103417
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www.oidb.metu.edu.tr

B.30.2.ODT.72.00.00/400 – 1908-500 09/04/2012

EĞİTİM FAKÜLTESİ DEKANLIĞINA

Gazi Üniversitesi'nden alınan, İlköğretim Fen ve Matematik Eğitimi Ana Bilim Dalı Yüksek Lisans Programı öğrencisi Semra Saçıcı'ya ait yazı ilgisi nedeni ile ilişikte sunulmuştur.

Bilgilerinize arz ederim.

Saygılarımla.

Nesrin Ünsal
Öğrenci İşleri Daire Başkanı

SSD/

GAZİ ÜNİVERSİTESİ

T.C.
GAZİ ÜNİVERSİTESİ REKTÖRLÜĞÜ
(Öğrenci İşleri Dairesi Başkanlığı)

SAYI : B.30.2.GÜN.0.72.01.42/ 1277-9120   04.../04/2012
KONU:

ORTA DOĞU TEKNİK ÜNİVERSİTESİ REKTÖRLÜĞÜNE
(Öğrenci İşleri Dairesi Başkanlığı)

İLGİ : a) 09/02/2012 tarih ve 400-745-1811 sayılı yazınız.
b) Üniversitemiz Gazi Eğitim Fakültesi Dekanlığı'nın 22/03/2012 tarih ve B.30.2.GÜN.0.12. 71.01 /1704 sayılı yazısı.

Üniversiteniz İlköğretim Fen ve Matematik Eğitimi Anabilim Dalı Yüksek Lisans Programı öğrencisi Semra SAÇICI'nın 2011-2012 Eğitim – Öğretim yılı II.Döneminde yüksek lisans tezi kapsamında **"Fen Bilgisi Öğretmen Adaylarının Öğretme ve Öğrenme Kavramları, Öğrenme Yaklaşımları ve Öz-Yeterlik İnançları Arasındaki İlişki"** konulu tez çalışması hakkındaki ilgi (a) yazınız Üniversitemiz ilgili birimlerine iletilmiş olup, Gazi Eğitim Fakültesi Dekanlığından alınan cevabi ilgi (b) yazının bir örneği ilişikte sunulmuştur.

Bilgilerinize arz ederim.

Prof.Dr. Duran ALTIPARMAK
Rektör Yardımcısı

Ek :
-İlgi (b) yazı (1 sayfa)

T.C.
GAZİ ÜNİVERSİTESİ
GAZİ EĞİTİM FAKÜLTESİ DEKANLIĞI

SAYI : B.30.2.GÜN.0.12.72.01/ 1704
KONU : İzin

22 Mart 2012

GAZİ ÜNİVERSİTESİ REKTÖRLÜĞÜ
Öğrenci İşleri Dairesi Başkanlığına

İLGİ : 05.03.2012 tarih ve B.30.2.GÜN.0.72.01.42/875-4994 sayılı yazınız.

Orta Doğu Teknik Üniversitesi İlköğretim Fen ve Matematik Eğitimi Anabilim Dalı Yüksek Lisans programı öğrencisi Semra SAÇICI'nın, **"Fen Bilgisi Öğretmen Adaylarının Öğretme ve Öğrenme Kavramları, Öğrenme Yaklaşımları ve Öz Yeterlik İnançları Arasındaki İlişki"** isimli tez çalışmasını 2011-2012 eğitim-öğretim yılı II. Döneminde Yüksek Lisans tezi kapsamında Fakültemiz İlköğretim Bölümü Fen Bilgisi Eğitimi Anabilim Dalı 4. sınıf öğrencilerine anket uygulama isteği Dekanlığımızca uygun görülmektedir.

Bilgilerinizi ve gereğini saygılarımla rica ederim.

Prof. Dr. Ali GÜL
Dekan V.

Gazi Eğitim Fakültesi Dekanlığı 06500 Beşevler-ANKARA Telefon: (312) 202 80 90 - (312) 202 80 91- (312) 202 80 92
Faks: (0 312) 223 86 93 e-posta: gef@gazi.edu.tr Elektronik Ağ: www.gef.gazi.edu.tr

APPENDIX B

VOLUNTARY PARTICIPATION FORM

Bu çalışma, Orta Doğu Teknik Üniversitesi İlköğretim Fen ve Matematik Eğitimi Bölümünde yüksek lisans yapmakta olan Semra Saçıcı tarafından lisansüstü tezi olarak yürütülen bir çalışmadır. Çalışmanın amacı fen ve teknoloji öğretmen adaylarının öğretme ve öğrenme kavramları, öğrenme yaklaşımları ve öz-yeterlilik inançları arasındaki ilişkiyi araştırmaktır. Elde edilen bulguların değerlendirilmesiyle araştırmacıların, eğitimcilerin, öğretmen adayı ve öğretmenlerin konuyla ilgili bilgi sahibi olmaları ve fen eğitimi programlarının geliştirilmesi beklenmektedir. Çalışmaya katılım tamimiyle gönüllülük temelinde olmalıdır ve katılmamaktan ötürü ya da katılımdan vazgeçme sonunda olumsuz hiçbir sonuç olmayacaktır. Cevaplarınız tamimiyle gizli tutulacak ve sadece araştırmacılar tarafından değerlendirilecektir; elde edilecek bilgiler bilimsel yayımlarda kullanılacaktır.

Anket, genel olarak kişisel rahatsızlık verecek soruları içermemektedir. Ancak, katılım sırasında sorulardan ya da herhangi başka bir nedenden ötürü kendinizi rahatsız hissederseniz cevaplama işini yarıda bırakıp çıkmakta serbestsiniz. Böyle bir durumda anketi uygulayan kişiye, anketi tamamlamadığınızı söylemek yeterli olacaktır. Anket sonunda, bu çalışmayla ilgili sorularınız cevaplanacaktır. Bu çalışmaya katıldığınız için şimdiden teşekkür ederiz. Çalışma hakkında daha fazla bilgi almak için Semra Saçıcı ile iletişim kurabilirsiniz (E-posta: ssacici@metu.edu.tr).

Bu çalışmaya tamamen gönüllü olarak katılıyorum ve istediğim zaman yarıda kesip çıkabileceğimi biliyorum. Verdiğim bilgilerin bilimsel amaçlı yayımlarda kullanılmasını kabul ediyorum. (Formu doldurup imzaladıktan sonra uygulayıcıya geri veriniz).

İsim Soyad	**Tarih**	**İmza**
	----/----/-----	

APPENDIX C

BACKGROUND CHARACTERISTICS SURVEY

Sayın Öğretmen Adayı,

Bu anket sizin öğretmen, öğrenci, öğretmenlik mesleği gibi kavramlar hakkındaki düşüncelerinizi ölçmek için hazırlanmıştır. Bu sorulara vereceğiniz yanıtlar, araştırma amacıyla kullanılacak, ve gizli tutulacaktır. Öğretmen adayı olarak vereceğiniz cevaplar, öğretmen yetiştirme programlarının geliştirilmesine önemli katkılarda bulunacaktır. Sizlerin görüşleri bizler için çok önemlidir.

Yardımlarınız için teşekkür ederim.

Araş. Gör. Semra Saçıcı

Bölüm I. Kişisel Bilgiler

1. GPA: ____________________

2. Sınıfınız: ❑1 ❑2 ❑3 ❑4

3. Cinsiyetiniz: ❑ Kız ❑ Erkek

4. Annenizin eğitim durumu:

❑İlkokul mezunu ❑Ortaokul mez. ❑Lise mez. ❑ 2-yıllık yüksekokul mez.
❑4-yıllık fakülte mez. ❑ Yüksek lisans/doktora mez. ❑Okur-yazar değil/terk

5. Babanızın eğitim durumu:

❑İlkokul mezunu ❑Ortaokul mez. ❑Lise mez. ❑2-yıllık yüksek okul mez.
❑4-yıllık fakülte mez. ❑Yüksek lisans/doktora mez. ❑Okur-yazar değil/terk

6. Annenizin mesleği: _______________________

7. Babanızın mesleği: ________________________

8. Mezunun olduğunuz lise türü:

❑Genel lise ❑Süper Lise ❑Anadolu Lisesi ❑Fen Lisesi
❑Teknik Lise ❑Meslek Lisesi ❑Anadolu Öğretmen Lisesi
❑Diğerleri *(lütfen belirtiniz)*__________

9. Mezun olunca öğretmenlik mesleğini yapmayı düşünüyor musunuz?
❑ Evet ❑ Hayır

APPENDIX D

TEACHING AND LEARNING CONCEPTIONS QUESTIONNAIRE (TLCQ)

Aşağıda öğrenme ve öğretme hakkında bazı görüşlere yer verilmektedir. Lütfen her ifadeyi dikkatle okuyunuz. İfadelere katılma derecenizi uygun seçeneği işaretleyerek gösteriniz.

	Kesinlikle Katılıyorum	Katılıyorum	Kararsızım	Katılmıyorum	Kesinlikle Katılmıyorum
1. Bir öğretmen için öğrencilerinin hislerini anlamak önemlidir.					
2. Öğretim, öğrencileri bilgiyi keşfetmeye cesaretlendirmek değil, öğrencilere doğru ve tam bilgi sağlamaktır.					
3. Öğrenme demek, öğrencilerin keşfetmek, tartışmak ve düşüncelerini ifade etmek için bol fırsatlara sahip olmaları demektir.					
4. İyi sınıflar öğrencileri düşünmeye ve birbirleriyle etkileşmeye teşvik edecek demokratik ve özgür bir atmosfere sahiptir.					
5. Öğrenme, öğretmenin öğrettiklerini hatırlamak demektir.					
6. Etkili öğretim, öğrencileri daha fazla tartışmaları ve etkinliklere katılmaları için cesaretlendirir.					
7. Öğretme için geleneksel ders verme yöntemi en iyi yöntemdir. Çünkü daha fazla bilgi içermektedir.					
8. Öğretme, basitçe ders konularını anlatmak, sunmak ve açıklamaktır.					
9. İyi öğretim, sınıfta en çok öğretmen konuştuğunda olur.					
10. Öğrenme, aslında tekrar ve uygulamadan oluşur.					
11. Öğrencilerin fikirleri önemlidir ve bu fikirler üzerinde dikkatle durulmalıdır.					
12. Öğretmenler öğrencilerin yaptıkları şeyler üzerinde daima kontrol sahibi olmalıdır.					

13. Bir öğretmenin başlıca görevi öğrencilere bilgi vermek, onlara tekrarlar ve uygulamalar yaptırmak ve ne hatırladıklarını test etmektir.					
14. Ders süresince öğrencilerin ilgisini ders kitapları üzerinde tutmak önemlidir.					
15. Her çocuk biriciktir ya da özeldir ve kendine özel gereksinimlerine uygun bir eğitim alma hakkına sahiptir.					
16. İyi öğrenciler derste sessiz olurlar ve öğretmenin öğrettiklerini takip ederler.					
17. Öğretimin odağı bilgi alışverişi değil, öğrencilerin kendi deneyimleri ile bilgiyi yapılandırmalarına yardım etmektir.					
18. En iyisi öğretmenlerin sınıfta olabildiği kadar çok otorite uygulamalarıdır.					
19. Farklı öğrencilere farklı amaçlar ve beklentiler uygulanmalıdır.					
20. Öğrenme esas olarak, olabildiği kadar çok bilgiyi özümlemeyi içerir.					
21. Öğrencilerin kontrol altında tutulmaları için daima azarlanmaları gerekir.					
22. İyi öğretmenler, yanıtları kendi başlarına düşünüp bulmaları için öğrencilerini daima cesaretlendirirler.					
23. Bir öğretmenin görevi, öğrencilerin yanlış öğrendikleri kavramları kendi kendilerine düzeltmelerini sağlamak değil, öğretmenin hemen düzeltmesidir.					
24. Öğrenciler kontrol altına alınmadıkça, öğrenme gerçekleşemez.					
25. İyi öğretmenler daima öğrencilerinin kendilerini önemli hissetmelerini sağlarlar.					
26. Öğretmeyi öğrenmek, basitçe ders anlatanların fikirlerini sorgulamadan uygulamak demektir.					
27. Bir şeyi daha sonra hatırlayabildiğimde onu gerçekten öğrenmişimdir.					
28. Öğretim, öğrenciler arasındaki bireysel farklılıklara uyacak kadar esnek olmalıdır.					
29. Bir öğretmenin başlıca rolü, öğrencilere bilgi aktarmaktır.					
30. Öğrencilere fikirlerini ifade etmeleri için pek çok fırsat verilmelidir.					

APPENDIX E

LEARNING APPROACH QUESTIONNAIRE (LAQ)

Aşağıda öğrenme yaklaşımları hakkında bazı görüşlere yer verilmektedir. Lütfen her ifadeyi dikkatle okuyunuz. İfadelere katılma derecenizi uygun seçeneği işaretleyerek gösteriniz.

	Kesinlikle Katılıyorum	Katılıyorum	Katılmıyorum	Kesinlikle Katılmıyorum
1. Genellikle ilk bakışta zor gibi görünen konuları anlamak için çok çaba sarfederim.				
2. Bir konuya çalışırken, öğrendiğim yeni bilgileri eskileriyle ilişkilendirmeye çalışırım.				
3. Ders çalışırken, öğrendiğim konuları günlük hayatta nasıl kullanabileceğimi düşünürüm.				
4. Konuları en iyi, öğretmenin anlattığı sırayı düşündüğümde hatırlarım.				
5. Öğrenmek zorunda olduğum konuları ezberlerim.				
6. Önemli konuları tam olarak anlayana kadar tekrar ederim.				
7. Öğretmenler, öğrencilerin sınavda çıkmayacak konulara çok fazla zaman harcamalarını beklememelidir.				
8. Bir kez çalışmaya başladığımda, her konunun ilgi çekici olacağına inanırım.				
9. Derslerde edindiğim veya kitaplardan okuduğum bilgiler hakkında sık sık kendime sorular sorarım.				
10. Konuları birbiri ile ilişkilendirmenin yeni bir konu hakkında genel bir fikir vermesi bakımından faydalı olduğunu düşünürüm.				
11. Anladığımdan iyice emin olana kadar ders yada laboratuar notlarımı tekrar tekrar okurum.				
12. Bir konu hakkında çok fazla araştırma yapmanın zaman kaybı olduğunu düşündüğümden, sınıfta yada ders notlarında anlatılanları detaylı bir şekilde çalışırım.				

13. Okumam için verilen kaynakları (kitap gibi), anlamını tam olarak anlayıncaya kadar okurum.				
14. Gerçek olaylara dayanan konuları, varsayıma dayanan konulardan daha çok severim.				
15. Bir konuda öğrendiğim bilgiyi başka bir konuda öğrendiğimle ilişkilendirmeye çalışırım.				
16. Benim için teknik terimlerin ne anlama geldiğini anlamanın en iyi yolu ders kitabındaki tanımı hatırlamaktır.				
17. Bulmaca ve problemler çözerek mantıksal sonuçlara ulaşmak beni heyecanlandırır.				
18. Genelde okumam için verilen materyalin bana sağlayacağı faydayı **düşünmem.**				
19. Konuları ezberleyerek öğrenirim.				
20. Çoğunlukla, konuları gerçekten anlamadan okurum.				
21. Bir konuyla ilgili verilen fazladan okumalar kafa karıştırıcı olabileceğinden sadece derste öğrendiklerimize parallel olarak tavsiye edilen birkaç kitaba bakarım.				
22. Ekstra birşeyler yapmanın gereksiz olduğunu düşündüğüm için, çalışmamı genellikle derste verilen bilgiyle sınırlarım.				

APPENDIX F

SCIENCE TEACHING EFFICACY BELIEFS INSTRUMENT (STEBI-B)

Aşağıda fen bilgisi öğretimine yönelik düşünceler göreceksiniz. Belirtilen ifadelere ne derecede katıldığınızı ya da katılmadığınızı ilgili seçeneği işaretleyerek belirtiniz.

	Kesinlikle Katılıyorum	Katılıyorum	Kararsızım	Katılmıyorum	Kesinlikle Katılmıyorum
1. Eğer bir öğrenci fen dersinde herzamankinden daha iyi ise, bunun nedeni çoğunlukla öğretmenin daha fazla çaba harcamasıdır.					
2. Fen konularını öğretmek için sürekli daha iyi yöntemler bulacağımı düşünüyorum.					
3. Ne kadar çok çaba harcasamda fen bilgisi konularını öğretirken yeterince etkili olamayacağım.					
4. Fen bilgisi kavramlarını etkili bir şekilde öğretebilmek için gerekli basamakları biliyorum.					
5. Öğrencilerin fen bilgisi dersi notlarının iyiye gitmesi genellikle öğretmenin daha etkili bir öğretim yöntemi kullanmasının sonucudur.					
6. Öğrencilerin fen bilgisi dersinde yaptıkları deneyleri takip etmede yeterince etkili olamayacağımı düşünüyorum.					
7. Fen bilgisi dersini genellikle etkili bir şekilde öğretemeyeceğim.					
8. Öğrencilerin fen bilgisi dersinde başarısız olmasının nedeni büyük bir olasılıkla etkili olmayan fen öğretimidir.					
9. İyi bir öğretimle, öğrencilerin fen bilgisi dersindeki bilgi yetersizliklerinin üstesinden gelinebilir.					
10. Öğrencilerin fen bilgisi dersindeki başarısının düşük olmasından öğretmen sorumlu tutulamaz.					
11. Fen bilgisi dersinde başarısız olan bir öğrencinin başarısının artması genellikle öğretmenin daha fazla ilgi göstermesinin sonucudur.					

12. Etkili bir şekilde öğretecek kadar fen kavramlarından iyi anlıyorum.					
13. Fen bilgisi dersini öğretirken öğretmenin daha fazla çaba harcaması, bazı öğrencilerin başarısını çok az oranda değiştirir.					
14. Öğrencilerin fen bilgisi dersindeki başarısından genellikle öğretmen sorumludur.					
15. Öğrencinin fen bilgisi dersindeki başarısı, öğretmenin etkili fen öğretimi ile doğrudan ilgilidir.					
16. Fen bilgisi deneyleriyle ilgili soruları açıklamada zorlanırım.					
17. Öğrencilerin fen bilgisi dersi ile ilgili sorularını genellikle cevaplarım.					
18. Fen dersini öğretmek için gerekli becerilere sahip olacağımdan endişeliyim.					
19. Eğer seçim hakkı verilseydi, okul müdürünü veya müfettişleri beni değerlendirmesi için dersime çağırmazdım.					
20. Fen kavramlarını anlamada zorlanan öğrencilerime nasıl yardımcı olacağımı bilemem.					
21. Fen bilgisi dersini öğretirken öğrencilerden gelecek soruları her zaman hoş karşılarım.					
22. Öğrencilere fen bilgisi dersini sevdirmek için ne yapmam gerektiğini bilmiyorum.					
23. Bir veli çocuğunun fen dersine daha fazla ilgi duyduğunu belirtiyorsa, bunun nedeni büyük olasılıkla öğretmenin dersteki performansıdır.					

APPENDIX G

DASTT-C INSTRUMENT SHEET

Aşağıdaki kutucuğa kendinizi, *"fen ve teknoloji öğretmeni"* olarak sınıf ortamında düşünüp çiziniz ve aşağıdaki soruları cevaplayınız.

Resminizde, öğretmen ne yapıyor?

Resminizde, öğrenciler ne yapıyor?

APPENDIX H

DASTT-C SCORE SHEET

I. TEACHER

Activity

Demonstrating Experiment/Activity ______________________________________

Lecturing/Giving Directions (teacher talking) ______________________________

Using Visual Aids (chalkboard, overhead, and charts) ______________________

Position

Centrally located (head of class) ____

Erect Posture (not sitting or bending down) _______________________________

Teacher Total: ____

II. STUDENTS

Activity

Watching and Listening (or so suggested by teacher behavior) ______________

Responding to Teacher/Text Questions___________________________________

Position

Seated (or so suggested by classroom furniture) ____________________________

Students Total: ____

III. ENVIRONMENT

Inside

Desks are arranged in rows (more than one row) ___________________________

Teacher desk/table is located at the front of the room________________________

Laboratory organization (equipment on teacher desk or table) _________________

Symbols of Teaching (ABC's, chalkboard, bulletin boards, etc.) _______________

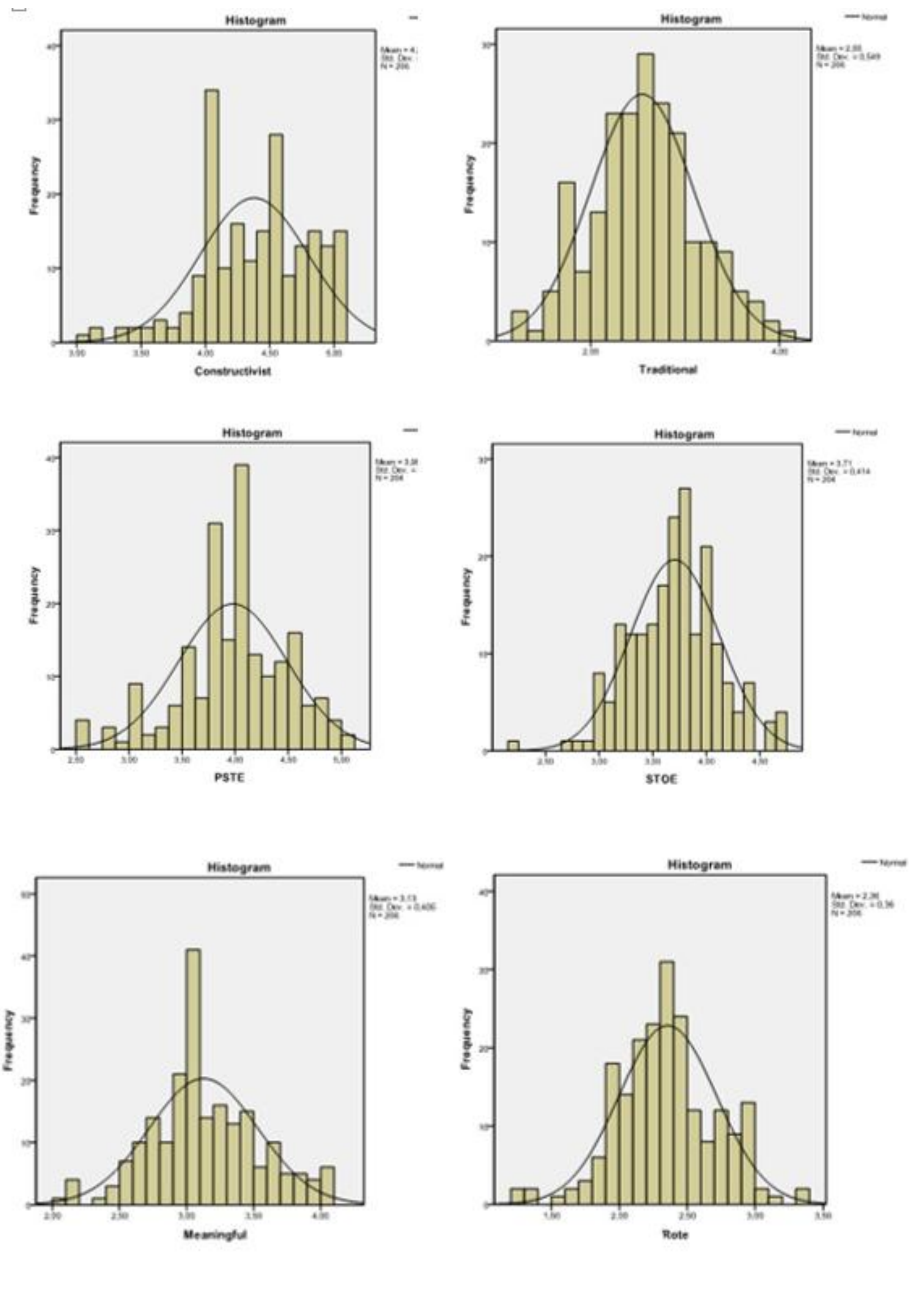
Symbols of Science Knowledge (science equipment, lab instruments, wall charts, etc.) ____

Environment Total: ______

TOTAL SCORE (PARTS I + II + III) =_______

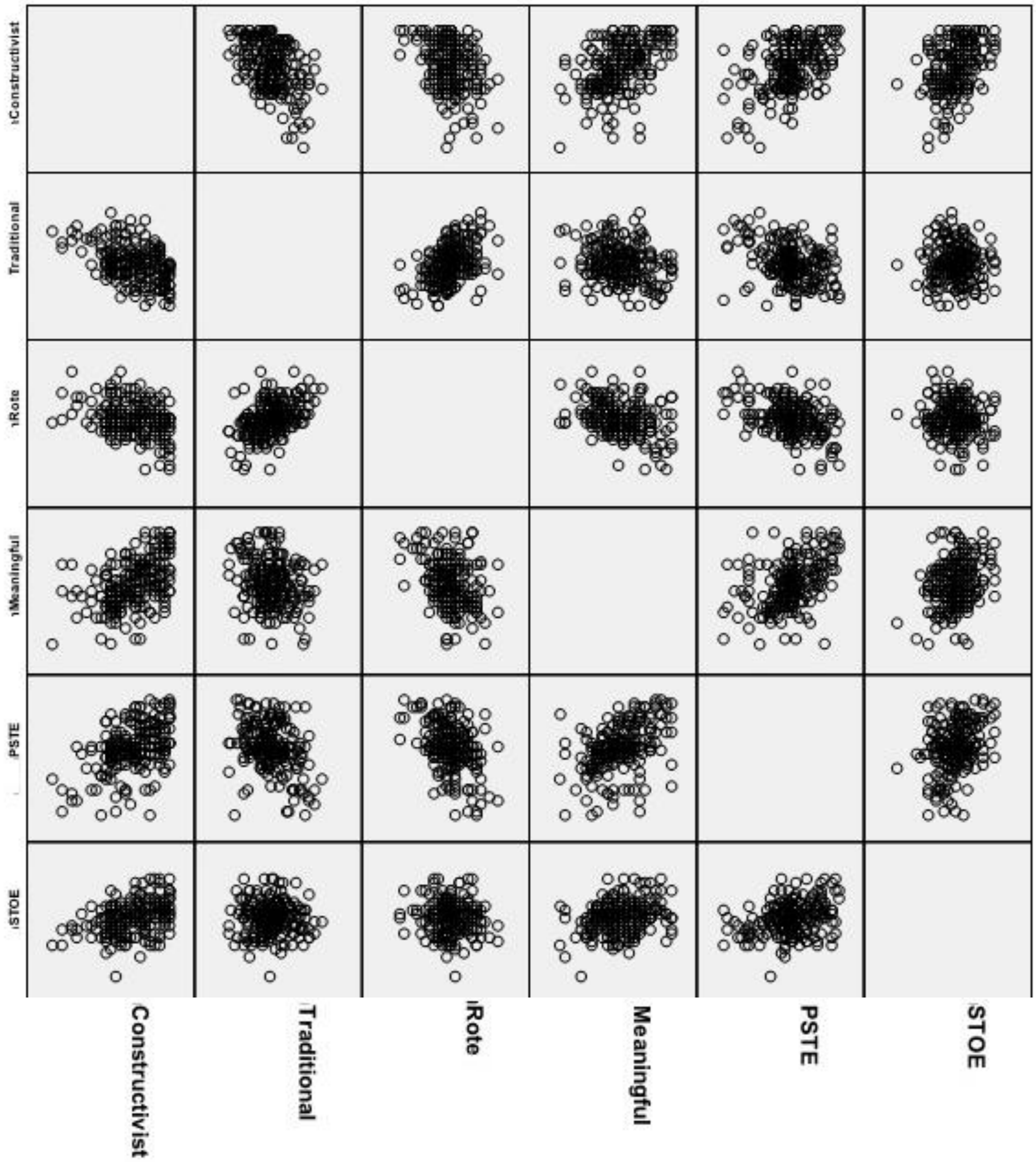
APPENDIX I

HISTOGRAMS of the SET 1 and SET 2 VARIABLES



APPENDIX J

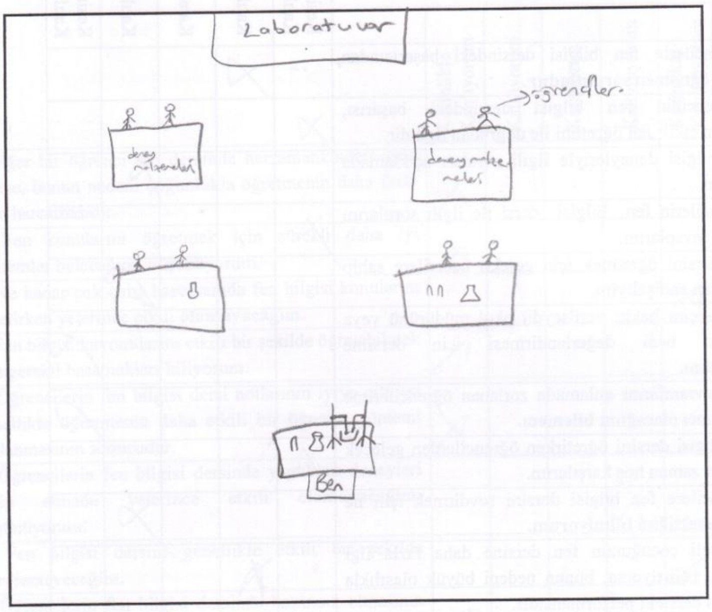
SCATTER PLOTS of the SET 1 AND SET 2 VARIABLES



APPENDIX K

SOME EXAMPLES from DASTT-C

Bölüm V. DASTT-C Anketi / Bir Fen Bilgisi Öğretmeni Çiz Testi
Aşağıdaki kutucuğa kendinizi, *"fen bilgisi öğretmeni"* olarak sınıf ortamında düşünüp çiziniz ve aşağıdaki soruları cevaplayınız.



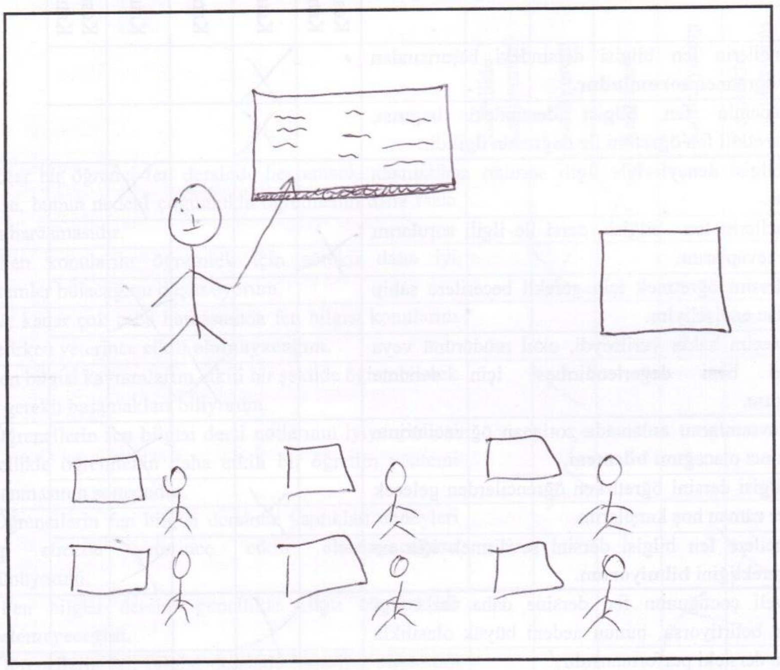
Resminizde, öğretmen ne yapıyor?

öğretmen öğrencilerle birlikte laboratuvarda deney yapıyor. Konu ile ilgili olan deney öğretmen tarafından öğrencilere tanıtılıyor. Yani gerekli açıklamalar yapıyor. Deney esnasında da her masadaki grubu gezerek deneyleri kontrol altında tutuyor.

Resminizde, öğrenciler ne yapıyor?

öğrenciler önce öğretmenlerinden deneyle ilgili bilgileri dinleyip. Deneyin yapılışına geçiyorlar. Her masa başında belli sayıda öğrenci grup halinde çalışıyor.

Bölüm V. DASTT-C Anketi / Bir Fen Bilgisi Öğretmeni Çiz Testi
Aşağıdaki kutucuğa kendinizi, *"fen bilgisi öğretmeni"* olarak sınıf ortamında düşünüp çiziniz ve aşağıdaki soruları cevaplayınız.



Resminizde, öğretmen ne yapıyor?

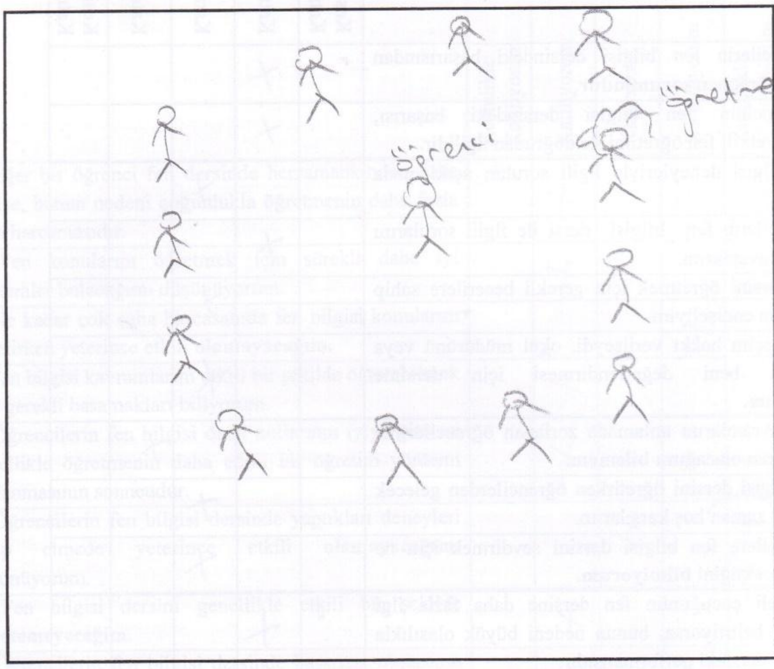
Konusuna etkili bir giriş yapmak için ilgili sorular tahtaya yazıyor ve öğrencilerine sorular sorarak derse giriş yapıyor

Resminizde, öğrenciler ne yapıyor?

Soruları akıllarına gelen ilk cevapları söylüyorlar

Bölüm V. DASTT-C Anketi / Bir Fen Bilgisi Öğretmeni Çiz Testi

Aşağıdaki kutucuğa kendinizi, *"fen bilgisi öğretmeni"* olarak sınıf ortamında düşünüp çiziniz ve aşağıdaki soruları cevaplayınız.



Resminizde, öğretmen ne yapıyor? Öğretmen öğrencilerle beraber oturuyor. Öğretmen öğrenci gibi davranıyor. Sorular soruyor.

Resminizde, öğrenciler ne yapıyor? Bir öğrenci yuvarlak masa olarak düzenlenmiş sınıfta ortada duruyor ve dersle ilgili düşüncelerini, o konuyla ilgili söylemek istediklerini anlatıyor. Sırayla başka öğrenci ortaya çıkıyor.

APPENDIX L

TEZ FOTOKOPİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü ☐

Sosyal Bilimler Enstitüsü ☐

Uygulamalı Matematik Enstitüsü ☐

Enformatik Enstitüsü ☐

Deniz Bilimleri Enstitüsü ☐

YAZARIN

Soyadı : SAÇICI
Adı : SEMRA
Bölümü : İLKÖĞRETİM FEN VE MATEMATİK EĞİTİMİ

TEZİN ADI (İngilizce) : THE INTERRELATION BETWEEN PRE-SERVICE SCIENCE TEACHERS' CONCEPTIONS OF TEACHING AND LEARNING, LEARNING APPROACHES AND SELF-EFFICACY BELIEFS

TEZİN TÜRÜ : Yüksek Lisans ☐ Doktora ☐

1. Tezimin tamamı dünya çapında erişime açılsın ve kaynak gösterilmek şartıyla tezimin bir kısmı veya tamamının fotokopisi alınsın. ☐

2. Tezimin tamamı yalnızca Orta Doğu Teknik Üniversitesi kullancılarının erişimine açılsın. (Bu seçenekle tezinizin fotokopisi ya da elektronik kopyası Kütüphane aracılığı ile ODTÜ dışına dağıtılmayacaktır.) ☐

3. Tezim bir (1) yıl süreyle erişime kapalı olsun. (Bu seçenekle tezinizin fotokopisi ya da elektronik kopyası Kütüphane aracılığı ile ODTÜ dışına dağıtılmayacaktır.) ☐

Yazarın imzası .... Tarih …………………