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RELATIONSHIP BETWEEN THE PROSPECTIVE SCIENCE TEACHERS' LEARNING STYLES, LEARNING AND STUDY STRATEGIES, AND SELF-EFFICACY BELIEFS IN SCIENCE TEACHING[1]

(FEN BİLGİSİ ÖĞRETMEN ADAYLARININ ÖĞRENME STİLLERİ, ÖĞRENME VE DERS ÇALIŞMA STRATEJİLERİ İLE FEN BİLGİSİ ÖĞRETİMİ ÖZYETERLİK İNANÇLARI ARASINDAKİ İLİŞKİ)

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ABSTRACT

The aim of this research is to investigate the relation between self–efficacy beliefs, learning and study strategies and learning styles of pre-service science teachers in science teaching. The data was collected by means of the science teaching self-efficacy beliefs skills developed by Enochs and Rings (1990) and translated into Turkish by Özkan, Tekkaya, and Çakıroğlu (2002), Learning and Study Strategies inventory developed by Weinstein. Schulte and Palmer (1987) and translated into Turkish by Köymen (1990) and the 1999 version of Learning Styles inventory developed by Kolb (1971) and adapted to Turkish by having the studies of validity and reliability by Evin Gencel (2006). The analysis of the data revealed that general learning style preferred by the science teacher candidates were "converging", the learning styles were related to the class level and science self-efficacy beliefs but not related to the gender. Besides, self-efficacy beliefs were at an efficacious level, and related to the class and gender. Also, the attitude and motivation levels as the sub-dimensions of learning and studying strategies were generally low but anxiety level was high, attitude and anxiety levels were related to the gender, motivation level was related to the class discrimination and learning styles were related to the attitude and studying skills.

Keywords: Teacher Training, Self-efficacy, Learning and Studying Strategy, Learning Styles, Science Teaching.

ÖZ

Bu araştırma, fen bilgisi öğretmen adaylarının fen bilgisi öğretimine yönelik öz-yeterlik inançları, öğrenme ve ders çalışma stratejileri ile öğrenme stilleri arasındaki ilişkiyi incelemek amacı ile yapılmıştır. Veriler Enochs ve Rings (1990) tarafından geliştirilen, Özkan, Tekkaya ve Çakıroğlu (2002) tarafından Türkçeye uyarlanan fen bilgisi öğretimi öz-yeterlik inancı ölçeği, Weinstein, Schulte ve Palmer (1987) tarafından geliştirilen, Türkçe geçerlik-güvenirlik çalışmaları Köymen (1990) tarafından gerçekleştirilen Öğrenme ve Ders Çalışma Stratejileri Envanvanteri (ÖDÇSE) ve Kolb (1971) tarafından geliştirilen, Evin Gencel (2006) tarafından Türkçe' ye uyarlanarak geçerlik-güvenirlik çalışmaları yapılan envanterin 1999 versiyonu olan Kolb Öğrenme Stilleri Envanteri (KÖSE III) kullanılarak toplanmıştır. Araştırmaya katılan fen bilgisi öğretmen adayları tarafından genel olarak tercih edilen öğrenme stilinin ayrıştırma olduğu, öğrenme stillerinin, sınıf düzeyi ve fen bilgisi öğretimi öz-yeterlik inancı ile ilişkili olduğu, cinsiyetle ilişkili olmadığı belirlenmiştir. Bunun yanı sıra öz-yeterlik inançlarının "yeterli" düzeyde olduğu, öz-yeterlik inançlarının sınıf ve cinsiyet değişkenleriyle ilişkili olduğu, öğrenme ve ders çalışma stratejilerinin alt boyutları olan tutum ve motivasyon düzeylerinin genel olarak düşük, kaygı düzeylerinin ise yüksek olduğu, tutum ve kaygı düzeylerinin cinsiyet ile, motivasyon düzeyinin sınıf değişkeniyle, öğrenme stillerinin tutum ve çalışma becerileri ile ilişkili olduğu sonuçlarına ulaşılmıştır.

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[1] This study has been generated from the thesis named "Relationship Between The Science Teachers' Learning Styles, Learning and Studying Strategies, and Self-Efficacy Beliefs About Teaching Science" which has been produced by Abdurrahman Köse at Çanakkale Onsekiz Mart University, the Institute of Social Sciences under the supervision of Assist. Prof. Dr. İlke EVİN GENCEL

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Anahtar Sözcükler: Öğretmen Yetiştirme, Öz-Yeterlik İnancı, Öğrenme ve Ders Çalışma Stratejisi, Öğrenme Stilleri, Fen Bilgisi Öğretimi.

INTRODUCTION

International economic competition, rapid scientific and technological developments will continue to affect our lives. In this respect, one of the important points to be taken into consideration to form a powerful future is the need of raising the individuals as scientifically and technologically literate. Individuals who are raised as scientifically literate can reach the information more quickly, generate new information, and apply scientfic methods and techniques to solve the problems they face.

Science education plays an important role in raising individuals who can reach the information, and similarly, efficacy levels of science teachers and science teacher candidates play a key role in science education's being at the intended level. The leading factors that are effective in the course of science education are personal characteristics, learning strategies, related awareness levels, and self-efficacy beliefs of teachers and teacher candidates.

Self-efficacy belief is an efficient characteristic for the formation of behaviour. It is defined as the own judgments of the individual about his capacity of organizing the activities which are required for showing a specific performance, and of successfully maintaining them (Bandura, 1997). Self-efficacy is not a result of the individual's capabilities, but a product of the judgments on what he can do by making use of his capabilities (Bandura 1995; Pajares, 2002; Senemoğlu, 2005), the most efficient source which determines the self-efficacy belief is the information acquired through direct experience. And the other sources are listed as observations of the individual about his successful or unsuccessful practices, society's effect on the success, and lastly the psychological state (Bandura, 1995).

It is observed that those who have high level of self-efficacy in acquiring a capability, learning or teaching a subject conform easily, study harder, and show greater resistance and success in the face of any hardship (Zimmerman, 2000). Studies which have been carried out show that teachers with a high level of self-efficacy are eager, patient, and more attached to the profession than teachers with a low level of self-efficacy (Woolfolk, 2000). Teachers' being able to use proper teaching strategies during the study period, to make a good planning, and to motivate the students will be possible with the self-efficacy they will acquire during their pre-service education. Correspondingly, students will be able to get positive sensual qualities about their teachers and courses.

Personal characteristics of teacher candidates play a key role in the efficiency of pre-service education for science teacher candidates. Personal characteristics are generally sequenced as the individuals' group

characteristics (age, income level, etc.), level of availability, sensual qualities, learning styles, learning and studying strategies (Şimşek, 2002).

Developing the empiric learning theory by taking the study period as the base, and providing sources for many studies, Kolb has defined the learning style as ways which the individual prefers in the course of acquiring and processing information. An individual who knows his own learning style will put this style into practice in the study period. He will learn both more easily and qucikly, and will most probably be successful in the study period (Biggs, 2001).

Kolb identifies four learning styles which are diverging, assimilating, converging, and accommodating. The learning style of diverging approaches to concrete situations with different viewpoints. It prefers to observe rather than take immediate action in the face of any situation (Kolb, 1999: 7). Individuals who have the learning style of diverging are patient and careful in the study period, and they like focusing on situations in which, like in brainstorming technique, different notions are generated (Ekici, 2003). Individuals who have the learning style of assimilating are rather successful at making a logical unity out of broad and comprehensive information. It is observed that assimilating students have some developed capabilities of making plans and determining problems, but fail to follow a systematical approach in practical studies (Hein&Budny, 2000; Kolb, 1999: 7).

It is emphasized that individuals who have the learning style of converging generally prefer deductive reasoning, and that their analytics, and capabilities of deciding and problem solving are sophisticated. The most important characteristic of the individuals who have the learning style of accommodating is that they have the capability to learn by making use of their previous experiences. These individuals who have leadership characteristics are regarded as inquisitive and investigative, and they generally come into prominence with their characteristics of assertiveness, flexibility, and open-mindedness (Aşkar & Akkoyunlu, 1993; Kolb, 1999).

One of the personal characteristics that are important in the study period is the learning and studying strategies. They are generally defined as behaviours and notions which are expected to affect the processes, which the individuals display in the study period, of getting information, encoding to the memory, and calling it back when necessary. Learning strategy is each one of the techniques which simplify the individual's self-learning. With learning strategies, individual's self-motivation, i.e. following efficient ways in choosing, acquiring, arranging, or integrating the information, is intended. Learners can utilize different strategies for each learning activity. In this respect, it is necessary for the individuals to form, maintain, change, and renew their own learning strategies so as to get the expected efficiency and success. Therefore, it is important to determine the learning strategies which students use, and to examine the relationship between these strategies and

some other qualities of theirs. Studying and learning strategies have important roles in learning how to learn, and in preparing influential and efficient teaching situations (Weinstein & Mayer, 1985).

When the data on Turkey's success situation in the domain of science are examined, it is seen that the results are not at the intended level. According to the EARGED (Education Research and Development Department) report by Ministry of Education, success of elementary school students in science is below 50 per cent in Turkey in general (Özdemir, 2006). In the report 2003 in which the results of the Exam on Evaluating the Student Success carried out again by MOE, it is stated that in science, the success related to observing, performing experiments in laboratory, generalizing and comprehending the results is too low (Eşme, 2004). The average success in the fields of science 1 and science 2, each including 30 questions, has been calculated as 2.7 and 7 according to the Student Selection Examination (SSE) 2006 results.

International evaluation results, too, put forth a similar scheme. In 1999, Turkey attended the TIMSS-R exam which was performed to evaluate the developments of countries in the fields of science and mathematics. Turkey was ranked as the 33rd out of 38 countries that took part in the exam. Programme of International Student Assessment (PISA) 2003 results, too, reveal that Turkey's success was below the average point. There definitely are many factors to these poor results. Some reasons may be listed as that the constructivist learning approach cannot be reflected to science and technology classes at the intended level, that the course periods are below the average, that conventional measuring tools are used in the evaluation phase, and also the efficacy levels of teachers (Bağcı Kılıç, 2002).

Teachers', who are the practitioners of educational programmes, learning styles and strategies, self-efficacy beliefs, and gains they acquire in the pre-service study periods are of capital importance for their teachership efficacies. Some studies in Turkey and abroad on self-efficacy belief in science teaching put forth that self-efficacy beliefs of teachers and teacher candidates are generally at mid and good levels, but that these beliefs are not at a efficacious level in sub-dimension of result expectation (Berkant & Ekici 2007; Ekinci Vural & Hamurcu, 2008; Meriç & Ersoy 2007; Morell & Caroll, 2003; Woolfolk, 2000). Fettahlıoğlu (2008) has identified that self-efficacy belief of teachers change in accordance with their learning styles.

No studies which examine the levels of self-efficacy belief of science teacher candidates in terms of their learning styles, and learning and studying strategies has been found within the relevant literature. From this point of view, a study that would evaluate the relationship between the learning styles, and learning and studying strategies of science -an important course for raising information literate individuals- teacher candidates and the levels of their self-efficacy beliefs in science teaching has been needed. It is considered that this research will contribute to the studies that will be performed in order to

develop the education of teacher candidates, and thus, to make up the deficiencies that arise in science study and develope the science study. In addition, it is considered that by identifying the relationship between learning styles, and learning and studying strategies, this study will help the related persons to learn how these variables can be used more effectively in the learning period.

Therefore, answers to the following questions are sought in the study:

1. What kind of a distribution do science teacher candidates show in terms of their self-efficacy beliefs in science teaching?
2. What kind of a distribution do science teacher candidates show in terms of their learning styles?
3. What kind of a distribution do science teacher candidates show in terms of their learning and studying strategies?
4. Do the self-efficacy beliefs of science teacher candidates show a significant difference in accordance with their learning styles?
5. Do the learning and studying strategies of science teacher candidates show a significant difference in accordance with their learning styles?
6. Is there a significant relationship between the science teacher candidates' learning and studying strategies, and self-efficacy beliefs in science teaching?

METHODOLOGY

This research is as descriptive study which is designed with survey model for determining the prospective science teachers' learning styles, learning and study strategies, and self-efficacy beliefs in science teaching.

Subjects

Teacher candidates studying at the Elementary Science Teaching Departments of education faculties in Turkey constitute the general population of the research. And the students at Elementary Science Teaching Department, at Çanakkale Onsekiz Mart University in the 2009-2010 academic year constitute the target population. There is no sampling since the working population is in an available condition. Distribution of the teacher candidates, who have taken part in the research, in terms of their genders and grade levels is provided in Table 1.

Table 1. Distribution of Prospective Science Teachers' in Terms of Their Genders and Grade Levels

		1st Grade	2nd Grade	3rd Grade	4th Grade	Total
Female	**N**	70	54	47	44	215
	%	25,5	19,8	17	16	78,2
Male	**N**	11	21	17	11	60
	%	4	7,7	6,2	4	21,8
Total	N	81	75	64	55	275
	%	29,5	27,3	23,2	20	100

As seen in Table 1, 29.5% of the 275 teacher candidates taking part in the research are 1st grade, 27.3% are 2nd grade, 23.2% are 3rd grade, and 20% are 4th grade students. 78.2% of teacher candidates are females, while the 21.8% of them are males.

Data Gathering Tools

Research data has been acquired through Scale for Self-Efficacy Belief İn Science Teaching, Kolb Learning Styles Inventory-III, and Detection Scale for Learning and Studying Strategies.

Scale for Self-Efficacy Belief in Science Teaching

It has been developed by Riggs and Enochs (1990) to measure the science teacher candidates' self-efficacy beliefs in science teaching. The scale that has been prepared in five point likert type is composed of 23 items and of two sub-dimensions which are Personal Self-Efficacy Belief İn Science Teaching, and Result Expectation in Science Teaching. Cronbach Alpha reliability coefficient of the scale which has been adapted to Turkish by Özkan, Tekkaya, and Çakıroğlu (2002) is .79 for the first sub-dimension, and .86 for the second. And in this study, the value calculated for the first sub-dimension is .76, and the value for the second is .90.

Kolb Learning Styles Inventory-III

There are 3 versions of the Kolb Learning Styles Inventory. The first version of the inventory has been developed by Kolb in 1971. The points taken from the scale are grouped according to the Experiential Learning Theory as "Converging", "Diverging", "Assimilating", and "Accommodating" in relation with the preferences of "Concrete Experience", "Reflective Observation", "Abstract Conceptualizing", and "Active Experience". Inventory's second version has been renewed in 1981. The inventory in question has been translated into Turkish by Aşkar and Akkoyunlu (1993),

validity and reliability studies have been performed. Validity and reliability study of the last version which has been prepared in 1999, and is comprised of 12 completion items has been performed by Evin Gencel (2006). According to the data gathered, Cronbach alpha value has been found to be .76 for concrete experience, .71 for reflective observation, .80 for abstract conceptualizing, .75 for active experience, .84 for abstract conceptualizing-concrete experience, and .79 for active experience-reflective observation. Reliability coefficients measured in this study are .75, .73, .82, .77, .85, and .78, respectively.

Learning and Study Strategies Inventory

It has been developed by Weinstein, Schulte, and Palmer (1987), and its validity-reliability studies have been carried out by Köymen (1990). The tool is composed of 77 items and 10 lower divisions. These are "Attitude, Motivation, Use of Time Management Principles, Anxiety, Concentration, Information processing, Selecting main ideas, Use of support techniques, Self-Testing, and Testing Strategies". It has been identified that the Cronbach alpha coefficients of sub-dimensions are within 0.68-0.86, and that test, retest correlation coefficients change within the range of 0.72-0.85. In this study, reliability coefficients of sub-dimensions have been calculated as .68; 0.72; 0.80; 0.69; 0.75; 0.82; 0.79; 0.85; 0.76, and 0.86, respectively.

Processes

Permissions necessary for the application of scales have been taken from the related university before starting the applications. Data gathering tools have been used by investigators. Within this period, directions on how to mark the data gathering tools have been primarily explained to the teacher candidates. Data gathering period has lasted for three weeks. At the end of this period, it has been found that some participants incompletely filled the data gathering tools, and hence, these data has not been evaluated.

FINDINGS

The first sub problem of the study has been determined to be "What kind of a distribution do science teacher candidates show in terms of their self-efficacy beliefs in science teaching?". The minimum and maximum points that have been taken to examine science teacher candidates', who have taken part in the research, general distribution in terms of their self-efficacy beliefs in science teaching. Mean and standard deviation points are provided in Table 2.

Table 2. Mean and Standard Deviation Values of Science Teacher Candidates' Self-Efficacy Belief Scores in Science Teaching

N	Minimum	Maximum	$\overline{X}$	S
275	46.00	109.00	83.75	10.56
Personal Self-Efficacy				
275	25.00	65.00	51.67	7.35
Result Expectation				
275	15.00	45.00	32.07	5.3

The highest point that teacher candidates can get from the scale for self-efficacy belief in science teaching is 115.00, and the lowest point is 23.00. Range of the scale has been identified through proportion of the difference between the highest and lowest points possible to the number of groups (Tekin, 1993). According to the evaluations done in light of this, 23-41 points are in no way efficacious, 42-60 points are inefficacious, 61-79 points are efficacious at mid-level, 80-98 points are efficacious, 99-115 points are very efficacious. According to Table 2, teacher candidates regard themselves as "efficacious". However, the fact that the average point is close to bottom line of the "efficacious" range is striking. Teacher candidates see themselves as "efficacious" in lower division of personal self-efficacy, and as "efficacious at mid-level" in lower division of result expectation.

The second sub problem of the research is stated as "What kind of a division do science teacher candidates show in terms of their learning styles?". Frequency and percentage distribution of the participants in terms of their learning styles are provided in Table 3.

Table 3. Frequency and Percentage Distribution of Science Teacher Candidates in Terms of Their Learning Styles

Learning styles	f	%
Accommodating	84	30.5
Diverging	45	16.4
Converging	90	32.7
Assimilating	56	20.4

As seen in Table 3, 33.7% of teacher candidates have the learning style of converging, 30.5% of them accommodating, 20.4% of them assimilating, and 16.4% of them diverging. It has been revealed that teacher candidates mostly have the learning style of convering, which is a sign of learning by thinking

and practicing. Besides, it is observed that the participants have different preferences about learning.

The third sub problem of the research is specified as "What kind of a division do science teacher candidates show in terms of their learning and studying strategies?". Descriptive statistical results of the points that participants has got from learning and studying strategies scale are provided in Table 4.

Table 4. Mean and Standard Deviation Values of Science Teacher Candidates' Learning and Study Strategies Points

	N	Minimum	Maksimum	$\overline{X}$	S
Attitude	275	12.00	40.00	30.58	4.80
Motivation	275	12.00	40.00	26.27	4.92
Use of time management principles	275	11.00	40.00	25.08	5.79
Anxiety	275	8.00	40.00	24.46	5.78
Concentration	275	10.00	36.00	25.14	4.73
Information processing	275	19.00	40.00	30.34	4.46
Selecting main ideas	275	10.00	25.00	19.73	2.9
Use of support techniques	275	12.00	38.00	29.98	4.4
Self testing	275	11.00	40.00	27.64	5.18
Testing strategies	275	16.00	40.00	29.25	4.54

In order to make them more comprehensible, data in Table 4 have been transformed into profile formation graphic which is indicated in the scale's original form. The data has been represented in Figure 1.

As seen in Figure 1, primarily the attitude and motivation levels of teacher candidates have been found to be below 50%. Besides, it has also been detected that lower divisions of use of time management mrinciples (60%), concentration (50%), and testing strategies (50%) are close to the bottom line. In addition, it can be said that lower divisions of selecting main ideas (70%), anxiety (45%), and self-testing (70%) are at efficacious levels, and that the lower division of information processing (80%) is at a rather efficacious level.

99	39	39	39	39	38	39	25	38	39	39	99
95	38	38	33	36	34	36	23	33	33	37	95
90	37	37	32	34	32	34	22	31	32	35	90
85	36	36	30	33	31	32	21	30	30	34	85
80	35	35	29	32	30	31	---	29	29	33	80
75	---	---	28	31	29	30	20	28	---	---	75
70	34	34	27	30	---	9	---	27	28	32	70
65	---	33	26	29	28	---	19	26	27	---	65
60	33	32	25	28	27	28	--	---	---	31	60
55	---	---	24	27	26	27	---	25	26	---	55
50	32	31	23	26	25	---	18	---	25	30	50
45	---	30	22	25	24	26	---	24	---	29	45
40	31	---	21	24	23	25	17	23	24	---	40
35	30	29	20	23	22	24	---	---	23	28	35
30	29	28	19	22	21	23	16	22	22	27	30
25	---	27	18	21	20	22	---	21	21	26	25
20	28	26	17	20	19	21	15	20	20	25	20
15	27	25	15	19	18	20	14	19	19	24	15
10	25	23	14	17	16	19	13	18	18	22	10
05	23	20	12	15	13	17	11	16	16	19	05
01	19	17	09	12	10	14	08	13	12	14	01
	Attitude	**Motivation**	**Use of time management principles**	**Anxiety**	**Concentration**	**Information processing**	**Selecting main ideas**	**Use of support techniques**	**Self testing**	**Testing strategies**	

Figure 1. Graphic for General Distribution of Lower Divisions of Learning and Study Strategies

The fourth sub problem of the research has been specified as “Do the self-efficacy beliefs of science teacher candidates show a significant difference in accordance with their learning styles?”. Average points and standard deviation values of the points that the participants have got from the scale as a whole and from its lower divisions are provided in Table 5.

Table 5. Mean and Standard Deviation Values for Self-Efficacy Belief Points in Science Teaching in Terms of Science Teacher Candidates' Learning Styles

Style	Self-Efficacy			Personal Self-Efficacy			Result Expectation		
	N	$\overline{X}$	S	N	$\overline{X}$	S	N	$\overline{X}$	S
Accommodating	84	85.51	10.5	84	52.69	7.54	84	32.82	5.41
Diverging	45	84.77	11.11	45	52.37	7.82	45	32.40	5.08
Converging	90	82.07	9.75	90	50.37	6.76	90	31.7	5.01
Assimilating	56	82.96	11.08	56	51.67	7.45	56	31.28	5.71

According to Table 5, teacher candidates who have the learning style of accommodating have acquired the highest mean in the scale as a whole and in lower divisions ($\overline{X}$ = 85.51, $\overline{X}$ = 52.69, $\overline{X}$ = 32.82). On the other hand, self-efficacy and personal self-efficacy average points ($\overline{X}$ = 82.07, $\overline{X}$ = 50.37) of teacher candidates with the learning style of converging, and also result expectation average points ($\overline{X}$ = 31.28) of teacher candidates with the learning style of assimilating are at the lowest level. The one way analysis of variance has been performed to find out whether the differences between the average points are statistically significant. Results are provided in Table 5.1.

Table 5.1. The Comparison of Self Efficacy Believes of Prospective Science Teachers According to Their Learning Styles

Self-Efficacy		Sum of Squares	Sd	Mean of Squares	F	p
General	**Between Groups**	594.537	3	198.179	3.79	0.149*
	Within Groups	29971.150	271	110.595		
	Total	30565.687	274			
Personal Self-Efficacy	**Between Groups**	260.296	3	86.765	1.61	0.186
	Within Groups	14541.900	271	53.660		
	Total	14802.196	274			
Result Expectation	**Between Groups**	99.095	3	33.032	1.17	0.319
	Within Groups	7601.450	271	28.050		
	Total	7700.545	274			

As seen in Table 5.1 the F value has been found to be significant in the points taken from the scale as a whole as a result of the variance analysis. According to results of Scheffe test which has been performed to specify within which groups there is a significant difference, teacher candidates with learning style of accommodating have significantly higher average points ($\overline{X}$ = 85.51) of self-efficacy belief in science teaching than those ($\overline{X}$ = 82.07, $\overline{X}$ =82.96) of the teacher candidates with learning style of converging and assimilating.

The fifth sub problem of the research has been identified as "Do the self-efficacy beliefs of science teacher candidates show a significant difference in accordance with their learning styles?". Percentage inventories for learning and studying strategies which the science teacher candidates utilize in accordance with their learning styles are provided in Figure 2.

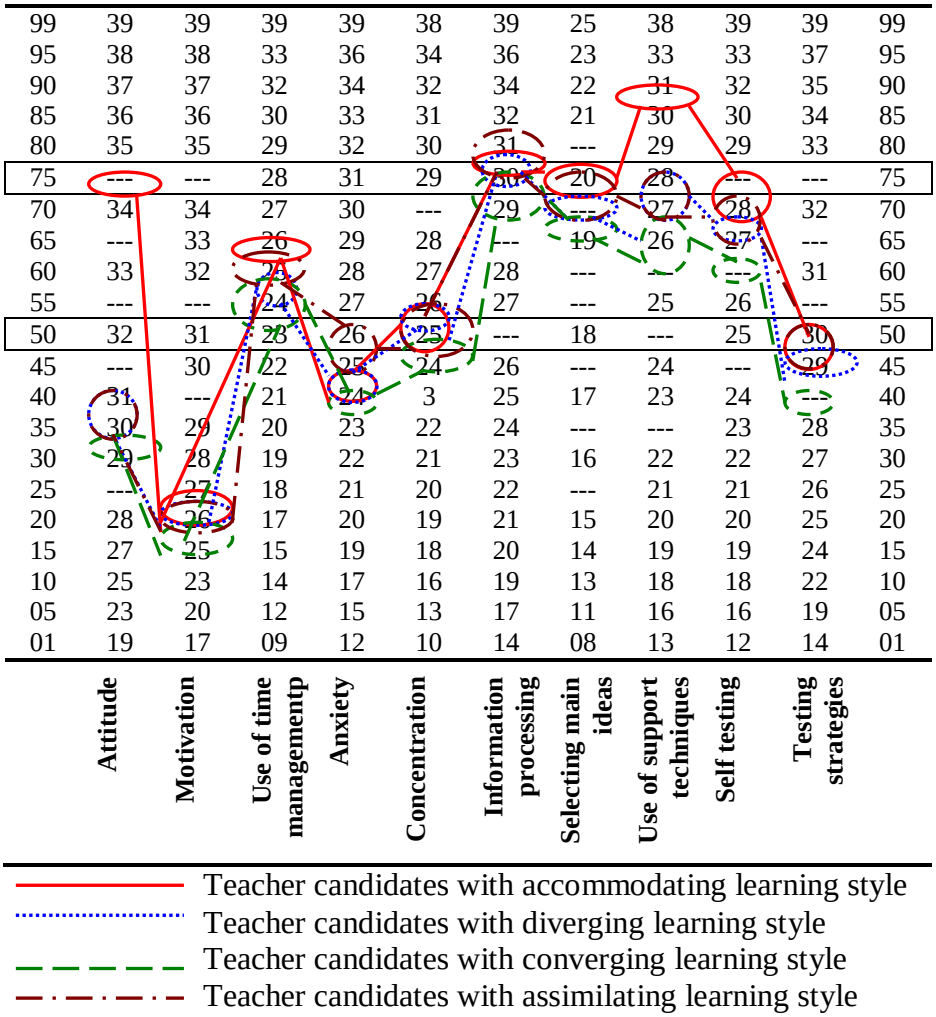

Figure 2. Graphic for Distribution of Teacher Candidates' Study Strategies in Accordance with Their Learning Strategies

As seen in Figure 2, teacher candidates' motivation levels (20%) are rather low regardless of which learning style they have. Attitude levels (35%-40%) of all teacher candidates except for those with learning styles of accommodating are also low. Attitude levels (75%) of teacher candidates with learning style of accommodating are much higher than those of other teacher candidates. In addition, it can be stated that teacher candidates with learning style of converging need to be supported in lower divison of testing strategies. Results of the one way analysis of variance performed to specify whether the differences between average points are significant are provided in Table 6.

Table 6. The Comparison of Learning and Studying Strategies of Prospective Science Teachers According to their and Learning Styles

		Sum of Squares	sd	Mean of Squares	F
Attitude	**Between Groups**	155.745	3	51.91	4.28*
	Within Groups	6165.164	271	22.75	
	Total	6320.909	274		
Motivation	**Between Groups**	52.998	3	17.666	0.727
	Within Groups	6583.548	271	24.294	
	Total	6636.545	274		
Use of Time Management Principles	**Between Groups**	130.073	3	43.358	1.294
	Within Groups	9077.833	271	33.498	
	Total	9207.905	274		
Anxiety	**Between Groups**	95.793	3	31.931	0.955
	Within Groups	9064.694	271	33.449	
	Total	9160.487	274		
Concentration	**Between Groups**	54.091	3	18.030	0.804
	Within Groups	6080.090	271	22.436	
	Total	6134.182	274		
Information processing	**Between Groups**	102.548	3	34.183	1.726
	Within Groups	5367.683	271	19.807	
	Total	5470.182	274		
Selecting main ideas	**Between Groups**	26.077	3	8.692	1.033
	Within Groups	2280.011	271	8.413	
	Total	2306.087	274		
Use of support techniques	**Between Groups**	128.960	3	42.987	4.241*
	Within Groups	5197.949	271	19.181	
	Total	5326.909	274		
Self-Testing	**Between Groups**	91.947	3	30.649	1.43
	Within Groups	7264.838	271	26.808	
	Total	7356.785	274		
Testing Strategies	**Between Groups**	106.911	3	35.637	1.740
	Within Groups	5549.758	271	20.479	
	Total	5656.669	274		

According to Table 6, difference between the averages in lower divisions of attitude and working auxiliaries has been found significant. According to result of the Scheffe test performed in order to find the source of this difference, points that teacher candidates with learning style of accommodating obtain from lower divisions of attitude and working auxiliaries are significantly higher than the points of teacher candidates with learning style of converging.

The sixth sub problem of the research has been defined as "Is there a significant relationship between the science teacher candidates' learning and studying strategies, and self-efficacy beliefs in science teaching?". Corelation results for determining the relationship between the points of participants' learning and studying strategies, and points of the self-efficacy belief in science teaching are provided in Table 7.

As seen in Table 7, significant relationships have been detected between self-efficacy belief and all lower divisions of study strategies. A negative relationship has been detected between the result expectation of self-efficacy belief, and the lower division of anxiety (r= -.128, p= .000). A positive relationship has been observed between the result expectation of self-efficacy belief, and the lower division of treatment of information (r= .172, p= .004). A low, positive relationship has been identified between -again- the result expectation of self-efficacy belief, and the lower divisions of self-testing. Strong positive relationships have been detected between the low divison of attitude, and the low divisions of motivation, use of time, anxiety, concentration, treatment of information, subject matter, working auxiliary, self-testing, and testing strategies.

Significant positive relationships have been observed between the lower divison of motivation, and the lower divisions of use of time, anxiety, concentration, treatment of information, subject matter, working auxiliary, self-testing, and testing strategies. Significant positive relationships have been identified between the lower divison of use of time, and the lower divisions of concentration, treatment of information, subject matter, working auxiliary, self-testing, and testing strategies. A low, positive relationship between lower division of anxiety and the lower divison of treatment of information (r= .122, p= .043); and a strong positive relationship between lower division of anxiety and the lower divisions of concentration, subject matter, and testing strategies have been detected. A significant positive relationship has been identified between the lower divison of concentration, and the lower divisions of treatment of information, subject matter, working auxiliary, self-testing, and testing strategies. In addition, a significant positive relationship has been observed between the lower divison of treatment of information, and the lower divisions of subject matter, working auxiliary, self-testing, and testing strategies.

Table 7. Correlations Between Learning Styles, Learning and Study Strategies and Self Efficacy Beliefs in Science Teaching

	General Self-Efficacy	Personal Self-Efficacy	Result expectation	Attitude	Motivation	Use of Time Management Principles	Anxiety	Concentration	Information processing	Selecting main ideas	Use of support techniques	Self-testing	Testing strategies
General Self-Efficacy	1												
Personal Self-Efficacy	.885**	1											
Result expectation	.765**	.378**	1										
Attitude	.255**	.326**	.057	1									
Motivation	.187**	.227**	.057	.458**	1								
Use of Time Management Principles	.191**	.252**	.031	.534**	.601**	1							
Anxiety	.102	.239**	-.128*	.117	.045	.181**	1						
Concentration	.216**	.277**	.048	.474**	.547**	.563**	.280**	1					
Information processing	.325**	.343**	.172**	.259**	.404**	.234**	.122*	.266**	1				
Selecting main ideas	.227**	.292**	.046	.274**	.294**	.293**	.275**	.360**	.326**	1			
Use of support techniques	.202**	.191**	.138*	.123*	.320**	.207**	-.072	.085	.488**	.223**	1		
Self-testing	.218**	.216**	.135*	.332**	.666**	.471**	-.046	.413**	.553**	.390**	.566**	1	
Testing strategies	.205**	.308**	-.020	.381**	.378**	.462**	.485**	.533**	.275**	.592**	.063	.291**	1

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

As seen in Table 7, a significantly strong, positive relationship has been observed between the lower divison of subject matter, and the lower divisions of working auxiliary, self-testing, and testing strategies. A significantly strong, positive relationship has been specified between the lower division of working auxiliary, and the lower division of self-testing (r= .566, p= .000). A significantly strong, positive relationship has been identified between testing strategies and self-testing (r= .291, p= .000).

When data in the table are evaluated as a whole, it is revealed that studying strategies and self-efficacy belief are related. In other words, it can be said that teacher candidates who efficaciously utilize learning and studying strategies have high levels of self-efficacy belief.

DISCUSSION

Significant relationships have been identified between science teacher candidates' learning styles, learning and studying strategies, and self-efficacy beliefs in science teaching. Research findings are discussed below according to their issued sequence.

In this research, it has been concluded that science teacher candidates regard themselves "efficacious" in the self-efficacy belief as a whole and the lower division of personal self-efficacy; and "efficacious at mid-level" in the lower division of result expectation. This result is in compliance with the findings of Berkant and Ekici (2007), Fettahlıoğlu (2008), Yılmaz (2007). In this respect, it can be stated that research findings in hand are parallel to the literature. When it is considered that self-efficacy belief positively affects the teacher candidates' own judgments of their capabilities in relation to the fact that the professional and field education they have received at university may influentially and efficaciously affect the science study, it can be considered that self-efficacy belief rises in parallel with this.

It has been specified that science teacher candidates generally have the learning style of converging, which is followed by the learning styles of accommodating, assimilating, and diverging. Some of the research in which KÖSE has been used as the data gathering tool, and which has been conducted abroad are such as to support this result. In these studies which have carried out at various educational level (Demir, 2008; Dunn, 1982; Güven, 2003; Oral, 2003), it has been concluded that students generally have the learning style of converging. However, there are also studies which put forth that participants take on the learning styles of assimilating (Aşkar ve Akkoyunlu, 1993; Ergür, 1998; Evin Gencel, 2006; Fox ve Rankowski, 1997; Gürsoy, 2008; Güven ve Kürüm, 2008) and diverging (Foney, 1994; Payne, 2000). Seeming to contradict the result of this research, this situation may have originated from the fact that the sample in the studies reflects a heterogenous scene in terms of field. In the research in hand, the participants are composed

of science teacher candidates. As a matter of fact, the learning style of converging describes the situations in which the learning ways of concrete experience and active experience become prominent, and the skills of problem solving develop. That these skills are far more developed in teacher candidates who will have many experiences in their professional career is regarded logical. In his study of science teacher candidates, Fettahlıoğlu (2008) has proven that the number of teacher candidates who have the learning style of converging is the greatest. In this respect, results which are obtained are consistent with the research in question in which the sample is constituted by science teacher candidates.

Additionally, the detection that especially in studies performed in Turkey, the learning style of assimilating is used predominantly may have originated from the fact that the concept of traditional education is prevalent. The reason is that students in a conventional education medium consider the teacher as the most important source of information, and this corresponds to properties of the learning style of assimilating.

It has been identified in the study that science teacher candidates' levels of self-efficacy belief differ in accordance with their learning styles. Self-efficacy belief levels of the teacher candidates with learning style of accommodating have been found to be much higher than those of the candidates with learning styles of converging and assimilating. Fettahlıoğlu (2008) has identified that self-efficacy belief levels of teacher candidates with learning style of converging are significantly higher than those of the candidates with learning style of assimilating. Since different studies which specify the learning styles of science teacher candidates according to KÖSE cannot be found, interpretability of this finding becomes challenging as the research count of this finding multiplies. However, the concrete experience which is the first learning cycle, and the active experience which is the final learning cycle of the learning style of accommodating are constituents of learning methods. And as a result of this, since the science teacher candidates' field courses are mostly based on test and implementation, and since the teacher candidates learn by feeling and practising, it is considered to cause increase in their self-efficacy belief levels.

It has been found in the research that the points which the science teacher candidates' learning and studying strategies which are obtained from sub-dimensions of especially attitude and motivation rather low; and the points obtained from lower points of treatment of information and working auxiliaries are rather high. When the literature is examined, it is observed that the findings of some research (Saracaloğlu, Evin Gencel and Varol, 2006; Şimşek, 2002; Haught and fri., 1998; Öztürk, 1995; Özer, 1993) support the research in hand. The negative attitude which the teacher candidates develop against the courses they take, and the low usage rates of learning strategies give rise to the thought that these factors cause increase in anxiety levels.

It has been revealed that the science teacher candidates' all learning and studying strategies except for anxiety are high in favour of women teacher candidates. In some research (Aydın, 1990; Dural, 2008; Güven, 2004; Matt, Perchersky&Cervantes, 1991; Saracaloğlu, Başer&Yavuz, 2002; Saracaloğlu, Evin Gencel&Varol, 2006; Sırmacı, 2003; Şen, 2006; Ural, 2006) carried out on the same issue, findings that are consistent with the result of this research have been obtained. It can be claimed that high levels of women teacher candidates' self-efficacy beliefs cause them to develop positive attitudes, and thus, the levels of anxiety to decrease.

A significant relationship has been identified between the science teacher candidates' learning styles, and learning and studying strategies. Points that teacher candidates with learning style of accommodating obtain from sub-dimensions of attitude and working skills are significantly higher than the points that teacher candidates with learning style of converging obtain. There are some research findings which support, and are different from these research findings. Tinajero ve Paramo (1998) have specified in their study that students with field-bounded learning styles and students with free-of-field learning styles utilize different learning strategies. In a dimension of the study carried out by Shih and et al. (1998), a relationship has been observed between the learning styles of university students, and the learning strategies they utilize. With his research, Güven (2004) has put forth that students with diverging learning style use the comprehension tracking strategies more often.

In addition, in Keane's (1993) study, it has been revealed that there is a positive relationship between the learning styles, and learning and studying strategies of university students; and that students use different learning strategies in accordance with their learning styles. All these findings are consistent with the finding that the students who have various learning styles found in this research utilize the specific learning strategies more often than other students. On the other hand, Halaçoğlu (1999) has identified in his study that there is no significant relationship between the learning styles and learning preferences (strategies) of the university students. As a result, it is understood that there is a difference not in all, but some sub-dimensions (attitude and working skills) of learning and studying strategies of university students in accordance with their learning styles. This difference is seen in the desire and self-regulation components which affect especially the individual's orientation and implementation of his own learning's.

It has been identified that there are strong positive relationships between the science teacher candidates' self-efficacy beliefs in science teaching, and learning and studying strategies; and a strong negative relationship between their self-efficacy beliefs and anxiety. It can be claimed that use of strategy simplifies learning, and thus, develops the sense of efficacy. Apart from this, low rates of anxiety is also one of the factors that simplifies learning.

Correspondingly, it can be considered that positive contagion of the self-efficacy belief is an expected condition.

Suggestions

It has been identified that most (32.7%) of science teacher candidates have the learning style of converging. However, it has been observed that number of students in each style group is at a substantial level (30.5 accommodating, 20.4% assimilating, 16.4% diverging). This finding which has been obtained from a small group should be taken into consideration. It should be taken into account that there are different learning preferences of students, and that methods and techniques used in the learning or teaching period will not create the same effect on every student.

Some regulations should be performed on pre-service education programs so that they provide information about the learning styles which have an important impact on the teacher candidates' study period. When the fact that there are different learning methods of teacher candidates, and that they develop self-efficacy and attitudes of different levels for each learning style are considered, methods and techniques which will address each learning style in the instructors' learning environments can be utilized.

Self-efficacy is one of the factors that will enable the teacher candidates to be successful in their profession. High rates of a teacher's self-efficacy belief has important impacts on the efficiency of lessons. Therefore, studies on identifying and developing the self-efficacy of teacher candidates need to be increased in number. Regulations can be performed so that teacher candidates become more active in school experience and teachership implementations. Teacher candidates, by being provided with facilities they can use to improve themselves in science teaching, can be enabled to improve their perfection and self-efficacy levels of science and technology teaching courses.

Sharing times can be specified so that science teachers can share their knowledge and experiences with the teacher candidates. Thus, teacher candidates can acquire functional information from teachers, who are implementers of the programme. Teacher candidates, by providing them a constant interaction with teachers and instructors experienced in the field, can be enabled to develop positive affective qualities related to the profession.

This research has studied the relationship between science teacher candidates' self-efficacy beliefs in science teaching, their learning styles, and learning and studying strategies. Generalisable results on the topic can be achieved by performing similar studies with different samples.

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