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A Study on Pre-service Science, Class and Mathematics Teachers' Learning Styles in Turkey

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Abstract
It is commonly believed that learning styles are not really concerned with "what" learners learn, but rather "how" they prefer to learn and it is also an important factor for students' academic achievement and attitudes. The purpose of this study was to investigate the learning styles of pre-service teachers enrolled at elementary education department of Faculty of Education in Turkey. The sample consisted of six hundred six pre-service teachers from elementary science, mathematics and class teacher program. The Kolb's Learning Style Inventory was used to determine the pre-service teachers' learning styles as divergent, assimilator, convergent, and accommodator, and the information sheet for demographic factors such as gender, grade, program and age was used to collect information from participants. The data were analyzed by using frequency, percent value, mean scores, standard deviation, independent samples t-test and one-way ANOVA. The results show that (i) the dominant learning style among the pre-service teachers is divergent and it is followed by accommodator learning style, (ii) the learning style components did not significantly differ by gender in all three groups, except for Active Experimentation, (iii) the mean scores for Abstract Conceptualization (AC), Active Experimentation (AE) and AE-RO scores of pre-service science teachers were significantly different from class teachers, (iv) the grade level progresses, the mean scores of CE, AE, AC, AC-CE, and AE-RO also increases.

Keywords: *Learning Styles, Pre-service Teachers, Kolb Learning Style*

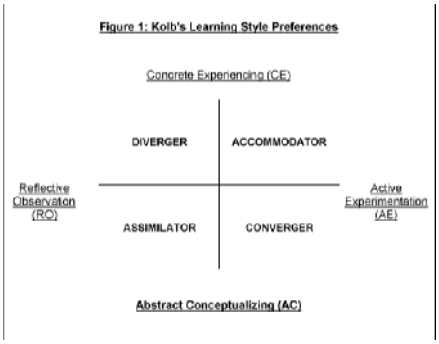
Introduction

It was well known fact that teachers are very effective agents on students' achievement and how students learn and behave. Teachers need to develop their knowledge in both subject matter and pedagogic content to met students' demands in the classroom. For this reason, teacher training programs should include various learning environments to allow pre-service teachers for gaining necessary skills. It is found that teachers' learning styles, teaching styles, and personality styles affect students' achievement and attitudes toward any subject. The concept of learning styles has been regarded as one of the important factors that explain individual differences in teaching and learning process (Ekici, 2002). This concept is related to individuals' preferences, interactions, reactions and experiences with learning environment.

In order to describe learning styles and to analyze which factors affect learning styles, many studies have been conducted for more than 40 years. In the literature, various definitions of learning styles can be found according to some basic features. For example, Keefe (1979) defined learning styles as the total of the learners' characteristics and "the composite of characteristic cognitive, affective, and psychological factors that serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment.". According to Dunn & Dunn (1978), learning style is a way of getting and processing the knowledge starting with the learners' dealing with new and difficult information (cited in, Kazu, 2009). James and Gardner (1995) defined learning style as the "complex manner in which, and conditions under which, learners most efficiently and most effectively perceive, process, store, and recall what they are attempting to learn" (p. 20). Merriam and Caffarella (1991) explained learning style as "individual's characteristic way of processing information, feeling, and behaving in learning situations" (p. 176).

Learning occurs differently regarding individuals' cognition, perception and psychological behaviors. Usage of different learning styles lead individuals to observe the circumstances, unify this with the concepts, make hypotheses and test them and choose new lives (Kolb, 1984). Kolb developed an Experimental Learning Model (ELM) which classifies individuals according to their learning preferences. This model is grounded on Jung's concept of types where development is accomplished by higher- level integration and expression of non-dominant modes of dealing with the world (Kolb, 1984). Kolb defined learning as a process of transformation of the experience. In ELM, learning is consisted of four-stage hypothetical cycle including *concrete experience (CE)*, *reflective observation (RO)*, *abstract conceptualization* (AC) and *active experimentation (AE)*. This cycle is a two dimensional and, one of the dimensions reflects concrete/abstract perception and the other one is active/reflective processing. Individuals in CE stage of learning are generally are open-minded and adaptable. In the RO stage, individuals watch and listen, view issues from different points of view, and discover meaning in the learning material. AC stage is related to the application of thought and logic. Especially, planning, developing theories, and analysis are the most important elements of this stage. The AE stage is mainly focused on activity and includes testing theories, carrying out plans, and influencing people and events. People who choose concrete experience will assert that thinking about something changes it, but those who prefer abstract conceptualization think that meaning is constructed only after internal processing. In the second dimension, processing, people will receive outcomes of their perception and have it in preferred way between active experimentation and reflective observation.

Kolb (1984) defined four learning styles for explaining individuals' learning preferences. These are *Diverger, Assimilator, Converger and Accommodator* and shown from Figure 1.



1. Divergers (Concrete experiencer/Reflective observer)
This type of learning style is combination of concrete experience and reflective observation learning styles. Individuals who own this learning style like to look at things from many perspectives and hence diverging from a single experience to multiple possibilities in terms of what this might mean. They are very open-minded and prefer to work with people. Generally, other people can easily influence divergers and to get constructive feedback is important for them. Watching and feeling are essential for divergers. Their judgments about any situation are taken very patiently and carefully but they don't like to involve in action. In the process of design their thoughts, their feelings and thoughts are at work. Socials practices, journalism, psychology, literature and art/theatre are the jobs which are suitable for divergers.

2. Convergers (Abstract conceptualization/Active experimentation)

Individuals who own this learning style learn best through active experimentation and abstract conceptualization. They like to work themselves, solve problems and find practical solutions. Convergers prefer to study on technical projects instead of social issues or interpersonal relationships. They are very good at conducting laboratory experiments and they can easily learn via computer-based learning methods.

3. Accommodators (Concrete experiencer/Active experimenter)

The dominant learning abilities for Accommodators are Concrete Experience (CE) and Active Experimentation (AE). They have the most hands-on approach, with a strong preference for doing rather than thinking and involving oneself in the experience. Accommodators are risk-taker and tends to solve problems often on other people's information rather than on own analytic ability. They prefer action-oriented jobs, such as business, marketing, sales, etc. They like to discover but learn better by themselves than with other people. The main questions for accommodators are 'what if?' and 'why not?' to support their action-first approach.

4. Assimilators (Abstract conceptualizer/Reflective observer)

The dominant learning abilities for Assimilators are Abstract Conceptualization (AC) and Reflective Observation (RO). They have the most cognitive approach, preferring to think than to act. They prefer instructional methods for their learning, for example, lecture method and lab demonstrations. This learning style reflects characteristic of basic sciences and mathematics. They are motivated to answer the question, "what is there to know?" .They are good at creating theoretical models. Less interested in people more concerned with abstract concepts (Litzinger & Osif, 1993).

Various learning style instruments are available for use by teachers and researchers to understand how people learn. These instruments are "*The Learning Channel Preference Test* "(LCPT) (O'Brien, 1989), "*Learning Style Profile"* (LSP) (Keefe & Monk, 1988), "*Felder's Index of Learning Styles"* (ILS) (Felder, 1993), "*Gregorc Style Delineator"* (Gregorc, 1982) and "Learning Styles Inventory" (LSI) (Kolb, 1985). Kolb (1985) explained that LSI is different from other tests of learning style and personality used in education by being based on a comprehensive theory of learning and development. He continued Experiential Learning Theory (ELT) draws on the work of prominent twentieth century scholars who gave experience a central role in their theories of human learning and development-notably John Dewey, Kurt Lewin, Jean Piaget, William James, Carl Jung, Paulo Freire, Carl Rogers, and

others-to develop a holistic model of the experiential learning process and a multi-linear model of adult development. The theory, described in detail in Experiential Learning: Experience as the Source of Learning and Development (p.2)

ELT is a integrated theory about learning and determines differences in learning styles of individuals. There have been various studies related to ELT addressing learning and teaching issues in many fields. In the Kolb & Kolb (1999)'s study, it is indicated that 1004 ELT research have been conducted since 1971. 860 of 1004 research were related to education including K-12, higher education and adult learning. Most of these studies conducted in the level of higher education which in many cases involves adult learning. In these studies, LSI was used to investigate the effect of instructional methods, teaching styles and curriculum using ELT on students' learning styles (Claxton & Murrell, 1987). On the other hand, some of these studies include psychometrics properties of LSI and comparison of different learning style assessment instruments. Studies conducted in primary education generally focused on the use of ELT in designing language and science curriculum (e.g., McCarthy, 1996; Hainer, 1992, cited in, Kolb, Boyatzis & Mainemelis, 2000).

Hasirci (2006) investigated whether there was a significant difference in pre-service teachers' preferred learning style according to their grade level. She found that approximately half of the students preferred assimilating and divergent learning styles and that there was were no significant differences in learning style scores for grades. Peker and Mirasyedioglu (2008) examined the differences of pre-service elementary school teachers' attitudes towards mathematics according to their learning styles. The results indicate that more than the half of the students (55.5 %) were assimilator learners, and more than the quarter (28.1%) are convergent learners. Divergent learners and accommodator learners were a little group. Similarly, Peker (2005) determined that more primary mathematics teacher education students were assimilator learners (65.8 %), quarter of them were convergent learners (25.8 %), 5.2 % of them were divergent learners, 3.2 % of them were accommodator learners. Pehlivan (2010) studied on pre-service teachers' learning styles and their attitudes toward teaching profession. She found that pre-service teachers predominantly prefer diverging (51,3%) and assimilator (30.4%) learning styles. Learning styles prospective teachers do not show differences depending their disciplines or study fields. According to findings of the study, the average points of attitude scale are showed that there is no significant difference depending fields of study and learning styles while there is a positive difference for girls. Kaya, Özabacı and Tezel (2009) conducted a study of primary school students' learning styles according to their demographic variables. They found that divergent (35.5%) and assimilators (27.4) are the dominant learning styles. In their study, they also showed that students' learning forms, components and learning styles did not show any differences according to gender and it varies according to grade and success level.

The purpose of this study was to investigate the pre-service teachers' learning styles who is enrolled at elementary education department of Faculty of Education in Turkey and the effect of some selected variables such as gender, age, program and grade on students' learning style. It is very important to understand and analyse preservice teachers' learning styles since if they are aware of their learning styles, they will recognise their future students' differentations in learning and make better decisions in teaching strategies

Research Questions

RQ1. What is the pre-service teachers' learning styles?

RQ2. Is there a significant difference between the mean scores of LSI for females and males?
RQ3. Are there significant differences in LSI scores for Science, Class, and Math teacher training programs?
RQ4. Are there significant differences in LSI scores for Grade 1, Grade 2, Grade 3, and Grade 4?

Methodology

This study is part of an ongoing research aiming to compare learning styles of pre-service teachers from Turkey, Ireland and France. This study is only focused on the Turkish data. In this study, survey model was used to determine the pre-service teachers' learning style and the variation of the participants' learning style according to gender, age, training program and grade level.

Sample

The sample consisted of 606 (388 female, 218 male) pre-service teachers from three different teacher training programs (Science, Mathematics and Class Teacher) under elementary department of faculty of education located at Aegean Region of Turkey. The percentages of pre-service teachers' are 33.3% for Grade 1; 6.3% for Grade 2, 38.8% for Grade 3 and finally 21.6% for Grade 4. Participants of this study from these grades were randomly selected to participate in the study. Table 1 provides further demographic information about the sample.

Table 1. Demographic Information for the sample by Gender

		Gender	
		Female	Male
Program			
	Science	85	65
	Class Teacher	264	130
	Math	39	23
Grade			
	Grade 1	145	57
	Grade 2	21	17
	Grade 3	149	86
	Grade 4	73	58
Age			
	17	6	1
	18	72	23
	19	54	29
	20	98	39
	21	80	46
	22	61	49
	23	14	20
	24	3	4
	25	0	4
	26	0	3

Instrument

A Turkish translated (by Aşkar & Akkoyunlu) version of Kolb Learning Style Inventory (LSI) was administrated to pre-service teachers to collect data. Pre-service teachers were asked to respond their learning style to 12 items in the Learning Style Inventory (LSI) by using four-point Likert Scale. There are four statements in each 12 items. The first one is Concrete

Experience (CE), the second one is Reflective Observation (RO), the third one is Abstract Conceptualization (AC) and the last one is Active Experimentation (AE). The scores to be taken from LSI are between 12 and 48 in each part. After this process by subtracting each student's CE scores from AC scores and RO scores from AE scores, the learning style of each participant was classified either as 'accommodating', 'diverging', 'assimilating' or 'converging'. The scores of AE-RO and AC-CE vary between -36 and +36. While, the positive score obtained from AC-CE shows that the learning is abstract, the negative score indicate that learning is concrete. Similarly, the positive score obtained from AE-RO indicate that the learning is active and the negative score shows that the learning is reflective (Aşkar & Akkoyunlu, 1993, Kaya, Özabacı & Tezel, 2009, Demirbaş, Demirkan, 2007).

Data Analysis

In order to exclude inquiries which were filled incorrectly and deficiently, data was checked using frequency analysis with SPSS. It is found that 21 inquiries were filled incorrectly and were excluded from the data. Means, standard deviations of measures of Learning Style Inventory were calculated. These were examined for statistical significance by carrying out independent-samples t-test and one-way Anova techniques and data were given on tables.

Findings

Table 2 presents the internal consistency coefficient (Cronbach Alpha) of learning styles components. These results suggest that the LSI scale shows good internal consistency reliability.

Table 2. Cronbach Alpha coefficients for the Scale Scores of the Learning Style Components

Learning Style Components		Reliability Factors
Concrete Experience	CE	.84
Reflective Observation	RO	.77
Abstract Conceptualization	AC	.86
Active Experimentation	AE	85
Abstract - Concrete	AC-CE	.82
Active - Reflective	AE-RO	.81

In order to find elementary pre-service teachers' learning styles, frequencies and percentage distributions were calculated and presented at Table 3.

Table 3. Frequency and percentage distributions of Pre-service Teachers' Learning Style

Learning styles	f	%
Converger	103	17.00
Assimilator	168	27.72
Diverger	245	40.43
Accommodator	90	14,85
Total	606	100,00

According to Table 3, among the pre-service teachers, the most learning style is Divergent (40.43%) and it is followed by Assimilators (27.72%), Convergent (17.00%), and Accommodator (14.85%).

Table 4. Frequency and percentage distributions of Pre-service Teachers' Learning Style according to program

	Science		Class		Math	
Learning Styles	f	%	f	%	f	%
Converger	40	26,67	54	13,71	9	14,52
Assimilator	36	24,00	118	29,95	14	22,58
Diverger	50	33,33	165	41,88	30	48,39
Accommodator	24	16,00	57	14,47	9	14,52

The findings that are presented in Table 4 show frequency and percentage distributions of pre-service teachers' learning styles according to their program. The results indicate that pre-service teachers from all three training programs show similar learning styles. When compared the programs, divergent is the dominant learning styles among the teacher training programs and it is followed by assimilator learning style.

Table 5. Independent-samples t-test results

Learning Style Components	Gender	N	X	SD	t	p
Concrete Experience (CE)	Female	388	30,27	7,38	-1,55	.12
	Male	218	31,21	6,93		
Reflective Observation (RO)	Female	388	34,69	5,85	-0,94	.34
	Male	218	35,16	6,05		
Abstract Conceptualization (AC)	Female	388	37,26	6,18	0,56	.57
	Male	218	36,95	6,87		
Active Experimentation (AE)	Female	388	38,71	6,67	2,08	.04*
	Male	218	37,52	6,90		
AC-CE	Female	388	6,99	8,27	1,82	.07
	Male	218	5,74	7,79		
AE-RO	Female	388	4,04	7,69	2,63	.01*
	Male	218	2,36	7,30		

* $p<0.05$

An independent-samples t-test was conducted to compare the LSI scores for females and males. Table 5 reports analyze results. According to Table 4, there were no significant differences in Concrete Experience (CE) scores for females (M=30.27, SD=7.38), and males [M=31.21, SD=6.93; t(604)=-1.55, p=.12]; Reflective Observation (RO) scores for females (M=34.69, SD=5.85), and males [M=35.16, SD=6.05; t(604)=-0.94, p=.34]; Abstract Conceptualization (AC) scores for females (M=37.26, SD=6.18), and males [M=36.95, SD=6.87; t(604)=0.56, p=.57]; AC-CE scores for females (M=6.99, SD=8.27), and males [M=5.74, SD=7.79; t(604)=1.82, p=.07]. There were significant differences in Active Experimentation (AE) scores for females (M=38.71, SD=6.67), and males [M=37.52, SD=6.90; t(604)=2.08, p=.04] and AE-RO scores for females (M=4.04, SD=7.69), and males [M=2.36, SD=7.30; t(604)=2.63, p=.01].

The findings that are presented in Table 6 show distribution of pre-service teachers' learning styles according to their program. Among the pre-service teachers, participants from science teacher training program have the highest mean scores [Concrete Experience (M=1.35);

Abstract Conceptualization (M=38.85); Active Experimentation (M=39.75); AC-CE (M=7.50); AE-RO (M=5.13)] except for Reflective Observation (M=34.62). The lowest mean scores for participants from class teachers were found in the mean Concrete Experience scores. Pre-service teachers from Mathematics and Class teacher training programs have also lowest scores for AE-CE and AE-RO when compared with science teacher training program.

Table 6. The Distribution of Pre-service teachers' learning styles according to their program

Learning style components	Program	N	X	SD
Concrete Experience (CE)	Science	150	31,35	6,73
	Class	394	30,29	7,47
	Math	62	30,79	6,82
Reflective Observation (RO)	Science	150	34,62	5,50
	Class	394	35,10	6,11
	Math	62	33,87	5,68
Abstract Conceptualization (AC)	Science	150	38,85	5,69
	Class	394	36,47	6,75
	Math	62	37,35	5,24
Active Experimentation (AE)	Science	150	39,75	6,42
	Class	393	37,98	6,79
	Math	62	36,61	7,00
AE-CE	Science	150	7,50	7,74
	Class	394	6,18	8,33
	Math	62	6,56	7,50
AE-RO	Science	150	5,13	7,86
	Class	393	2,90	7,36
	Math	62	2,74	7,85

A one-way between-groups analysis of variance was conducted to explore the impact of training programs (science, class teacher and maths) on the pre-service teachers' learning styles. The findings are presented in the Table 7.

Table 7. One-way Anova results of pre-service teachers' learning styles according to their program

Learning Style Components	Source of Variance	Sum of Squares	df	Mean Square	F	p	Meaningful variation
Concrete Experience (CE)	Between Groups	122,646	2	61,323	1,17	0,31	-
	Within Groups	31488,095	603	52,219			
	Total	31610,741	605				
Reflective Observation (RO)	Between Groups	92,754	2	46,377	1,32	0,27	-
	Within Groups	21143,041	603	35,063			
	Total	21235,795	605				
Abstract Conceptualization (AC)	Between Groups	616,832	2	308,416	7,62	0,00	Science – Class
	Within Groups	24401,801	603	40,467			
	Total	25018,634	605				
Active Experimentation (AE)	Between Groups	529,833	2	264,917	5,87	0,00	Science – Class Science – Math
	Within Groups	27185,958	602	45,159			
	Total	27715,792	604				
AC-CE	Between Groups	190,726	2	95,363	1,45	0,24	-
	Within Groups	39643,658	603	65,744			

	Total	39834,384	605				
	Between Groups	573,352	2	286,676	5,04	0,01	Science – Class
AE-RO	Within Groups	34219,187	602	56,843			
	Total	34792,539	604				

When table 7 is examined, there was statistically difference at the p<.05 level in some mean scores of learning styles components for pre-service teachers' training programs. Post hoc comparisons using the Tukey HSD test indicated that the mean Abstract Conceptualization score for science teachers (M=38.85, SD=5.69) was significantly different from class teachers (M=36.47, SD=6.75); the mean Active Experimentation score for science teachers (M=39.75, SD=6.42) was significantly different from class teachers (M=37.98, SD=6.79) & Mathematics teachers (M=36.61, SD=7.00); and finally, the mean AE-RO score for science teachers (M=5.13, SD=7.86) was significantly different from class teachers (M=2.90, SD=7.36). In general, pre-service teachers from mathematics training program did not differ significantly from either two other programs except for Active Experimentation (AE).

Table 8. The Distribution of Pre-service teachers' learning styles according to grade level

Learning style components	Grade	N	X	SD
Concrete Experience (CE)	Grade 1	202	29,33	7,17
	Grade 2	38	30,29	6,96
	Grade 3	235	30,96	7,42
	Grade 4	131	32,02	6,79
Reflective Observation (RO)	Grade 1	202	35,32	6,27
	Grade 2	38	35,45	4,49
	Grade 3	235	34,54	5,97
	Grade 4	131	34,56	5,66
Abstract Conceptualization (AC)	Grade 1	202	36,19	6,92
	Grade 2	38	36,34	6,59
	Grade 3	235	37,03	6,17
	Grade 4	131	39,07	5,66
Active Experimentation (AE)	Grade 1	201	37,14	7,14
	Grade 2	38	38,29	5,56
	Grade 3	235	38,03	6,61
	Grade 4	131	40,47	6,36
AC-CE	Grade 1	202	6,86	8,52
	Grade 2	38	6,05	9,04
	Grade 3	235	6,07	7,86
	Grade 4	131	7,05	7,67
AE-RO	Grade 1	201	1,86	7,54
	Grade 2	38	2,84	5,54
	Grade 3	235	3,49	7,52
	Grade 4	131	5,92	7,71

Table 8 presents findings for distribution of Pre-service teachers' learning styles according to grade level. When Table 8 examined, Grade 4 has the highest mean scores in all of the learning styles components except for Reflective Observation. In addition to this, first grade pre-service teachers have the lowest mean scores in all of the learning styles components except for AC-CE. While highest mean score (X=40.47) is in the Active Experimentation for

the fourth grades, lowest mean score (X=29.33) is in the Concrete experience for the first grades. Grade 2 has the lowest mean score (X=6.05) in the AC-CE. However, Grade 1 has the lowest mean score (X=1.86) in the AE-RO. The highest scores were taken by Grade 4 in the AC-CE and AE-RO (X=7.05; X=5.92 respectively).

In order to find out the impact of grades on the learning styles of pre-service teachers, one-way anova was done. The findings are presented in the Table 9.

Table 9. One-way Anova results of pre-service teachers' learning styles according to their grade

Learning Style Components	Source of Variance	Sum of Squares	df	Mean Square	F	p	Meaningful variation
	Between Groups	624,56	3	208,19	4,04	0,01	Grade 1-4
Concrete Experience (CE)	Within Groups	30986,18	602	51,47			
	Total	31610,74	605				
	Between Groups	91,91	3	30,64	0,87	0,46	-
Reflective Observation (RO)	Within Groups	21143,88	602	35,12			
	Total	21235,80	605				
	Between Groups	697,12	3	232,37	5,75	0,00	Grade 1-4
Abstract Conceptualization (AC)	Within Groups	24321,51	602	40,40			Grade 3-4
	Total	25018,63	605				
	Between Groups	904,66	3	301,55	6,76	0,00	Grade 1-4
Active Experimentation (AE)	Within Groups	26811,14	601	44,61			Grade 3-4
	Total	27715,79	604				
	Between Groups	114,16	3	38,05	0,58	0,63	-
AC-CE	Within Groups	39720,23	602	65,98			
	Total	39834,38	605				
	Between Groups	1318,59	3	439,53	7,89	0,00	Grade 1-4
AE-RO	Within Groups	33473,95	601	55,70			Grade 3-4
	Total	34792,54	604				

The findings presented in Table 9 show that there is statistically difference at the $p<.05$ level in mean CE, AC, AE, AE-RO scores for pre-service teachers' grades. In order to determine the differences, post-hoc comparisons using Tukey HSD test was used. The results indicate that the mean CE scores for Grade 1 (M=29.33, SD=7.17) is significantly different from Grade 4 (M=32.02, SD=6.79). The mean AC score for Grade 1 (M=36.19, SD=6.92) is significantly different from Grade 4 (M=39.07, SD=5.66). There are also significant differences between Grade 3 (M=37.03, SD=6.17) and Grade 4 (M=39.07, SD=5.66) for AC. Similarly same differences were found between Grade 1 - 4 and between Grade 3-4 for AE and AE-RO.

Discussions and Conclusions

This study investigated pre-service teachers' learning styles according to demographic factors, gender, three different teacher training programs, and grade level.

First of all, the cronbach alpha coefficients for the scale used in this study revealed that internal reliability was high (see Table 2). This result is also consistent with previous research findings obtained by Aşkar and Akkoyunlu (1993), Ergür (1998), Demirbaş (2001), Güven (2003) and Kaya, Özabacı & Tezel, (2009).

The first result from the frequency analysis is the presence of dominant divergent learners (40.4%) among the pre-service teachers. It is followed by assimilator (27.7%), convergent (17.0%) and accommodator learners (7.43%). Demirbaş (2007), after summarizing result for a number of studies investigating the divergent learners' characters, concluded that "these learners (divergent) are imaginative and emotional. They have the ability to synthesize and/or assimilate various observations for new idea generation (Hsu, 1999). They are less concerned with theorems and generalizations. Their approach to problem solving is not systematic, but is more creative in comparison to the other learning styles. These learners when working in-groups listen to the suggestions of others and accept critiques from them" (p.348). According to Raschick et al (1998), the converger-type learners tend to have a good understanding of practical ideas and their application. In formal learning situations, people with this style prefer to experiment with new ideas, simulations, laboratory assignments, and practical applications (Kolb, 1985). Since science is accompanied closely with experimentation, laboratory work and application assignments, convergers in the population was consistent with the statements of Kolb (1985). The results obtained for pre-service science teachers supports the findings of Kolb's study (1985). Assimilators and convergers have emerged as the most frequent learning style types in Özkan's (2004) sample population. Kolb (1985), stated that mathematics and science attracts individuals who are assimilators and the findings of this research supported that view. Since our population included only students attending to science, class, and mathematics groups, those results were not surprising. It is also important to note that Turkish higher educational system based on traditional instruction method. It is revealed that divergent and assimilator learners find traditional methods suitable for their learning (Peker, 2003; Peker, Mirasyedioğlu, 2008). The results of the study also supported the theory of Collinson (2000) that students manifest significant variations in how they prefer to learn in a classroom setting.

Many studies of learning styles indicate that there is no significant difference in LSI scores for males and females (Knight, Elfenbein, and Martin, 1997) though some argue that Learning Style Inventory is sensitive to gender and the validity of instrument score varies for females and males (Brew, 2002; Smith and Kolb, 1996). In this study, there was no significant in LSI scores for genders except for in Active Experimentation (AE) scores in favor of females. The present study continues the line of research that has demonstrated no significant gender differences.

In the context of the recent reform initiatives by the Council of Higher Education (YOK) in faculties of education in Turkey, department of elementary education was established at universities in 1998. The department currently runs five teacher education programs: science, mathematics, early childhood, social sciences, and class teacher training programs. The primary goal of the department of elementary education is to train teachers who have positive attitudes toward teaching and have necessary professional skills for elementary education field. The present study revealed that pre-service teachers from three training programs have the similar learning styles that is the convergents and assimilators are dominant. Many studies of learning styles in Turkey focused on the single teacher training program. For example, the pre-service class teachers (Hasırcı, 2006), mathematics teachers (Peker and Mirasyedioglu, 2008) were the sample to collect data in some studies. While Peker and Mirasyedioglu, 2008 found that the dominant learning styles among the pre-service mathematics teachers were convergent and assimilator, Hasirci, found that more than the half of the pre-service class teachers were assimilator learners assimilator and divergent. In the present study, it is also shown that the mean AC, AE, and AE-RO scores for science teachers were significantly

different from class teachers and mathematic teachers in the case of AE. Kolb & Kolb (2005), after explaining technical issues for the inventory, they indicate that "An individual with a converging style has AC and AE as dominant learning abilities. People with this learning style are best at finding practical uses for ideas and theories. They have the ability to solve problems and make decisions based on finding solutions to questions or problems. Individuals with a Converging learning style prefer to deal with technical tasks and problems rather than with social issues and interpersonal issues. These learning skills are important for effectiveness in specialist and technology careers. In formal learning situations, people with this style prefer to experiment with new ideas, simulations, laboratory assignments, and practical applications" (p.5). The results obtained for pre-service science teachers from this study supports Kolb & Kolb (2005) explanations.

The distribution of pre-service teachers' learning style components according to grade level was analyzed and it was found that the highest mean score for the grades were in Active Experimentation (AE). According to Atherton (2009), active experimentation is more public and visible to others. Zanich (1991) highlighted that a high score on Active Experimentation indicates an active, "doing" orientation to learning that relies heavily on experimentation. High AE individuals learn best when they can engage in such things as projects, homework, or small group discussions. They dislike passive learning situation such as lectures. These individuals tend to be extroverts. The findings of this study are accord with the explanations done by Zanich (1991) and Kolb (2005). It is also found that grade level progresses, the mean scores of CE, AE, AC, AC-CE, and AE-RO also increases. It shows that pre-service teachers develop their learning styles during the educational life in faculty of education. However the mean score of RO decreases during grade level progresses. An individual with a high score on RO prefer learning situations such as lectures that allow them to take the role of impartial objective observers. These individuals tend to be introverts (Zanich, 1991). Beyond this explanation, it is important to note that pre-service teachers are not likely to tend reflective observation.

Notwithstanding the limitation of this study, the findings have important implications for practical applications in teacher training policies. By examining the learning style of pre-service teachers, teaching staff can re-design their courses including and using the necessary equipments to facilitate pre-service teachers' learning. It is important to highlight that pre-service teachers should be informed about their learning styles both for their own learning and their teaching in the future. Finally, the learning styles of individuals from different pre-service teacher training programs such as physics, chemistry, biology, music etc. can be explored and compared as further study.

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