

THE INVESTIGATION OF THE LEARNING STYLES OF PRE-SERVICE MATHEMATICS TEACHERS BY SOME VARIABLES

Assoc. Prof. Dr. Abdulkadir TUNA
Kastamonu University
Educational Faculty
TURKEY

Prof. Dr. Ahmet KAÇAR
Kastamonu University
Educational Faculty
TURKEY

ABSTRACT

This study aimed at determining the learning styles of pre-service mathematics teachers and investigating whether such learning styles varied by some variables (grade, type of high school graduated, and sex). The study, which was a descriptive one, was conducted on 126 pre-service mathematics teachers attending a state university located in the north of Turkey in the 2013-2014 academic year. Kolb's Learning Styles Inventory was employed for determining the learning styles of the pre-service teachers. It was seen that the pre-service mathematics teachers predominantly had the *converging* learning style. In addition, it was found out that the learning styles of the pre-service mathematics teachers varied by grade.

Keywords: Mathematics education, pre-service mathematics teachers, learning styles.

INTRODUCTION

People acquire different knowledge, skills, abilities, and attitudes in their lives due to various factors including heredity, environment, and time. They use different ways in acquiring the above-mentioned. Every individual has a unique manner of learning. Both our knowledge of learning and the research on human brain support the idea that learning is unique to person (Özden, 1999). These differences in the learning process have led to the concept of learning style (Aydoğdu & Kesercioğlu, 2005). Learning style can be defined as using ways different from those of others in the stages of being prepared for learning, learning, and recalling. Temperament, style, field of interest, skills, environment and time are all influential on learning styles. The determination of the learning styles of individuals may facilitate the learning process and give meaning to many behaviors (Vural, 2004). Studying on learning styles, Keefe (1982) defined the concept as "cognitive, affective, and physiological traits that serve as relatively stable indicators of how learners perceive, interact with, and respond to learning environments". Gregorc (1985) defined it as "an external behavior, an attribution, and a state which is an indicator of the spirit and some mental qualifications" (Keefe, 1982, Gregorc, 1985; Cited by Açıkgöz, 2003).

Many learning style models have been developed up to now. Since the concept of learning style is a complex structure covering many concepts including but not limited to perception, putting the information in mind, meta-cognition, inherited attributes, and past experiences, it is inevitable that there are a wide variety of models on learning styles. Various learning style models have been developed by Jung, Simon and Byram, Kolb, McCarthy, Gregorc, Dunn&Dunn, etc. (Aydoğdu & Kesercioğlu, 2005). The present study focused on the Kolb' learning style model.

According to Kolb's experiential learning model, learning process has two basic dimensions. While the first dimension extends from abstract conceptualization to concrete experience, the second dimension is from

active experimentation to reflective observation. While how an individual perceives a piece of information is explained by concrete experience and abstract conceptualization, how s/he processes such information is about reflective observation and active experimentation. According to Kolb's learning style model, individuals perceive information by feeling or thinking, and process it by watching or doing (Aydoğdu & Kesercioğlu, 2005).

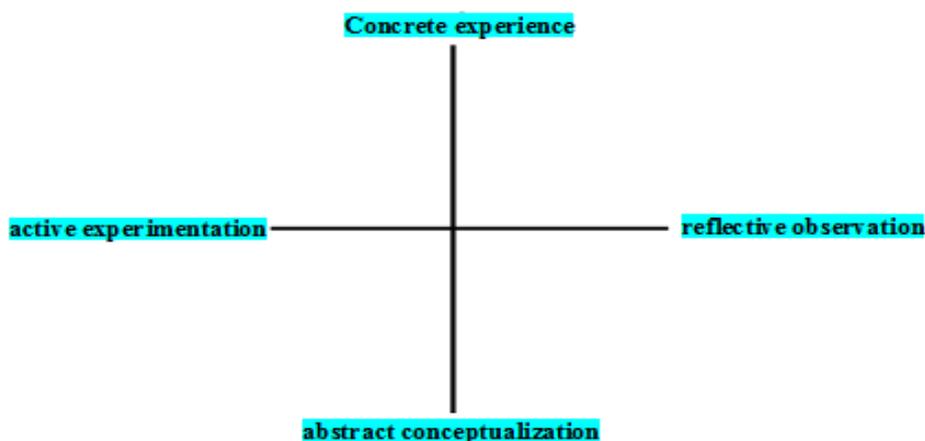


Figure 1: Kolb's Learning Style Model (McCarthy, 1987)

In 1976, Kolb developed a learning inventory measuring learning preferences on a bipolar basis. He made some arrangements in the said model in 1985 (Özden, 1997; Köksalan, 2007). The points in the inventory reveal different preferences of individuals from abstract to concrete experience and active experimentation. The total points of individuals indicate their learning styles. Based on the dimensions of perceiving and processing information, Kolb mentioned four learning styles: *diverging*, *assimilating*, *converging*, and *accommodating* (Kolb, 1985; Cited by Aşkar and Akkoyunlu, 1993).

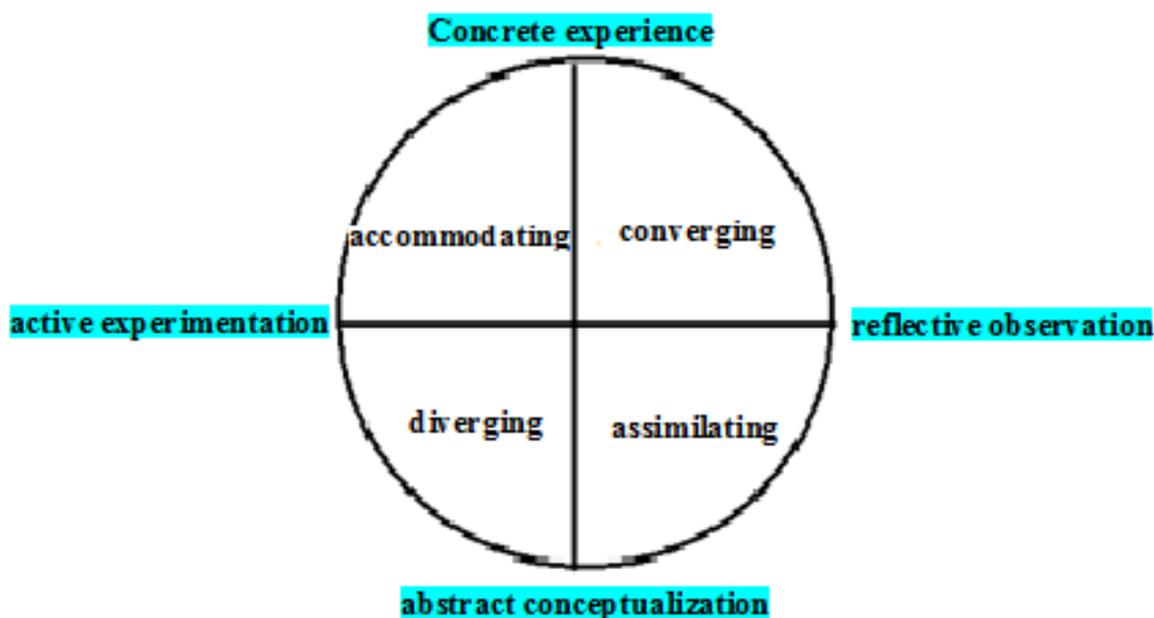


Figure 2: Kolb's Learning Style Model (McCarthy, 1987)

Diverging: Individuals having this learning style predominantly employ concrete experience and reflective observation. They gather information through concrete experience, and transform it into experiences. They comprehend and process information via reflective observation. They adapt through observation rather than doing actively. They shape their thoughts based on their own feelings and opinions. They perform better when they are requested to generate different ideas through brainstorming, etc. Social scientists and individuals preferring organizational development are in this group.

Assimilating: Individuals with this learning style predominantly employ reflective observation and abstract conceptualization. They gather information through abstract conceptualization, and comprehend and process it via reflective observation. They learn better by thinking and watching. They are skillful in creating conceptual models. They are more interested in abstract concepts and ideas. They are good at understanding information and organizing it in a systematic and logical format. Researchers and designers are in this group.

Converging: Individuals having this learning style predominantly use abstract conceptualization and active experimentation. They gather information through abstract conceptualization and process it through active experimentation. Among the typical characteristics of these individuals are decision-making, problem-solving, putting ideas into practice, systematic planning, and making a logical analysis of ideas. They learn by doing and experiencing. They are successful in traditional intelligence tests. They are better in problem-solving and technical tasks rather than social and interpersonal issues. Engineers are in this group.

Accommodating: Individuals with this learning style predominantly employ concrete experience and active experimentation. They gather information through concrete experience and process it through active experimentation. They learn by doing and feeling. They prefer to plan, get involved in new experiences, take risks, and take actions. They fit the situations where one has to adapt to changes automatically. They can communicate with people easily, and are open-minded. Marketers and salespersons are in this group.

Arguing that every individual has a unique learning style, Kolb's learning approach may yield efficient results if it is implemented in a learning environment. It goes without saying that one of the fields where the importance of individualized learning is emphasized is mathematics education. Thus, the investigation of the learning styles of pre-service mathematics teachers is considered significant.

Research Problem

The main problem of the present study was as follows: "What are the predominant learning styles of the pre-service mathematics teachers attending the faculty of education of a state university located in the north of Turkey?" In consideration of this main problem, the study made an attempt to answer the following questions:

1. What is the distribution of the learning styles of pre-service mathematics teachers?
2. Do the learning styles of pre-service mathematics teachers vary by grade?
3. Do the learning styles of pre-service mathematics teachers vary by the type of high school graduated?
4. Do the learning styles of pre-service mathematics teachers vary by sex?

METHOD

Research Model

The present study, which aimed at revealing the pre-dominant learning styles of pre-service mathematics teachers, employed a descriptive survey model. A survey model describes an existing situation as it is (Karasar, 2007).

Study Group

The study group consisted of 126 pre-service mathematics teachers attending the department of mathematics education of the faculty of education of a state university located in the north of Turkey in the 2013-2014 academic year. Demographic characteristics related to the above-mentioned participants are presented in table 1.

Table 1: Demographic characteristics related to the pre-service mathematics teachers participating in the study

Variables		f	%
Grade	1	32	25.4
	2	25	19.8
	3	37	29.4
	4	32	25.4
Type of High School Graduated	Anatolian high school	65	51.6
	Anatolian teacher high school	27	21.4
	Regular high school	33	26.2
	Vocational high school	1	0.8
Sex	Female	83	65.9
	Male	43	34.1
Total		126	100

As is seen in table 1, of the pre-service mathematics teachers participating in the study, 65.9% were female, 34.1% were male, 25.4% were first grade students, 19.8% were second grade students, 29.4% were third grade students, 25.4% were fourth grade students, 51.6% were graduated from an Anatolian high school, 21.4% were graduated from an Anatolian teacher training high school, and 26.2% were graduated from a regular high school.

Data Collection Tool

“Kolb’s Learning Style Inventory (LSI)”, developed by Kolb (1985) and adapted to Turkish by Aşkar and Akkoyunlu, and the information form containing the demographic characteristics of the pre-service teachers, prepared by the researcher, were used for data collection. After detailed information was given in regard to the inventory, voluntary pre-service mathematics teachers were included in the study. The inventory consisted of 12 items, each one of which contained four statements. Each one of these four statements represented the sub-dimensions of learning styles. The first statements were about Concrete Experience (CE), the second statements were about Reflective Observation (RO), the third statements were about Abstract Conceptualization (AC), and the fourth statements were about Active Experimentation (AE). The pre-dominant learning styles of the pre-service mathematics teachers were determined based on their total points in the inventory. Reliability coefficients concerning 4 dimensions of the Learning Style Inventory (Cronbach’s Alpha) varied between 0.73 and 0.83.

Data Analysis

Each item in the Learning Style Inventory (LSI) contained four statements. Each one of these statements represented a different learning style. Based on the points given by the pre-service mathematics teachers to each statement in the LSI, total points in the range of 12 to 48 were obtained for each statement. After total CE, RO, AC, and AE points of 12 items were determined, combined points were obtained. In this way, the learning style of each pre-service mathematics teacher was detected. The research data were analyzed via frequency analysis, percentage analysis, arithmetic mean analysis, standard deviation analysis, Pearson chi-square test of independence, and one-way variance analysis. The related findings are tabulated below.

FINDINGS

This section presents the findings obtained in the study along with interpretations of such findings. The findings are interpreted in the order of sub-problems.

Findings Concerning the First Sub-Problem

Table 2 presents the findings concerning the sub-problem, “What is the distribution of the learning styles of pre-service mathematics teachers?” After that, these findings are interpreted.

Table 2: Findings Concerning the Learning Styles of Pre-Service Mathematics Teachers

Learning Style	Frequency (f)	Percentage (%)
Accommodating	6	4.8
Converging	66	52.4
Assimilating	37	29.4
Diverging	17	13.5
<i>Total</i>	<i>126</i>	<i>100</i>

As is seen in the table 2, of the pre-service mathematics teachers, 4.8% had “accommodating” learning style, 52.4% had “converging” learning style, 29.4% had “assimilating” learning style, and 13.5% had “diverging” learning style. Most of the pre-service mathematics teachers (52.4%) had converging learning style. Individuals having this learning style predominantly use abstract conceptualization and active experimentation. They gather information through abstract conceptualization and process it through active experimentation. Among the typical characteristics of these individuals are decision-making, problem-solving, putting ideas into practice, systematic planning, and making a logical analysis of ideas. They learn by doing and experiencing. Only 4.8% of the pre-service teachers had “accommodating” learning style. Individuals with this learning style prefer to get involved in new experiences, and take risky actions. They fit the situations where one has to adapt to changes automatically. They can communicate with people easily, and are open-minded. The findings concerning the learning styles of the pre-service mathematics teachers are presented in the chart 1.

Findings Concerning the Second Sub-Problem

Table 3 presents the findings concerning the sub-problem, “Do the learning styles of pre-service mathematics teachers vary by grade?”

Table 3: The Analysis of the Learning Styles of the Pre-Service Mathematics Teachers by Grade

Learning Styles	Grade							
	1 st Grade		2 nd Grade		3 rd Grade		4 th Grade	
	f	%	f	%	f	%	f	%
Accommodating	2	6.3	1	4.0	2	5.4	1	3.1
Converging	10	31.3	11	44.0	22	59.5	23	71.9
Assimilating	15	46.9	9	36.0	8	21.6	5	15.6
Diverging	5	15.6	4	16.0	5	13.5	3	9.4
Total	32	100	25	100	37	100	32	100

As is seen in the table 3, the most common (46.9%) learning style among the 1st grade pre-service mathematics teachers was assimilating, while the least common (6.3%) was accommodating; the most common (44%) learning style among the 2nd grade pre-service mathematics teachers was converging, while the least common (4%) was accommodating; the most common (59.5%) learning style among the 3rd grade pre-service mathematics teachers was converging, while the least common (5.4%) was accommodating; and the most common (71.9%) learning style among the 4th grade pre-service mathematics teachers was converging, while the least common was accommodating. It was seen that as the grades of the pre-service mathematics teachers increased, they had converging learning style more.

Findings Concerning the Third Sub-Problem

Table 4 presents the findings concerning the sub-problem, “Do the learning styles of pre-service mathematics teachers vary by the type of high school graduated?”

Table 4: The Analysis of the Learning Styles of the Pre-Service Mathematics Teachers by the Type of High School Graduated

Learning Styles	The type of high school graduated					
	Anatolian High School		Anatolian Teacher Training High School		Regular High School	
	f	%	f	%	f	%
Accommodating	5	7.7	1	3.7	0	0
Converging	32	49.2	18	66.7	16	48.5
Assimilating	19	29.2	6	22.2	11	33.3
Diverging	9	13.8	2	7.4	6	18.2
Total	65	100	27	100	33	100

As is seen in the table 4, the learning styles of the pre-service mathematics teachers did not vary by the type of high school graduated. While the most common learning style among the pre-service mathematics teachers graduated from all three types of high school was converging, the least common learning style among the said pre-service teachers was accommodating.

Findings Concerning the Fourth Sub-Problem

Table 5 presents the findings concerning the sub-problem, “Do the learning styles of pre-service mathematics teachers vary by sex?”

Table 5: The Analysis of the Learning Styles of the Pre-Service Mathematics Teachers by Sex

Learning Styles	Sex			
	Male		Female	
	f	%	f	%
Accommodating	1	2.3	5	6.0
Converging	26	60.5	40	48.2
Assimilating	10	23.3	27	32.5
Diverging	6	14.0	11	13.3
Total	43	100.0	83	100.0

As is seen in the table 5, while 60% of the male pre-service mathematics teachers had converging learning style, 48% of the female pre-service mathematics teachers had converging learning style. In addition, while 23.3% of the male pre-service mathematics teachers had assimilating learning style, 32.5% of the female pre-service mathematics teachers had assimilating learning style. That shows that converging is a more common learning style among men while assimilating is more common among women.

CONCLUSION AND DISCUSSION

The results of the present study, which aimed at determining the learning styles of pre-service mathematics teachers, are explained below.

It was seen that while 52% of the pre-service mathematics teachers had converging learning style, 29% had assimilating learning style. That demonstrates that the pre-service mathematics teachers had such characteristics as problem-solving, decision-making, presenting one's ideas in a logical and systematic format, and focusing on abstract concepts. The findings of the present study are in parallel with those of some studies in the literature (Kaf- Hasırcı, 2006; Çaycı-Ünal, 2007; Can, 2011, Genç-Kocaarslan, 2013). The information presented to the individuals having this learning style needs to be ordered, logical, and detailed. They like auditory and visual presentations in particular (Kolb, 1984; Felder, 1996; Geiger, 1992; McCarty, 2010).

It was found out that the learning styles of the pre-service mathematics teachers varied by grade. While 30% of the 1st grade pre-service mathematics teachers had converging learning style, 72% of the 4th grade pre-service mathematics teachers had converging learning style. The courses taken by the pre-service mathematics teachers in their undergraduate education may have been influential on this situation. In other words, it can be said that the courses included in the mathematics education curriculum are congruent for converging learning style. This result is consistent with the research results provided by Matthews (1996), Karademir and Tezel (2010), and Can (2011).

It was determined that the learning styles of the pre-service mathematics teachers did not vary by the type of high school graduated. 49% and 29% of the Anatolian high school graduates had converging and assimilating learning styles respectively, 66% and 22% of the Anatolian teacher training high school graduates had converging and assimilating learning styles respectively, and 48% and 33% of the regular high school graduates had assimilating learning styles respectively. It was seen that converging was the most common learning style among the graduates of the above-mentioned three types of high school.

It was detected that the learning styles of the pre-service mathematics teachers did not vary by sex. While 60% of the male pre-service mathematics teachers had converging learning style, 48% of the female pre-service mathematics teachers had converging learning style. In addition, while 23% of the male pre-service mathematics teachers had assimilating learning style, 32% of the female pre-service mathematics teachers had assimilating learning style. In other words, while men adopted converging learning style more than women did, women adopted assimilating learning style more than men did.

In consideration of the above-mentioned research results, the following recommendations are put forward. Since most pre-service mathematics teachers are seen to have converging learning style, course plans should be made in accordance with this learning style. In addition, pre-service teachers should be encouraged by their lecturers to employ appropriate teaching methods in their courses by determining the learning styles of their students in their professional teaching lives. The awareness of pre-service teachers should be raised concerning the fact that the individual differences and learning styles of students should be taken into consideration when deciding the teaching method to be employed.

BIODATA AND CONTACT ADDRESSES OF AUTHORS



Abdulkadir TUNA is an assoc professor at Kastamonu University, Educational Faculty Mathematics Education, Turkey. He received Ph.D in Mathematics Education from Gazi University. His study areas mathematical thinking and learning, Mathematics Education and 5E Learning model.

Assoc. Prof. Dr. Abdulkadir TUNA
Kastamonu University
Educational Faculty
TURKEY
E. Mail: atuna@kastamonu.edu.tr



Ahmet KAÇAR is an professor at Kastamonu University, Department of Mathematics, Turkey. He has many researches about mathematics and mathematics education.

Prof. Dr. Ahmet KAÇAR
Kastamonu University
Educational Faculty
TURKEY
E. Mail: atuna2536@gmail.com

REFERENCES

- Açıkgöz, K. (2003). *Etkili Öğrenme ve Öğretme (Effective Learning and Teaching)*. İzmir: Eğitim Dünyası Yayınları
- Aşkar, P. & Akoyunlu, B. (1993). Kolb Öğrenme Stili Envanteri (Kolb's Learning Style Inventory). *Eğitim ve Bilim*, 17(87), 37-47.
- Aydoğdu, M., Kesercioğlu, T. (2005). *İlköğretimde Fen ve Teknoloji Öğretimi (Science and Technology Teaching in Primary Education)*. Ankara: Anı Yayıncılık
- Can, Ş (2011). Investigation of The Relationships Between the Learning Styles of Preservice Elementary Teachers and Some Variables. *Hacettepe University Journal of Education*, (41), 70-82.
- Çaycı, B. and Ünal, E. (2007). Sınıf Öğretmeni Adaylarının Sahip Oldukları Öğrenme Stilllerinin Çeşitli Değişkenlere Göre İncelenmesi (The Examination of the Learning Styles of Pre-service Primary School Teachers by Various Variables). *Üniversite ve Toplum: Bilim, Eğitim ve Düşünce Dergisi*. Volume: 7, Issue: 3.
- Felder, R. M., Siverman L. (1988). Learning and Teaching Styles in Engineering Education. *Engineering Education* 78(7), 674-68.
- Gregorc, A. F. (1984). Style as a symptom: A phenomenological perspective. *Theory into Practice*, 23, 1, 51-55.

Kaf, Hasırcı, Ö.(2006). Sınıf öğretmenliği öğrencilerinin öğrenme Stilleri: Çukurova niversitesi Örneği (The learning styles of pre-service primary education teachers: The case of Çukurova University). Eğitimde Kuram ve Uygulama (Journal of Theory and Practice in Education).2(1), 15-25.

Karasar, N. (2000). Bilimsel Araştırma Yöntemi (Scientific Research Method). Ankara: Nobel Yayın ve Dağıtım

Karedemir, E., Özden, T.(2010). Sınıf öğretmeni adaylarının öğrenme Stillerinin Demografik Değişkenler Açısından İncelenmesi (The examination of the learning styles of pre-service primary school teachers by demographic variables). Pamukkale Üniversitesi, Eğitim Fakültesi Dergisi, (28), 129-145.

Kolb, D. (1984). Experiential learning experience as the source of learning and development. New Jersey, Prentice Hall.

Köksalan, B. (2007). Beyin Temelli Öğrenme (Brain-Based Learning). K. Ersanlı (Ed), Eğitim Psikolojisi. İstanbul: Lisans Yayıncılık.

Matthews, D. B.(1996). An Investigation of Learning Styles and Perceived Academic Achievement for High School Students. Clearing House, 69(4)249-255.

Mccarthy, B. (1987). The 4Mat system: teaching to learning styles with right/left mode techniques. Barrington: Excel, Inc.

Özden, Y. (1999). Eğitimde Dönüşüm-Eğitimde Yeni Değerler (Transformation in Education-New Values in Education). Ankara: Pegem A Yayıncılık.

Özden, Y. (1997). Öğrenme ve Öğretme (Learning and Teaching). Ankara: Pegem Yayıncılık.

Vural, B. (2004). Eğitim-Öğretimde Planlama, Ölçme ve Stratejiler (Planning, Assessment, and Strategies in Education). İstanbul: Hayat Yayınları.