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THE RELATIONSHIP BETWEEN THE PRE-SERVICE SCIENCE TEACHERS' SCIENTIFIC PROCESS SKILLS AND LEARNING STYLES

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Abstract

In the present study, the purpose is to determine the relationship between the pre service science teachers' scientific process skills and their learning styles. For this purpose, the study was carried out with 151 1th and 4th year students attending Science Teacher Education Department of Education Faculty at Muğla University. In the study, survey method is used. The pre-service teachers' learning styles were determined through "Kolb Learning Style Inventory" adapted to Turkish by Aşkar and Akkoyunlu (1993). In order to evaluate the pre-service teachers' scientific process skills; "Scientific Process Skills Test" developed by Burns, Okey and Wise (1985) to determine the scientific process skills of high school and university students and adopted to Turkish by Ateş ve Bahar (2004) was used. When SPS scores are generally examined, it is seen that the pre-service teachers having separating and changing learning styles have higher SPS scores when compared to the pre-service teachers having the other learning styles.

Keywords: Learning Styles, Pre-Service Science Teachers', Scientific Process Skills.

INTRODUCTION

Today's modern perception of education aims to instill the methods of acquiring information in students rather than to get them memorize the information.In this context, Turkey in 2004, Education Program of Science and Technology Course is a major change has occurred. As this program is the acquisition of scientific process skills. According to Bağcı- Kılıç, (2006), in science and technology teaching programs, scientific process skills are divided into two as basic and integrated scientific process skills: Basic scientific process skills are observation, classification, prediction, inference, and communication skills. Without developing these skills, it is difficult for people to construct new information. Integrated scientific process skills are advanced skills such as determination and control of variables, hypothesis construction and testing, data evaluation,

making definitions depending on certain situations, conducting experiments, modeling. Thus, scientific process skills lay the basis of scientific inquiry and scientific thinking. A learning environment where SPS is used requires active participation of students. While individuals are sharing a common educational environment, they follow different methods to transform phenomena and events into experiences by internalizing them. These methods are called learning styles which determine the quality of an individual's learning process and his/her approach to learning (Eren, 2002). Different models related to learning styles have been developed since 1940s. Each of these models emphasizes a different dimension of individuals, being either cognitive, affective or physiological (Cornet, 1983).

One of the authors having the greatest amount of research on learning styles is David A. Kolb. According to Kolb's experimental learning theory, learning takes place as a result of experiences and individuals do not learn in the same manner all the time (Yoon, 2000; Kolb, 2000; 1984; Whitcomb, 1999). According to the experimental learning theory, thoughts are not stable, they constantly change depending on the experiences (Kolb, 1984). According to David Kolb, new information, skills and attitudes can be acquired through involving them in four types of experimental learning. Learning styles are in the form of a circle and everybody is somewhere in this circle. For students to be effective, students need different capabilities. Fields (capabilities) affecting learning are these:
*Concrete Experience:*By Feeling (initiating new experiments)
Reflective Observation: By Observing (watching others or himself/herself)
Abstract Conceptualization: By thinking (developing theories to explain observation)
Active Experience: By doing (using theories to solve problems or make decisions)

According to Kolb, there are basic dimensions of learning process. First one represents a continuum ranging from abstract conceptualization to concrete experience, and the second one represents a continuum ranging from active experience to reflective observation. In Kolb's learning style model, concrete experience and abstract conceptualization explain how individuals perceive information and reflective observation and active experience explain how individuals process information.

According to Kolb learning style model, there are four learning styles. These are: changing, internalizing, separating and adapting (placing) learning styles. For individuals having Changing learning style, best learning occurs between the dimension of concrete experiences and reflective observation. They learn by feeling and observing. While structuring their thoughts, they pay attention to their own feelings and thoughts. For learners having internalizing learning, the best learning occurs between the dimensions of abstract conceptualization and reflective observation. They learn by observing and thinking through concepts. They focus on abstract concepts and opinions while learning something. For individuals having separating learning style, the best

learning occurs between the dimensions of abstract conceptualization and active experiencing. They learn by thinking through concepts and doing. Their main characteristics are problem solving, decision making, logical analysis of opinions and systematic planning. For individuals having placing learning style, the best learning occurs between the dimensions of active experiencing and concrete experiencing. They learn by doing and feeling. Their main characteristics are planning, carrying out decisions and being involved in new experiences.

Evaluation of individuals' learning styles is of great importance for learning-teaching process (Hein ve Budny, 2000). According to Babadoğan (2000), if learners' learning styles are known, it becomes easier to determine how the individuals learn and what type of teaching design should be adopted. Enhancing SPS levels of teachers and pre-service teachers is a need for the success of science and technology education. In this respect, it seems to be important to investigate the relationship between learning styles and SPS to enhance their SPS levels by considering pre-service teachers' learning styles.

METHOD

Model of the Study

In this study, the survey method was used to determine the relationship between the pre-service science teachers' scientific process skills and their learning styles.

Participants

The study was carried out with 151 1th and 4th year students attending Science Teacher Education Department of Education Faculty at Muğla University.

Data Collection Tool

The pre-service teachers' learning styles were determined through "Kolb Learning Style Inventory" adapted to Turkish by Aşkar and Akkoyunlu (1993). The inventory consists of 12 ıtems each of which having four options including 4 learning styles defined by Kolb (1985). For each learning style, the reliability coefficients were found to be as follows: concrete experience .58, reflective observation .70; abstract conceptualization .71; active experimentation .65; abstract – concrete .77, active – reflective .76. These reliability coefficients were found to be satisfying. In order to evaluate the pre-service teachers' scientific process skills; "Scientific Process Skills Test" developed by Burns, Okey and Wise (1985) to determine the scientific process skills of high school and university students and adopted to Turkish by Ateş ve Bahar (2002) was used. This scale includes 36 multiple-choice items. The test is made up of 5 dimensions: 1. Identifying variables (12), 2. Operationally defining (6), 3. Stating hypothesis (9), 4. Data and graph interpretation (6), 5. Designing experiment (3). For the original test, cronbach alpha was calculated to be 0.86 by Burns. On the other hand, Ateş and Bahar (2004) found it as 0.74.

Data Analysis

The data were analyzed through SPSS 15.0 program package. To determine pre-service teachers' SPS score means in relation to their learning styles, "descriptive statistics" is used, and for the analysis of the SPS sub-dimensions in relation to pre-service teachers' learning styles," One Way ANOVA (one-way variance analysis) "is used.

FINDINGS

1-Findings Concerning The Relationship Between Pre-Service Science Teachers' Learning Styles And SPS Scores

Table 1.1. Distribution of pre-service science teachers' learning styles

	f	%
Separating	56	37.1
Internalizing	48	31.8
Changing	30	19.9
Placing	17	11.3
Total	151	100

When Table 1.1 is examined, it is seen that 56 (37.1%) of the participants have separating, 48 (31.8%) internalizing, 30 (19.9%) changing and 17 (11.3%) placing learning styles. Therefore it can be claimed that the relatively more dominant learning styles among the pre-service science teachers are separating (37.1%) and internalizing (31.8%) and relatively less dominant styles are placing (11.3%) and changing (19.9%) learning styles.

Table 1.2. Pre-service teachers' SPS score means in relation to their learning styles

	N	$\overline{X}$	Sd
Separating	56	23.46	4.80
Internalizing	30	22.13	7.19
Changing	48	18.18	6.17
Placing	17	19.47	6,27
Total	151	21.07	6.32

When the pre-service teachers' SPS scores are compared in relation to learning styles; SPS score mean of the pre-service teachers having separating style is found to be $\overline{X}$=23.46, that of the pre-service teachers having changing learning styles is $\overline{X}$=22.13, that of the pre-service teachers having internalizing learning style is ($\overline{X}$=18.18) and that of the pre-service teachers having placing learning style is ($\overline{X}$=19.47).

Table 1.3. Results of One Way ANOVA concerning the pre-service teachers' SPS scores in relation to learning styles

	KT	Sd	KO	F	p
Betweengroups	797.256	3	265.752	7.517	.000
Within Groups	5196.943	147	35.353		
Total	5994.199	150			

In relation to the pre-service teachers' learning styles, a significant difference was found among the SPS scores of the pre-service teachers ($F(3.147)= 7.517$, $p<.05$). This difference was found to be between the SPS scores of the pre-service teachers having separating and internalizing learning styles and those of the pre-service teachers having changing and internalizing learning styles. These differences seen among SPS arithmetic means favor the pre-service teachers having separating and changing learning styles.

2-Findings Concerning SPS Sub-Dimensions In Relation To Pre-Service Teachers' Learning Styles

Five sub-dimensions of SPS investigated in the present study are: Determining and controlling the variables, defining by doing, establishing hypothesis, data analysis and graph plotting, and conducting experiments.

Table 2.1. Findings concerning determining and controlling the variables in relation to the pre-service teachers' learning styles

	N	$\bar{X}$	Sd
Separating	56	.67	.17
Internalizing	30	.63	.22
Changing	48	.52	.22
Placing	17	.55	.21
Total	151	.60	.21

According to the table 2.1., when the scores obtained for sub-dimension of determining and controlling the variables are compared in relation to the learning styles, it is seen that arithmetic mean scores for the sub-dimension of determining and controlling the variables are ($\bar{X}$=0.67) for separating, ($\bar{X}$=0.63) for changing, ($\bar{X}$=0.52) internalizing and ($\bar{X}$=0.55) for placing.

Table 2.2. One Way ANOVA results concerning the sub-dimension of determining and controlling the variables in relation to the learning styles

	KT	Sd	KO	F	p
Betweengroups	.650	3	.217	5.155	.002
Within Groups	6.182	147	.042		
Total	6.833	150			

A significant difference was found for the sub-dimension of determining and controlling the variables in relation to the pre-service teachers' learning styles (F(3.147)= 5.155, p<.05). This difference was found to be between the determining and controlling the variables sub-dimension of pre-service teachers having separating and internalizing learning styles and this difference favors the pre-service teachers having separating learning styles.

Table 2.3. Findings concerning the sub-dimension of defining by doing in relation to the pre-service teachers' learning styles

	N	$\overline{X}$	**Sd**
Separating	56	.44	.24
Internalizing	30	.54	.28
Changing	48	.36	.17
Placing	17	.34	.19
Total	151	.42	.23

According to table 2.3., when the scores for the sub-dimension of defining by doing are compared in relation to the learning styles, it is seen that arithmetic mean scores for the sub-dimension of defining by doing are ($\overline{X}$=0.44) for separating, ($\overline{X}$=0.54) for changing, ($\overline{X}$=0.36) for internalizing and ($\overline{X}$=0.34) for changing learning styles.

Table 2.4. One Way ANOVA results concerning the sub-dimension of defining by doing in relation to the learning styles

	KT	Sd	KO	F	p
Betweengroups	.741	3	.247	4.766	.003
Within Groups	7.620	147	.052		
Total	8.362	150			

A significant difference was found for the sub-dimension of defining by doing in relation to the pre-service teachers' learning styles (F(3.147)= 4.766, p<.05). This difference was found to be between the scores obtained for the defining by doing sub-dimension by the pre-service teachers having "separating and internalizing" and "changing and placing" learning styles and this

difference favors the pre-service teachers having changing learning style.

Table 2.5. Findings concerning the sub-dimension of establishing hypothesis in relation to the pre-service teachers' learning styles

	N	$\bar{X}$	Sd
Separating	56	.63	.25
Internalizing	30	.47	.21
Changing	48	.44	.20
Placing	17	.55	.17
Total	151	.53	.23

When the scores for the sub-dimension of establishing hypothesis are compared in relation to the learning styles, it is seen that arithmetic mean scores for the sub-dimension of establishing hypothesis are ($\bar{X}$=0.63) for separating, ($\bar{X}$=0.47) for changing, ($\bar{X}$=0.44) for internalizing and ($\bar{X}$ =0.55) for placing learning styles.

Table 2.6. One Way ANOVA results concerning the sub-dimension of establishing hypothesis in relation to the learning styles

	KT	Sd	KO	F	p
Betweengroups	1.091	3	.364	7.410	.000
Within Groups	7.213	147	.049		
Total	8.304	150			

A significant difference was found for the sub-dimension of establishing hypothesis in relation to the pre-service teachers' learning styles ($F(3.147)= 7.410$, $p<.05$). This difference was found to be between the scores obtained for the establishing hypothesis sub-dimension by the pre-service teachers having "separating and changing" and "separating and internalizing" learning styles and this difference favors the pre-service teachers having separating learning style.

Table 2.7. Findings concerning the sub-dimension of data analysis and graph plotting in relation to the pre-service teachers' learning styles

	N	$\bar{X}$	Sd
Separating	56	.80	.19
Internalizing	30	.77	.28
Changing	48	.70	.23
Placing	17	.74	.20
Total	151	.75	.23

When the scores for the sub-dimension of data analysis and graph plotting are compared in relation to the learning styles, it is seen that arithmetic mean scores for the sub-dimension of data

analysis and graph plotting are ($\bar{X}$=0.80) for separating, ($\bar{X}$=0.77) for changing, ($\bar{X}$=0.70) for internalizing and ($\bar{X}$=0.74) for placing learning styles. No significant difference was found among the scores obtained by the pre-service teachers for the sub-dimension of data analysis and graph plotting in relation to their learning styles.

Table 2.8. Findings concerning the sub-dimension of conducting experiments in relation to the pre-service teachers' learning styles

	N	$\bar{X}$	**Sd**
Separating	56	.73	.26
Internalizing	30	.77	.30
Changing	48	.50	.33
Placing	17	.43	.34
Total	151	.63	.33

When the scores for the sub-dimension of conducting experiments are compared in relation to the learning styles, it is seen that arithmetic mean scores for the sub-dimension of conducting experiments are ($\bar{X}$=0.73) for separating, ($\bar{X}$=0.77) for changing, ($\bar{X}$=0.70) for internalizing and ($\bar{X}$ =0.74) for placing learning styles.

Table 2.9. One Way ANOVA results concerning the sub-dimension of conducting experiments in relation to the learning styles

	KT	Sd	KO	F	p
Betweengroups	2.632	3	.877	9.284	.000
Within Groups	13.891	147	.094		
Total	16.522	150			

A significant difference was found for the sub-dimension of conducting experiments in relation to the pre-service teachers' learning styles ($F(3.147)= 9.284$, $p<.05$).This difference was found to be between the scores obtained for the establishing hypothesis sub-dimension by the pre-service teachers having "separating and internalizing", "separating and placing", "changing and internalizing" and "changing and placing" learning styles and this difference favors the pre-service teachers having separating and changing learning style.

DISCUSSION

1-When the literature is reviewed, findings similar to ones found in the present study can be seen (Jones et.al., 2003; Gürsoy; 2008; Erdoğan 2008; Baykara Pehlivan, 2010).

2- Moreover, it was found that no matter which teaching method the student is subjected to, some learning styles are more advantageous over other learning styles in terms of scientific achievement and scientific process skills (Arı & Bayram, 2011).

CONCLUSIONS

1-At the end of the study, it was found that dominant learning styles among the science pre-service teachers are separating and internalizing learning styles. Therefore, it can be concluded that science pre-service teachers prefer learning by doing, they are successful in problem-solving, logical analysis, and decision making, and moreover, they prefer to use detailed, sequenced, and planned information.

2- In relation to learning styles, when SPS scores of science pre-service teachers are compared, it is seen that the mean SPS score of the students having separating learning style is higher than those of the students having the other learning styles. When SPS scores are examined, it is seen that the pre-service teachers having separating and changing learning styles have higher SPS scores when compared to the pre-service teachers having the other learning styles. When the sub-dimensions of SPS are generally examined, it is seen that the pre-service teachers having separating learning style have higher scores for the sub-dimensions of determining and controlling the variables, and establishing hypotheses, pre-service teachers having changing learning style have higher scores for the sub-dimension of defining by doing, and the pre-service teachers having separating and changing learning styles have higher scores for the sub-dimension of conducting experiments. No significant difference was obtained for the sub-dimensions of data analysis and graphic plotting.

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