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The effect of learning styles of preservice chemistry teachers on their perceptions of problem solving skills and problem solving achievements

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Abstract

This study aims to determine learning styles of preservice chemistry teachers and to examine the effect of different learning styles on their perceptions of problem solving skills and problem solving achievements. The preservice chemistry teachers of Hacettepe University Faculty of Education, Department of Chemistry Education participated in the study. The preservice chemistry teachers were applied The Kolb Learning Style Inventory which was developed by Kolb (1985) to determine their learning styles. The Problem Solving Inventory which was developed by Heppner and Petersen (1982) was applied to determine preservice chemistry teachers' perceptions of problem solving skills and The Chemical Calculations Achievement Test was applied to determine their problem solving achievements. Obtained data analyzed by using SPSS and obtained results were discussed.

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1. Introduction

There are various ways that students prefer for receiving and processing information. Some students focus on data and operations while others are better at theories and mathematical models. While written and verbal explanations are effective for some students, visual elements such as drawings, figures and graphics are more effective for others. Some students prefer interactive environments while others prefer to study individually. These differences in students' preferences indicate that they have different learning styles (Felder, 1996). The concept of learning style was first propounded by Rita Dunn in 1960. Cano and Garton (1994) stated that learning styles were among the most crucial factors effecting students' academic achievement. There are different definitions regarding learning styles in the literature. According to Kolb (1984) learning style is the ways that the individual prefers during receiving and processing information. According to Dunn and Dunn (1993) it is the use of different and unique ways while preparing to learn new and difficult information, while learning and while remembering the learned information later. According to Clark (1999), on the other hand, it is student's way of using stimuli and answering stimuli in learning environments. In this context, these differences among students also affect their problem solving skills which is defined as students' making a decision and finding a solution depending on their previous

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information (Çoban, 2011). There are different problem solving definitions in the literature. According to Wheatley (1984) problem solving is what you do when you do not know what to do. Gagne (1970) stated that problem solving was the highest level of learning and problem solving skill was an inevitable life skill, and defined problem solving as a thinking process in which the student explored the composition of the learned rules in order to solve a new problem (Gagne, 1977). According to Cardellini (2006), on the other hand, problem solving is something more than placing the numbers into well-learned formulas and it is directly related to creativity, deliberation and formal information. Achievement in problem solving process depends on defining the problem correctly (Kuzgun, 1995), individual's skill of dealing with problematic situations, focusing on the problem, the way of approaching to the problem and the way in which the individual evaluates oneself in dealing with his/her real personal problems (Hepner and Peterson, 1982; as cited in Ferah, 2000). The reason is that people who have positive senses of self in terms of problem solving tend to be more successful in real problem solving. The people who approach their problems with thoughts such as "I can deal with my problems", "these problems are not too terrifying to deal with" and "dealing with these problems mostly depend on me" tend to think healthier and find effective solutions to their problems (Güçlü, 2003). Kolb (1984), also, presented that individual's skill of obtaining and using knowledge while solving a problem is related to learning styles. In this context, this research aimed to find out whether there is a difference among preservice teachers' perceptions of problem solving skills and problem solving achievements depending on their learning styles or not.

1.1 Aim of the study

This study aims to determine the learning styles of preservice chemistry teachers and to examine the effect of different learning styles on their perceptions of problem solving skills and problem solving achievements. In this aspect, we are guided by the following subproblems: 1. What are the learning styles of the preservice chemistry teachers? 2. Is there a significant difference between perceptions of problem solving skills of preservice chemistry teachers according to their learning styles? 3. Is there a significant difference between problem solving achievements of preservice chemistry teachers according to their learning styles?

1.1. Study Group

46 preservice chemistry teachers from Hacettepe University Faculty of Education, Department of Chemistry Education in the spring term of the 2011-2012 academic years participated in the study.

2.Method

2.1. Data Collection Tool

Kolb's Learning Style Inventory: This Inventory was originally developed by Kolb (1985) and adapted into Turkish by Aşkar and Akkoyunlu (1993). This Inventory is consisted of 12 questions about the ways in which one learns best. Each question has four answers, which are ranked by an individual in terms of best fit on a scale of 1 – 4 (being best). Each answer represents four learning style. The Inventory includes four learning modes. These are: concrete experience (CE), reflective observation (RO), abstract conceptualization (AC) and active experimentation (AE). The combination of two learning modes which are dominants is considered as individuals' learning style. "Accommodator" learning style is the combination of AE and CE, "Diverger" learning style is the combination of CE and RO, "Converger" learning style is the combination of AE and AC, "Assimilator" is the combination of RO and AC. The Cronbach alpha coefficients are calculated as .82 for CE, .73 for RO, .83 for AC, .72 for AE, .78 for AC-CE, .81 for AE-RO by (Aşkar and Akkoyunlu, 1993).

Problem Solving Inventory: This Inventor was originally developed by Heppner and Petersen (1982) and adapted into Turkish by Savaşır and Şahin (1997). The inventory is composed of 35 items with 6 point Likert scale. Savaşır and Şahin (1997) determined that this inventory is consisted of three subfactors; problem solving confidence, approach-avoidance and personal control. The Cronbach alpha reliability coefficient was calculated as .90. The

obtained high scores from the inventory show that perception of problem solving skills is low while obtained low scores show that that perception of problem solving skills is high.

Chemical Calculations Achievement Test: This test which is consisted of 15 multiple choice questions related to the topic of “Chemical Calculations” was developed by researchers for this study. It is examined by three experts in the field of chemistry education for content validity. The Cronbach alpha reliability coefficient was calculated as .70.

3. Findings

Firstly, the data obtained from Kolb’s Learning Style Inventory were analyzed to determine learning styles of preservice chemistry teachers. Their learning styles are given in Table 1.

Table1. The descriptive statistics of preservice chemistry teachers’ learning styles

	Accommodator	Diverger	Assimilator	Converger	Total
N	4	8	16	18	46
%	8,70	17,39	34,78	39,13	100

When Table 1 was examined, it was determined that of the preservice chemistry teachers 8.7 % have “Accommodator”, 17,39 % have “Diverger”, 34,78% have “Assimilator” and 39,13 % have “Converger” learning styles. 12 preservice chemistry teachers were left out of analysis to prevent the negative effect of the number of preservice chemistry teachers who have “Accommodator” and “Diverger” learning styles (N=4; N=8) on statistical significance. Analyses were conducted for 34 preservice chemistry teachers who have “Converger” and “Assimilator” learning styles.

Secondly, independent samples t-test was conducted to determine whether there is a significant difference between perceptions of problem solving skills of preservice chemistry teachers according to their learning styles. The t-test result is given in Table 2.

Table2. t-test result related to perceptions of problem solving skills of preservice chemistry teachers according to their learning styles

Learning Styles	N	\bar{X}	S	sd	t	p
Converger	18	82,55	16,57	32	-1,41	0,168
Assimilator	16	90,06	14,14			

When Table 2 was examined, any significant difference was not found between perceptions of problem solving skills of preservice chemistry teachers according to their learning styles ($t(32) = -1,41, p > 0.05$).

Thirdly, independent samples t-test was conducted to determine whether there is a significant difference between problem solving achievements of preservice chemistry teachers according to their learning styles. The t-test result is given in Table 3.

Table 3. t-test result related to problem solving achievements of preservice chemistry teachers according to their learning styles

Learning Styles	N	\bar{X}	S	sd	t	p
Converger	18	9,55	2,33	32	2,51	0,017
Assimilator	16	7,81	1,68			

When Table 3 was examined, a significant difference was found between problem solving achievements of preservice chemistry teachers according to their learning styles ($t(32) = 2,51, p < 0.05$). Problem solving achievements of preservice chemistry teachers who have “Converger” learning style ($\bar{X} = 9,55$) are higher than preservice chemistry teachers who have “Assimilator” learning style ($\bar{X} = 7,81$). This finding could be interpreted

that there is a significant relationship between problem solving achievements and learning styles of preservice chemistry teachers.

4. Discussion

Regarding the first subproblem, the dominant learning styles of the preservice teachers were found to be “Converger” (39,13%) and “Assimilator” (34,78%). In the literature, it was determined that individuals in teaching profession mostly had “Assimilator” learning style while individuals interested in sciences mostly had “Converger” learning style (Kolb,1984; Aşkar and Akkoyunlu,1993). The fact that the study group comprises of preservice chemistry teachers indicates that we obtained a result supported by the literature. The recent studies conducted in our country in order to find out preservice teachers’ learning styles also support the result of our study (Baykara Pehlivan, 2010; Demir, 2008; Güven, 2003).

Regarding the second subproblem of the study, when the average grades that the preservice chemistry teachers got from problem solving inventory were examined, it was found that the preservice chemistry teachers having the “Converger” learning style had an average of $\bar{X}=82,55$; while the preservice chemistry teachers having the “Assimilator” learning style had an average of $\bar{X}=90,06$ (Table 2). This result indicates that the preservice chemistry teachers’ perceptions of their problem solving skills are at a medium level. It was found out that the preservice chemistry teachers’ perceptions of their problem solving skills do not show a significant difference depending on learning styles ($t_{(32)} = -1,41$, $p > 0,05$). In the literature, there are not many researches conducted in this area however, Küçükkaragöz, Deniz, Ersoy and Karataş (2009) stated in their research that the problem solving skills of elementary science, mathematics and Turkish preservice teachers did not show significant differences depending on their learning styles just as similar to the result we obtained. Şirin and Güzel (2006), also, found out that there is not a significant relationship between learning styles and problem solving skills in their research conducted with the students of faculty of education.

Regarding the third subproblem of the study, when the Table 3 was examined, it was found that the problem solving achievements of the preservice teachers showed a significant difference depending on their learning styles ($t_{(32)}=2,51$, $p < 0,05$). Many researches that examined the relationship between the students’ learning styles and their achievements indicate the presence of the relationship between learning style and achievement (Boatman, Courtney ve Lee, 2008; Collison, 2000; Lang, Stinson, Kavanagh, Liu ve Basile, 1999; Matthews, 1996; Synder, 2000; Woolhouse ve Blaire, 2003;). Chiou (2008) suggested that the learning style preferences of the students affected their performances depending on the type of the course. Tatar, Tüysüz and İlhan (2008) found out that there was a statistically significant difference between the preservice chemistry teachers’ achievements depending on their learning styles.

When the Table 3 was examined, it was found that the achievements of the preservice chemistry teachers having the “Converger” learning style were significantly higher than the achievements of the preservice chemistry teachers having the “Assimilator” learning style. It is seen that this result is supported by the literature. Kolb (1993) stated that the individuals having the “Converger” learning style were more successful in making decisions and solving problems and that these features were the strong aspects of these individuals. Smith and Kolb (1996) suggested that the students having the “Converger” style were better at deciding the problem solving way and at problem solving activities. Demirbas and Demirkan (2007) reached the conclusion that the students having the “Converger” learning style was more successful in problem solving activities.

The fact that the preservice chemistry teachers’ problem solving achievements change depending on their learning styles might be interpreted as that the achievements they will get from different types of measuring tools might also change. In this regard, in the future researches, it might be examined whether the preservice teachers’ achievement points they get from different types of measuring tools indicate a significant difference depending on their learning styles or not. Besides, it might also be examined whether there are differences in the preservice teachers’ learnings in different learning environments depending on their learning styles.

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