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Prospective chemistry teachers' learning styles and learning preferences

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Abstract

The purpose of this study was to determine the relationship between learning styles and learning preferences of 100 prospective chemistry teachers. And also the role of gender in learning preferences was examined. As data collection tool, Learning Style Inventory developed by Kolb (1985) and adapted to Turkish by Aşkar and Akkoyunlu (1993) was used in order to determine prospective chemistry teachers' learning styles, and Learning Preferences Inventory developed by Loo (2004) was conducted in order to determine learning preferences of the participants. For the evaluation of the data, statistical analysis were applied.

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Keywords: Learning styles; learning preferences, prospective chemistry teachers, Kolb Learning Style Inventory.

1. Introduction

Learning is an ongoing process and occurs in different ways for different people. Based upon individual personalities and unique experiences, individuals develop a set of preferred styles of learning. (Pallapu, 2008).

Jensen (2003) defined it as a preferred way of thinking, processing, and understanding information (p. 31). It refers to a person's characteristic style of acquiring and using information in learning and solving problems. Newby, Stepich, Lehman and Russell (2000) define learning style as 'the use of different methods by individuals while processing and arranging the information as well as reacting to environmental stimuli. According to Kemp, Morrison and Ross (1998), learning styles are traits that refer to how individuals approach learning tasks and process information (p. 40). Learning style is a method of personal choice to perceive and process information (Kolb, 1984). Briefly, these styles define how individuals process new information, solve problems and make decisions (Kolb and Smith, 1996). To Kolb's Experiential Learning Model, learning is conceived as a four stage cycle starting with concrete experience which forms the basis for observation and reflection upon experiences. These observations are assimilated into concepts and generalizations about experiences which in turn, guide new experiences and interactions with the world. Kolb's model reflects two independent perceiving and processing dimensions: the concrete experience-abstract conceptualization, perceiving dimension and the active experimentation-reflective observation, processing dimension. These two dimensions form four learning styles (Loo, 2004). *Accommodator:*

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Dominant learning abilities are Concrete Experience (CE) and Active Experimentation (AE). People with this learning style have the ability to learn from primarily ‘hand-on’ experience. They enjoy carrying out plans and involving themselves in new and challenging experiences. *Assimilator*: Dominant learning abilities are Abstract Conceptualization (AC) and Reflective Observation (RO). People with this learning style are best at understanding a wide range of information and putting into concise, logical form” *Converger*: Dominant learning abilities are Abstract Conceptualization (AC) and Active Experimentation (AE). 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. *Diverger*: Dominant learning abilities are Concrete Experience (CE) and Reflective Observation (RO). People with this learning style are best at viewing concrete situations from many different points of view. It is labeled ‘Diverger’ because a person with it performs better in situations that call for generation of ideas, such as a ‘brainstorming’ session (Kolb, Boyatzis, & Charalampos, 2000, Robatin, 2009).

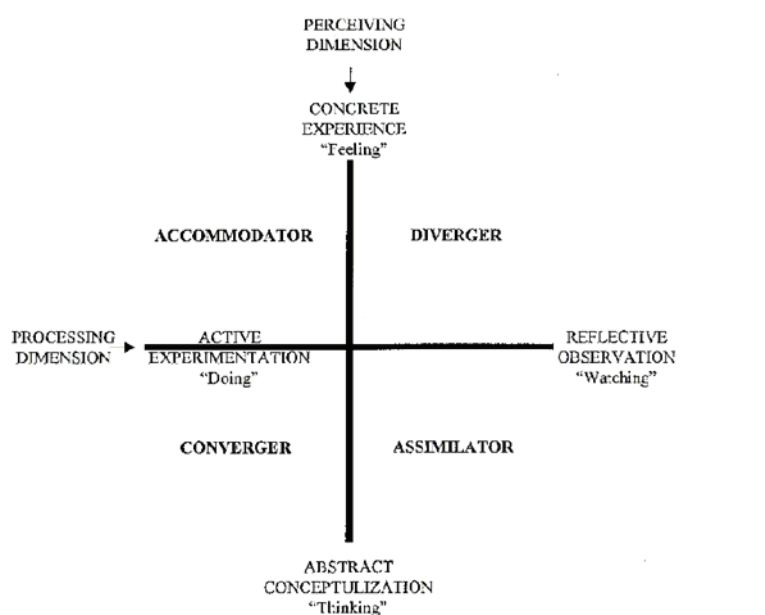


Figure 1. The perceiving and processing dimension and four learning styles (Loo, 2004)

The learning type “feeling” is associated with the concrete experience end of the perceiving dimension while the “thinking” type is associated with the abstract conceptualization and of the perceiving dimension. The “doing” type is associated with the active experimentation end of the processing dimension while the “watching” type is associated with reflective observation dimension (Loo, 2004). Briefly, according to Kolb’s Experiential Learning Model, there are four dimensions of learning styles. Think of these dimensions as a continuum with one learning preference on the far left and the other on the far right. Once we know where our preferences lie on each of these dimensions, we can begin to stretch beyond those preferences and develop a more balanced approach to learning.

Learning preference is a person’s choice of one learning situation over another (Rezler, Rezmovic , 1981). Students’ learning preferences is dependent of learning style (Robatin, 2009). In Loo’s (2004) study, he investigated the relationship between learning styles and different learning preferences . The sample of the study was 201 management undergraduate students. Only three significant relationships and weak linkages between learning styles and learning preferences were found. Also, Sadler-Smith (1997) investigated the relationship between learning styles and learning preferences. And they found statistically significant but weak correlation between the scores of learning styles inventory and learning preferences inventory.

Learning styles and learning preferences are not constant and, indeed, change over time. Therefore, it is important to take account of learners’ different learning styles and their learning preferences in the planning of learning and teaching process (Kemp, Morrison, Ross, 1998). In other words, it would be much more suitable if the

methods and strategies to be adopted, class environment, teaching materials were selected according to the different learning styles and learning preferences.

1.1. Aim of the study

The aim of the present study is to determine the learning styles and learning preferences of prospective chemistry teachers. The following research questions were investigated in the study:

1. What are prospective chemistry students' learning styles?
2. What are prospective chemistry students' learning preferences according to their learning styles and gender?
3. What are the differences between prospective chemistry teachers' learning styles and their learning preferences?

1.2. Study Group

The study group of this study was composed of 100 prospective chemistry teachers attending Department of Chemistry Education, Hacettepe University.

2. Method

2.1. Data Collection Tool

Kolb's Learning Style Inventory and Loo's Learning Preferences Inventory were used as data collection tools in the study.

Kolb's Learning Style Inventory: Kolb's Learning Style Inventory (LSI) is one of the most popular one and the LSI has been used extensively as a measure of adult students' preferred learning style (Kolb, 1986; Brower, Stemmans, Ingersoll & Langley, 2001; Liegle & Janick, 2006). In this study, in order to determine the learning style of each student Kolb's Learning Style inventory was used. Kolb's Learning Style Inventory revised in 1986 and adapted into Turkish by Askar and Akkoyunlu (1993). The inventory consists of 12 questions each with 4 options. Students are requested to assign a score (from 4 to 1) to each expression; starting from the most likely to the least likely. When the sum of these scores is taken, a value for each learning style is found. These values range from 12 to 48. The reliability coefficient of the Inventory was determined as $\alpha = .73$ (Aşkar and Akkoyunlu, 1993. 42).

Loo's Learning Preferences Inventory: In order to determine learning preferences of the participants, learning preferences inventory developed by Loo (2004) was conducted. There are 12-items to address the learning activities, and for the evaluation, a five point response scale from dislike to like was used. The alpha reliability coefficient of the scale were calculated. The alpha reliability coefficient of the test was found as . 83

3. Findings and Discussion

In this part of the article, findings are presented and discussed with questions posed in the study.

What are prospective chemistry students' learning styles? The descriptive statistics of prospective teachers' learning styles are given in Table 1.

Table 1: The descriptive statistics of prospective teachers' learning styles

	n	%
Accommodator	6	6
Assimilator	21	21
Converger	68	68
Diverger	5	5
Total	100	100

When the learning styles of the students were examined, it became clear that 68% of the students fell into the group of convergers and 21% were assimilators. The fact that majority of the students were convergers and the study group was composed of students studying at Faculty of Education, Department of Chemistry Education and they will be teacher or scientists etc Kolb (1984) underlined that experiential learning model may indicate learning style

norms within academic disciplines. Results reflect the relationship between learning styles and occupational preferences. Convergers migrate toward engineering, medical technology and environmental sciences whereas scientists, engineers, technicians and academicians are examples of assimilators (Kolb & Wolfe, 1981; Kolb, 1984; Aşkar & Akkoyunlu, 1993; Nilson, 2003; Kvan & Jia, 2005). Besides, *The Converger* learning style is seen when an individual prefers both abstract conceptualization and active experimentation. Individuals learning in this way are quite successful in terms of the practical application of ideas and theories, solving problems and making decisions. Assimilators generally focus on the logical validity of theories instead of their applicability. It is stated that the characteristics of these individuals could be developed through conducting research on the organization of information, establishing conceptual models, testing and confronting the ideas and theories, designing tests, conducting quantitative data analysis (Uğur, Akkoyunlu, & Kurbanoglu, 2009).

What are prospective chemistry students' learning preferences according to their learning styles and gender?

The descriptive statistics of prospective teachers' learning preferences according to their learning styles and gender are given in Table 2.

Table 2. The descriptive statistics of prospective teachers' learning preferences according to their learning styles and gender

Learning preference	Accommodator (n=6)		Assimilator (n=21)		Converger (n=68)		Diverger (n=5)		Males (n=34)		Females (n=66)	
	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD
Reading printed materials	4,17	,408	4,14	1,014	3,74	1,074	3,60	1,517	3,62	1,256	3,95	,935
Writing major term papers	3,50	,548	4,67	6,545	2,85	1,123	2,60	1,517	2,74	1,189	3,53	3,816
Participating in groups	4,50	,548	2,95	1,359	3,84	1,045	3,80	1,095	3,68	1,093	3,70	1,202
Doing major team projects	4,50	,548	2,76	1,300	3,85	1,069	4,00	,707	3,71	1,115	3,65	1,222
Doing cases	4,67	,516	3,81	,928	4,09	,859	4,20	,447	4,12	,844	4,05	,867
Multiple choice tests	3,83	1,169	3,19	1,078	3,31	,935	3,80	1,304	3,41	,925	3,30	1,037
Giving presentations	4,33	,516	3,24	1,091	3,32	1,057	3,40	1,140	3,24	1,257	3,44	,947
Learning different theories	4,20	,447	3,67	1,065	3,71	1,008	3,80	1,304	3,65	1,012	3,77	1,012
Doing practical exercises	4,33	,816	4,38	,973	4,29	,993	3,80	1,095	4,26	,963	4,30	,992
Solving problems	4,33	,516	4,10	,995	4,18	,945	4,60	,548	4,09	,996	4,24	,878
Doing library research	4,00	,632	3,65	,988	3,49	,970	3,40	1,342	3,12	1,038	3,77	,862
Exercising a lot of creativity	4,83	,408	3,90	1,165	4,26	1,017	4,80	,447	4,00	1,101	4,38	,963

As seen in Table 2, the most preferred learning activities are “exercising a lot of creativity” (mean=4,83 SD=,408), “doing cases” (mean=4,67 SD=,516), “participating in groups” (mean=4,50 SD=,548) and “doing major team projects” (mean=4,50 SD=,548) for accommodator learners. *The Accommodator* learning style includes concrete experience and active experimentation. Individuals preferring this learning style learn by doing and feeling. They like new experiences and planned work. Instead of intellectual analysis, they prefer to act on feelings. They like collecting information through dialogues with people, rather than gathering the necessary information through technical analysis (Kolb, 1984; 1985).

The most preferred learning activities are “writing major term papers” (mean= 4,67 SD= 6,545) and “doing practical exercises” (mean= 4,38 SD=,973), “reading printed materials” (mean= 4,14 SD= 1,014) and “solving problems” (mean= 4,10 SD=,995) for assimilator learners. *The Assimilator* learning style includes abstract conceptualization and reflective observation. Individuals having this learning style are able to comprehend and transform comprehensive information in a large interval into a meaningful whole. They prefer dealing with abstract concepts and topics rather than tackling people. They are good at planning, creating models, defining problems and developing theories. It will be useful to develop their skills through exercises on organizing information, creating conceptual models, testing theories and ideas, designing experiments and carrying out quantitative data analysis (Kolb, 1993, Yılmaz – Soylu & Akkoyunlu, 2009).

The most preferred learning activities are “doing practical exercises” (mean= 4,29 SD=,993), “exercising a lot of creativity” (mean=4,26 SD= 1,017), “solving problems” (mean= 4,18 SD=,945) and “doing cases” (mean= 4,09 SD=,859) for converger learners. The converger learning style includes Abstract Conceptualization and Active Experimentation. They are quite good at taking practical advantage of ideas and theories. Among their strengths are skills of problem-solving, decision-making, deductive reasoning and problem-detecting (Kolb, 1993, Yılmaz – Soylu & Akkoyunlu, 2009).

The most preferred learning activities are “exercising a lot of creativity” (mean=4,80 SD=,447), “solving problems (mean= 4,60 SD=,548), “doing cases” (mean= 4,20 SD=,447) and doing major team projects” (mean=4,00 SD=,707) for diverger learners. The diverger learning style includes Concrete Experience and Reflective Observation. Individuals having this learning style are able to see concrete situations from different perspectives. They enjoy producing various ideas on an ample scope through methods such as brainstorming. They have vast cultural knowledge and like collecting information. Among the remarkable strengths of divergers are creativity, understanding others, being aware of problems and developing a large perspective about an event by brainstorming (Kolb, 1993, Yılmaz – Soylu & Akkoyunlu, 2009). As seen in Table 2, results are support the Kolb’s experiential learning model.

When learning preferences are investigated according to gender, it is observed that the most preferred learning activity for girls is “exercising a lot of creativity” (mean=4,38 SD=,963) and for boys is “doing practical exercises” (mean=4,26 SD=,963) (Table 2). Chang (2004) reported that males have a preference for rational evaluation and logic, whereas females use "elaborative" processing in which they tend to seek personal relevance or creative fun. In addition, males tend to be more achievement oriented, whereas females are more socially and performance oriented.

3. What are the differences between prospective chemistry teachers’ learning styles and their learning preferences? Descriptive statistics of prospective teachers’ learning styles and their learning preferences are given. in Table 3.

Table 3. Descriptive statistics of prospective teachers’ learning styles and their learning preferences

Learning preference	Active experimentation-reflective observation				Abstract conceptualization-concrete experience				Total Sample (n=100)	
	Watching		Doing		Thinking		Feeling			
	M	SD	M	SD	M	SD	M	SD	M	SD
Reading printed materials	4,04	1,113	3,77	1,041	3,83	1,069	3,91	1,044	3,89	1,760
Writing major term papers	4,27	5,943	2,91	1,100	3,28	3,361	3,09	1,136	3,39	2,885
Participating in groups	3,11	1,336	3,89	1,028	3,63	1,181	4,18	,874	3,70	1,105
Doing major team projects	3,00	1,296	3,91	1,049	3,60	1,213	4,27	,647	3,69	1,051
Doing cases	3,88	,864	4,14	,849	4,02	,879	4,45	,522	4,12	,779
Multiple choice tests	3,31	1,123	3,35	,957	3,28	,965	3,82	1,168	3,44	1,053
Giving presentations	3,27	1,079	3,41	1,059	3,30	1,060	3,91	,944	3,47	1,035
Learning different theories	3,69	1,087	3,74	,986	3,70	1,016	4,00	,943	3,78	1,008
Doing practical exercises	4,27	1,002	4,30	,975	4,31	,984	4,09	,944	4,24	,976
Solving problems	4,19	,939	4,19	,917	4,16	,952	4,45	,522	4,25	,833
Doing library research	3,60	1,040	3,53	,954	3,52	,971	3,73	1,001	3,59	,994
Exercising a lot of creativity	4,08	1,115	4,31	,992	4,18	1,056	3,91	1,044	4,12	1,052

When Table 3 is investigated, it is observed that, for the total sample, the most preferred learning activities are “doing practical exercises” (mean=4,24 SD=,976) and “solving problems” (mean=4,25 SD=,833) and the least preferred learning activities are “writing major term papers” (mean=3,39 SD=2,885) and “multiple choice tests” (mean=3,44 SD=1,053). “Watching” and “Thinking” learning types mostly preferred “doing practical exercises” (mean=4,27 SD=1,002; mean=4,31

SD=,984) and “Doing” learning type mostly preferred “exercising a lot of creativity” (mean=4,31 SD=,992) and “Feeling” learning type mostly preferred “doing cases” and “solving problems” (mean=4,45 SD=,522).

4. Conclusion

With this study it was determined that most of the prospective chemistry teachers have Converger and Assimilator learning styles and the most preferred learning activities by prospective chemistry students are “doing practical exercises” and “solving problems”. As mentioned before, students’ demographic background support the Kolb’s model.

The most preferred learning activity for girls is “exercising a lot of creativity” and for boys is “doing practical exercises”. With this study it is once more proved that there are individual differences amongs students in a classroom environment, therefore students have different learning styles and learning preferences. It is important to determine preferences of students based on their learning styles, if we, as educators, are to provide strategies for students’ needs. Knowing students’ learning styles and learning preferences also help to overcome the tendency of many educators to treat all students in a similar way. It has been suggested that being aware of students’ learning styles and preferences when designing classroom practises has implications for students achievement and quality of instruction.

5. Limitations

The *Loo’s Learning Preferences Inventory* has not been statistically validated, and this represents a limitation to this study. These concerns have been addressed recently by the researchers, the alpha reliability coefficient of the scale were calculated out of the study group. Another limitation of this study, the relatively homogenous population surveyed in this study and it remains a drawback of the study. The other limitation of the study was the participants’ learning style were accommodators and divergers learning styles with a small size group.

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