Dialects in Design Learning

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Abstract

Learning as a lifelong and interactive activity, is defined as a continues cycle in which learning starts with an experience, continues with reflection, and then an action which turns to be a concrete experience for reflection according to Kolb's *Experiential Learning Theory* (ELT). Design education in its featured nature is stated as a good example of ELT and its formation is considered to a suitable approach for all higher education of different disciplines. Previous research shows that most of the design students have a balanced learning style. All four learning styles of ELT are effective in design learning; however, the performance level of different learners with diverse learning styles in various stages of the design learning processes might differ. Another important factor in design learning is the perceptual, cognitive and spatial abilities of the learner. These will help to define the design ability that could be classified as coping with ill-defined problems, problem structuring, managing goals and constraints, generating solution concepts, thinking by drawing, and intuitive reasoning.

In the scope of the study it is aimed to figure out the correlations of the learning styles and spatial abilities of the design learners. The spatial ability scores of the design students through some mechanical aptitude tests are figured out and these scores were correlated with the learning styles of them. Results show that the students with higher scores in mechanical aptitude tests tend to have more experiential skills then analytical skills on the bipolar perceive axis and they tend to act by having better behavioural skills rather than the perceptual learning skills on the bipolar process axis. These differences are considered to be the dialects of the design learners through the learning process. By considering the considerably balanced distribution of the learning styles and the developing performance levels in spatial abilities through experience, it is concluded that the association and synergy of the learning dialects are essential for the efficiency of the design education.

Keywords: Experiential Learning Theory, Learning Styles, Spatial Ability, Design Learning

Learning process

For the recent years, learning has been one of the most important research areas for design (Demirkan and Demirbas, 2008; Demirbas and Demirkan, 2007, 2010). Learning process is critically important in the discussion of education and any individual's way of learning is the key for an educational improvement (Leutner and Plass, 1998). Each individual's way of receiving and acquiring new knowledge and information differs from each other, and this could be considered as the learning styles of the individuals which is the biological and developmental set of personal characteristics

(Demirbaş and Demirkan, 2003; Fox and Batholomae, 1999; Kraus et al., 2001). The perception, organization and retention of new knowledge is distinct, consistent and unique for every individual (Chou and Wang, 2000; Hsu, 1999). Out of several different studies and instruments, Experiential Learning Theory of Kolb is one of the most popular studies (Kolb and Kolb, 2005; Smith and Kolb, 1996; Kolb, 1984).

Experiential Learning

According to Kolb's Experiential Learning Theory, learning is a cyclic process that starts with experience continues with reflection that brings conceptualization and finally leads to an action (Metallidou and Platsidou, 2008; Kolb, 1984). Through this process there are four learning actions as learning by experiencing, reflecting, thinking and doing. These are considered as the four modes of learning as concrete experience (CE), reflective observation (RO), abstract conceptualization (AC) and active experimentation (AE). These four learning modes create to bipolar dimensions as perceive (vertical axis) and process (horizontal axis). Perceive dimension is the concrete/abstract dimension while process is the active/reflective dimension (Willcoxson and Prosser, 1996). Ideally any learner would move through each mode of the cycle equally (Demirbaş and Demirkan, 2007; Smith and Kolb, 1996; Willcoxson and Prosser, 1996), but various research search show that not all of the individuals equally experience each stage (Demirbaş and Demirbaş, 2007; Demirbaş and Demirkan, 2007). The combination of learning preference through experiencing or thinking and the learning preference through reflecting or doing reveals the learning style of the individual (Figure1).
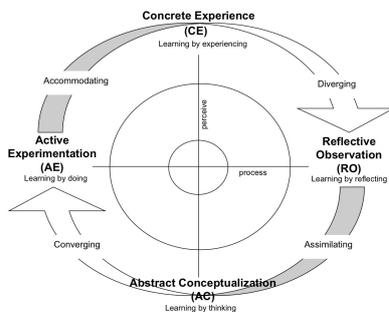

Figure 1. Experiential Learning Theory, Modes of Learning (cited from Demirbaş and Demirkan, 2007, p.347.

In order to find the learning style of the learner the combined scores are calculated by subtracting AE from AC and RO from AE. The find out scores are put on the Learning Style Type Grid, which gives the exact learning style of the individual as *accommodating, diverging, assimilating* and *converging*. Accommodating learners prefer getting things done and generally considered as practical and adaptable during the learning activity. Diverging learners are considerably more imaginative and they tend to brainstorming. Assimilating learners are theory developers and good in defining things. Generally they are more interested in abstract concepts than people and real experiences. Converging learners are good in deductive reasoning and they are considered to be the problem solvers and good decision makers (Figure 2).
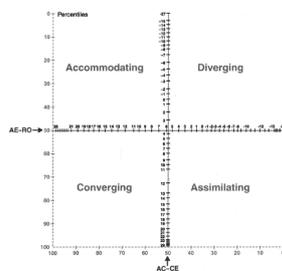

Figure 2. Learning Style Type Grid (cited from Kolb, 1999, p.6).

Design Learning

In its special nature the learning process in design education could be considered as unique and different than other traditional higher education programs. The most unique notion of the design

education is its interactive process in which all parties should be active. In this respect it is considered to be a general model for higher education by Schon (1987). Schon states design education process as 'action-in-reflection' and 'reflection-in-action' in which while students reflects on the action of instructor, the instructor reflects on action of students. This is a continues process through which all four learning modes of ELT is experienced through the different stages of the learning and teaching action (Demirbaş and Demirkan, 2007).

Design education is not something that aims to teach how to design but it is also crucial to teach how to define what the design problems is (Cross, 2001; 2006; Schon, 1984). In order to do this, experience is one of the key concepts of design teaching and learning. Different than a regular classroom, design studio is the main learning environment that provides the reflection-in-action and action-in-reflection interaction. In this respect design studio is a good example of ELT. During different stages of any design learning activity in the design studio both the learner and the instructor experience the different modes of learning cycle (Demirbaş and Demirkan 2003).

Spatial Ability

Spatial ability is described as the capacity of the individuals to understand and/or recall the spatial relationships between things (Quaiser-Pohl et al., 2004). As one of the important traits of cognitive skills, spatial ability is a unique and distinguishable type of intelligence rather than the verbal ability, memory ability, reasoning ability etc. It is made up of several sub-skills that are linked to each other and develop all through the life of the individual (Webb, 2007; Humphreys and Lubinski, 1998). In everyday life, spatial skills are stated to be important for success in solving many daily tasks. From orienting oneself in any environment; be able to use a map, adapt oneself in a heavy traffic, packing up, using a mirror etc. are all activities in which there is spatial ability (Carpenter and Just, 1986; Lohman, 1979).

Spatial ability is considered as one of the most important personality traits that accounts for success in many fields such as mathematics, engineering, natural sciences and design such as architecture, interior architecture, industrial design, visual communication design etc. All these disciplines involve the use of spatial skills (Gardner, 1986). In this sense, it would be correct to mention that it is one of the most important personality traits for interior architects since the work is much more related with the space itself. In order to design a space or in other words to transform a space to a place, the designer should have a high spatial perception which is directly related with spatial ability. By all means, spatial ability is not something that is only related with the abilities of perception and cognition of space but it is also the skills required to construct necessary mental models of things from theory to practice.

Spatial skills do not stand alone but work with other abilities such as logical reasoning, verbal skills, memory retrieval etc. Any deficits in on generally compensated by the excellence of other(s).

Case Study

Previous research emphasize that there is a direct relation between the learning styles and performance levels of interior architecture and architecture students (Demirbaş and Demirkan, 2007; 2008; Kvan and Yunyan, 2005). Besides, Demirbaş and Demirkan (2008) state that although all design students with diverse learning styles develop their performance levels in time, the level of the development is dependent on the learning styles. In general studies focusing on the learning styles of design students state that there is no specific learning style for design students but each design learner could have a diverse learning style which creates a distribution of the whole population on the learning style type grid. In this respect design education is considered to be a good example of ELT since all learning activities can take place during the whole learning process. However, according to different studies the general distribution of the design students through learning style type grid is towards the lower part that is more related with learning through experiencing, and towards the left side which is more related with learning by doing (Demirbas and Demirkan, 2007; Kvan and Yunyan, 2005).

As mentioned above, spatial skills under cognitive abilities are one of the most important personality traits that is effective in human intelligence. Besides especially in interior architecture education, spatial abilities have a unique position since the main problematic of the discipline is space. Considering the previous findings in the literature, it is aimed to consider the relationship between

learning styles and spatial ability levels of interior architecture students. In this respect instead of the performance levels of the interior design students on any designing process, their spatial ability levels have been tested by Maze Tracing Speed Test (MT) and Copying Test (CT). Maze Tracing Speed Test is designed to test the ability of an individual to find a path through a maze in a given time. It is formed of two successive similar parts. Three minutes is given for each part and each part has 24 maze squares. The total correctly finished mazes are the scores of the individual for each part. Copying Test is designed to test the ability of an individual to keep in mind a pattern and recall it on a square of dots. This test is also formed of two successive similar parts. Just like the other one, three minutes is given for each part and there are 32 shapes to remember in each part. The total correctly remembered squares are the scores of the individual for both parts. The results will be considered according to the learning styles of the participant students.

It is hypothesized that interior design students who have more experiential skills than analytical skills and having better behavioral skills than perceptual skills have higher spatial skills. A case study has been conducted with 23 freshman interior architecture students at. In the first phase students were given the *Learning Styles Inventory Test* (LSI) of Kolb. Through this process the learning styles of the participants was found out. In the second phase each participant was asked to complete a *Maze Tracing Test* and a *Copying Test* successively. Each of these tests have two parts to be completed with similar criteria so each participant should complete the similar test twice that shows the development rank of the individual.

Similar with pervious studies (Demirbas and Demirkan, 2003; 2007) the distribution of the students is more converging and assimilating students (Figure 3). There is only one student in the diverging style for that reason his scores was eliminated from the assessments in order to eliminate the risk of any bias. The four learning scores of the LSI (AC, CE, AE and RO) and two combined scores (AC-CE and AE-RO) were correlated with the Maze Tracing Speed test (MT) and Copying test (CT) scores (Table 1).
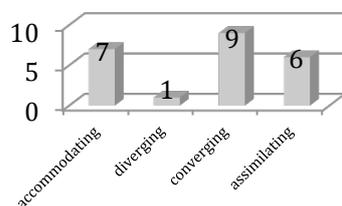

Figure 3. LS distribution of the sample.

Table 1. *Pearson Correlation between LS and Spatial Ability scores*

	CE	AC	RO	AE	ACCE	AERO	MT1	MT2	CT1	CT2
CE	1.000									
AC	-0.24	1.000								
RO	-0.58**	-0.010	1.000							
AE	-0.09	-0.72	-0.35	1.000						
ACCE	-0.74**	0.83**	0.33	-0.45*	1.000					
AERO	0.11	-0.38	-0.73**	0.85**	-0.32	1.000				
MT1	0.59**	-0.14	-0.70**	0.23	-0.44*	0.45*	1.000			
MT2	0.53*	-0.24	-0.57**	0.26	-0.47*	0.36	0.93**	1.000		
CT1	0.19	-0.17	-0.41	0.33	-0.23	0.42	0.49*	0.53*	1.000	
CT2	0.31	-0.27	-0.51*	0.42	-0.36	0.52*	0.57**	0.51*	0.75**	1.000

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)

When MT 1 and CT 1 scores are correlated with the modes of learning, it is found that they are highly correlated with CE and RO scores. CE is positively correlated with MT1 ($r=0,59$, *df=20, p<0.01*) and MT2 ($r=0.53$, *df=* 20, *p<0.05*) and RO is negatively correlated with MT1

(r=-0,70, df=20, p<0.001), MT2 (r=-0.58, df=20, p<0.01) and CT2 (r=-0.51, df=20, p<0.05). When the correlations between the ability test scores and combined scores of LSI are considered, it is noticeable that while AC-CE is negatively correlated with MT1 and MT2 (p<0.05), AE-RO is positively correlated MT1 and CT2 (p<0.05). These results validates the hypothesis that the students with more experiential skills (CE) have higher scores in the spatial ability tests and students who prefer learning by doing (AE, tends to behavioral skills than perceptual skills) have better performance in spatial ability tests.

As expected more of the students are on the left side of the learning style type grid as accommodating (30.4%) and converging (39.1% students). 26.1% are assimilating and only 1 student is under the diverging group. As mentioned above the scores of this student was not considered in the evaluations. When the Maze Test and Copying Test performance levels of the students are considered in relation with their learning styles, it is noticeable that there are statistically significant differences between the scores in favor of accommodating students (MT1 F=8.13, p=0.003; MT2 F =5.50, p=0.013; CT1 F =4.58, p=0.024; CT2 F =8.41, p=0.002) (Table 2).

Table 2. *Mean Scores for MT1, MT2, CT1 and CT2 according to Learning Styles*

		N	Mean	Std.Dev.
MT1				
	Accommodating	7	13.71	2.93
	Converging	9	8.78	3.23
	Assimilating	6	6.50	3.94
	Total	22	9.73	4.33
MT2				
	Accommodating	7	16.71	3.99
	Converging	9	11.67	3.39
	Assimilating	6	9.33	5.32
	Total	22	12.64	4.97
CT1				
	Accommodating	7	17.43	6.193
	Converging	9	11.33	4.66
	Assimilating	6	9.83	3.37
	Total	22	12.86	5.70
CT2				
	Accommodating	7	23.14	6.01
	Converging	9	12.67	6.27
	Assimilating	6	12.17	4.12
	Total	22	15.86	7.43

Conclusion and discussion

The limited number of participants averted to conduct further statistical analysis, however the found out results were meaningful to consider the correlation between the learning styles and spatial ability levels of interior architecture students. It could be concluded that the individuals who rely on learning from specific experiences and being sensitive to feelings and people (Smith and Kolb, 1996), and who show ability to get things done, don't afraid to take risks and influencing events through action, have higher spatial abilities both in Maze test and Copying test.

Similar with the previous findings the distribution of the interior architecture students could be accepted as a balanced distribution between the learning styles except from diverging style. According to the Cycle of Learning which is composed of four modes of learning, students show a tendency towards CE-*learning by experiencing* on the perceive axis and AE-*learning by doing* on the process axis.

Among mechanical aptitude tests, spatial ability tests are much more relating with the spatial relationships between the objects. As mentioned above spatial skills are important for solving a lot of daily problems such as using a map, orienting oneself in an unfamiliar environment, packing up etc. Especially in design education it is mostly affective for the development of the skills of understanding a space and then learn how to change space as a place either for the user or for the function or both. Previous research shows that these abilities can be developed through time, especially by experience and practice. In this respect experience and learning is crucial for the development of the spatial skills, and within the context of this study it was aimed to consider spatial ability of the interior architecture students through learning styles. The results show that the performance levels of all students with diverse learning styles show an increase from the first test to the second in both Maze test and Copying test. Although the spatial ability performances of learners with diverse learning

styles are statistically different from each other, the progress level for all learning styles were almost same. In Copying test, the progress level of the accommodating students from the first test to the second is significantly ore than the development of the performances of the students with other learning styles. This is found to be a very sound result since accommodating learners more rely on learning by experience and doing.

The personality traits of interior architecture students are considered to be the learning dialects of design. These dialects affect the performance level of the students in spatial ability that is very important for interior architecture learner. For further study, it is aimed to study with a larger sample group in order to figure out more concrete results. Besides, together with spatial ability performances, students performances in the design courses under the consideration of their learning styles would open up new points of views for a more effective design education. By considering the considerably balanced distribution of the learning styles and the developing performance levels in spatial abilities through experience, it is concluded that the association and synergy of the learning dialects are essential for the efficiency of the design education.

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