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THE EFFECT OF LEARNING STYLES ON THE PERFORMANCE OF ARCHITECTURE STUDENTS IN STRUCTURAL DESIGN COURSES

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Abstract

Every student has a prefered way of perceiving, interacting with, and responding to the learning environment. Instructors can use the information regarding the learning styles to shape their teaching approaches in order to enhance the performance of their students. This paper presents the findings of a study carried out at the Department of Architecture of Istanbul Kultur University to investigate the impact of learning styles on the performance of architecture students in structural design courses. Learning styles of 53 architecture students were assessed with the Kolb's Learning Style Inventory (K-LSI). Academic performance of these students in mechanics and strength of materials courses were compared with their learning styles. It was observed that the academic performance of the students were consistent with their learning styles.

Keywords: Learning Styles, Architectural Education, Structural Engineering Courses

INTRODUCTION

Schön's theories of "Reflective Learning" and "Reflective Practioner" had a profound impact on the architectural design education and raised a significant interest in studying the cognitive aspects of design thinking as well as developing cognitive approaches to a new design pedagogy which focuses on the design processes rather the design product [1,2,3,4]. Kolb's theory of "Experiential Learning" provided a suitable framework which could be used to assess the design processes of students of architecture. As a result, the number of studies conducted on assessing the effects of learning styles of architecture students on their design processes and the performance in the architectural design studio have been increasing in the last decade [5,6,7,8,9].

Although, substantial amount of research has been conducted on the ways of improving the performance and creativity of students in the design studio due to its unique nature and seminal role, there is still a lack of research on the use of cognitive pedagogical approaches in the classroom-based courses such as the structural engineering courses in the architectural curriculum. Structural engineering courses aim to establish a solid understanding of the behaviour of structural systems under gravity and seismic loads which is particularly necessary in order to practise architectural design in Turkey, where over 90% of the population resides in seismically active regions. The significance of good architectural and structural designs in mitigating earthquake induced damages to structures has been especially underlined after the Kocaeli earthquake of 1999, which caused over 50000 casualties and billions of Dollars in damages.

Therefore, investigating the factors that effect the performance of architecture students in structural engineering courses is a rewarding area of research as these results may in time lay the foundation for developing ways to better integrate structural design knowledge into the architectural design process. This paper reports the results of an emprical study on the possible effects of students' learning styles, as outlined by Kolb's theory of experiential learning, on their academic perfomance in the structural engineering courses of "Mechanics" and "Strength of Materials.

LEARNING STYLES

Learning styles are associated with the prefered way of perceiving, interacting with, and responding to the learning environment. Instructors can use the information regarding the learning styles of their students to shape their teaching approaches in order to enhance their performance. Various

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classification schemes for learning styles have been developed by researchers in the last three decades. David Kolb's model which is based on the "Experiential Learning Theory", is one of the most widely used models for identifying the learning styles of individuals [10].

Experiential learning theory suggests that knowledge is generated by grasping and transforming experience. According to the experiential learning model, there are two modes of grasping experiexce, namely, "Concrete Experience (CE)" and "Abstract Conceptualization (AC)" and two modes of transforming experience, namely, "Reflective Observation (RO)", and "Active Experimentation (AE)". In this context, learning process can be visualized as a recursive cycle with the phases of experiencing, reflecting, thinking, and acting (Figure 1). According to Kolb, "*Immediate or concrete experiences are the basis for observations and reflections. These reflections are assimilated and distilled into abstract concepts from which new implications for action can be drawn. These implications can be actively tested and serve as guides in creating new experiences.*" [11]

Learning process ideally involves all modes of grasping and transforming experience. However, individuals tend to favor and develop one mode of grasping experience and one mode of transforming experience, which eventually shape their learning styles. According to Kolb, individuals can adopt four learning styles, depending on their approaches for grasping and transforming experience, namely, "converging (AC+AE)", "diverging (CE+RO)", "assimilating (AC+RO)" and "accomodating (CE+AE)" [10,11].

Kolb developed the Learning Style Inventory (K-LSI) in 1984, to assess the learning preferences of individuals by examining their approaches for grasping and transforming experience. K-LSI is composed of 16 questions asking the individuals to state their order of preference for the four actions listed under each question. The overall order of preference for these questions is then used to evaluate the individual's tendency for the approaches used for grasping and transforming experience. The results of this evaluation are then plotted on the AE-RO and AC-CE axes to obtain the learning style of the individual [11].

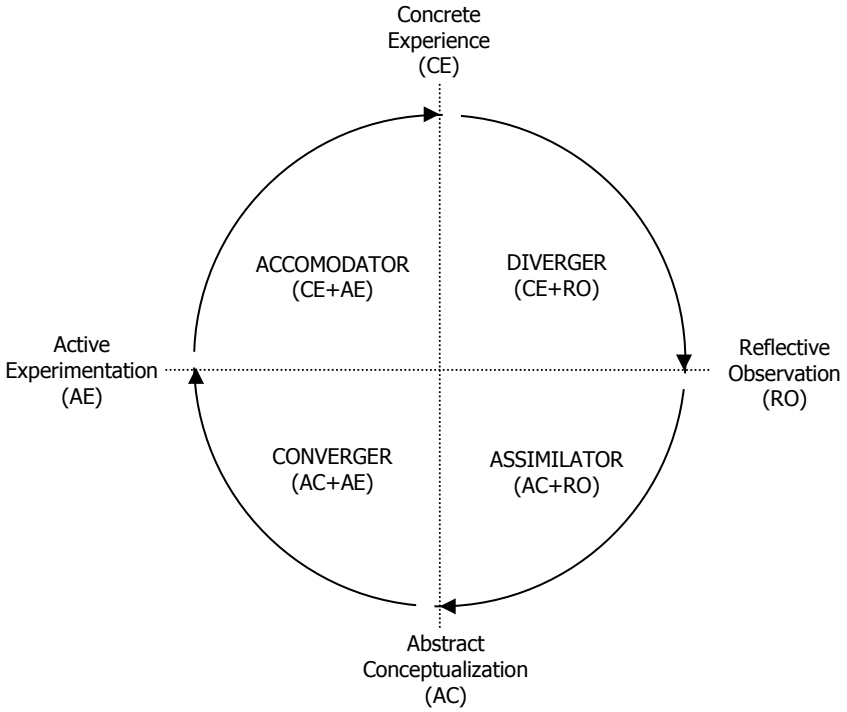

Figure 1. Kolb's Experiential Learning Model [11]

Kolb's Learning Style Inventory was originally developed in the 1970's and has been revised over the course of years. The most recent version is K-LSI v.3.1 which was developed in 2005. K-LSI has been translated to a number of languages, including Turkish. The Turkish translation of the K-LSI, prepared

by Aşkar and Akkoyunlu in 1993 [12], was used to assess the learning styles of the students participating in this study.

EMPRICAL STUDY

The curriculum of the Department of Architecture of Istanbul Kultur University requires the students to take the structural engineering courses of "Mechanics", "Strength of Materials", "Structural Analysis" and "Reinforced Concrete", starting from the second semester, in the given order. The curriculum also offers technical elective courses in structural engineering including, "Structural Systems", "Structural System Materials" and "Earthquake Resistant Design".

Mechanics and strength of materials courses are fundamental for establishing the theoretical framework for structural analysis and structural design. In other words, these courses enable the students to understand how loads and structures can be abstracted from the structural point of view, how structures resist forces, how the loads are distributed throughout the structure and ultimately how the members of a structural system are designed. Considering the significant differences between the classroom-based teaching style of structural engineering education and the studio-based architectural education, exploring ways to improve the conveying of the concepts delineated in these structural engineering courses in the context of architectural design education is a challenging and a rewarding area of research.

The emprical study was conducted on 53 students enrolled in the Department of Architecture of Istanbul Kultur University on a voluntary basis. Learning styles of the students were determined with the Turkish K-LSI, adapted by Aşkar and Akkoyunlu in 1993 [12]. The distribution of the learning styles of the students are presented in the Table 1.

Table 1. The distribution of the learning styles of the architecture students participating in the study

Students	Learning Styles
12	Converger
25	Assimilator
9	Diverger
7	Accomodator

Afterwards, the academic performance of the students in the "Mechanics" and "Strength of Materials" courses they have taken in their second and third semesters were compared with their learning styles. Academic performance of the students in mechanics and strength of materials courses are presented in the Tables 2 and 3. Comparison of the academic performance in mechanics and strength of materials courses with respect to the learning styles of the students participating in the study are presented in the Figure 2.

Table 2. Comparison of the academic performance of the students with respect to their learning styles for the mechanics course

Students (Total)	Learning Style	A A-		B+ B B-		C+ C C-		D+ D D-	
		Students	%	Students	%	Students	%	Students	%
12	Converger	3	25	4	33	2	17	3	25
25	Assimilator	2	8	9	36	11	44	3	12
9	Diverger	1	11	2	22	2	22	4	45
7	Accomodator	1	14	2	29	4	57	0	0

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Table 3. Comparison of the academic performance of the students with respect to their learning styles for the strength of materials course

Students (Total)	Learning Style	A A-		B+ B B-		C+ C C-		D+ D D-	
		Students	%	Students	%	Students	%	Students	%
12	Converger	4	33	4	33	3	25	1	9
25	Assimilator	5	20	8	32	11	44	1	4
9	Diverger	2	22	2	22	2	22	3	34
7	Accomodator	0	0	5	72	1	14	1	14

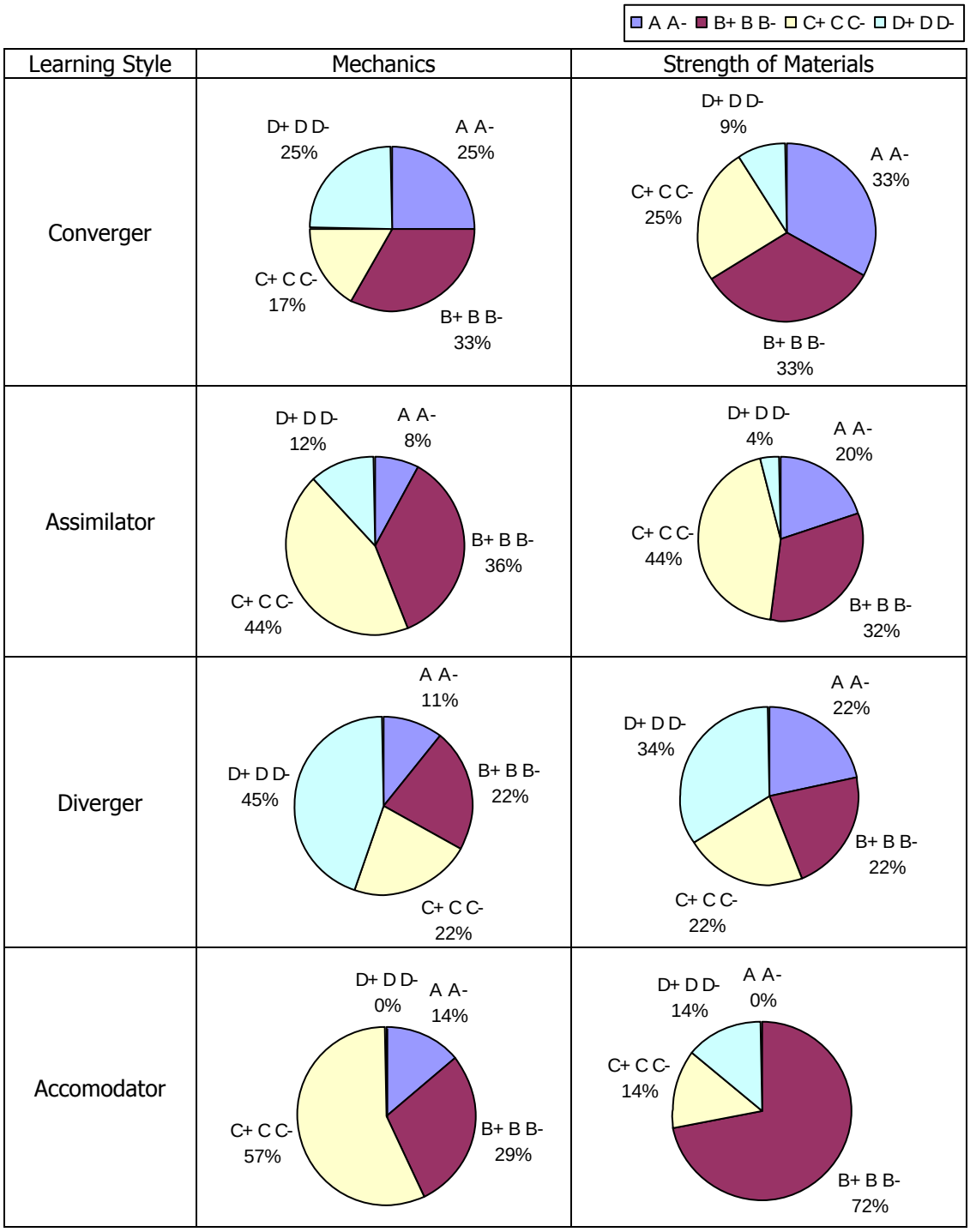

Figure 2. Comparison of the academic performance with respect to the learning styles

Evaluation of the academic performance for mechanics course reveals that the best performers (A, A-) were among the convergers and the assimilators. The accomodators were midrange performers, as more than half of the accommodators earned C grades. Divergers generally performed poorly compared to the other learning style groups.

Evaluation of the academic performance for strength of materials course reveals that the best performers (A, A-) were again among convergers and assimilators. Accomodators performed better in the strength of materials course as the majority of them earned B grades. Although, the grades earned by the divergers were almost equally distributed over the four grade ranges, the percentage of grades above the D range was lower compared to the other groups of learners.

CONCLUSIONS

Investigation of the learning styles of the architecture students showed that assimilators were the majority group followed by the convergers. This is in line with the results of the studies conducted on design students by Demirbas and Demirkan [7] and Tucker [10], which state that majority of their test populations were comprised of assimilators and convergers. Regardless, this study was conducted with 53 students of architecture and repeat studies, preferably with larger populations can serve to validate and enhance the results obtained from this study.

Evaluation of the academic performance of the students at mechanics and strength of materials courses showed that the learning styles of the students had similar effects on their academic perfomance for both of the courses. For each of these courses, the academic performance of convergers and assimilators was higher compared to other groups of learners and the performance of the divergers were poor compared to other groups of learners.

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