LEARNING STYLES AND STUDENTS’ PERFORMANCE IN DESIGN PROBLEM SOLVING

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Abstract
Design curricula and all core design studio courses are prepared for performance attainment by giving theoretical and professional training. However, students' performance may be affected by both the constraints set on a design problem, and their learning styles. This study explores the performance of interior architectural students in relation to their learning styles (as proposed by Kolb’s Experiential Learning Theory), and different types of constraints set on design problems. Design performance, measured as conceptual development, form and spatial configuration, structural innovation and ergonomics, and craftsmanship, was found to change throughout the two bipolar continuum of the learning cycle with regard to two design conditions characterized by different types of constraint use.

Keywords
Design education, design constraints, experiential learning.

Introduction
One important goal of design education is to develop students' independent abilities of designing and to enhance their cognitive and representation skills. To achieve this aim, diverse teaching methodologies have been employed in design studios around the world. Among these is the traditional approach, which entails teaching design based on studio critiques (Uluoğlu, 2000; Webster, 2001). The traditional method considers project-based learning as the main pedagogical method of design education, by means of which design knowledge is transmitted from instructors to students (Heylighen & Verstijnen, 2003; Schon, 1985). During the 'crit' sessions students develop design projects in a trial-and-error manner, while they receive feedback from their instructors.

The design process generally begins with the definition of a design problem, design goals and intentions, preferences and constraints, and ends up with the production of an outcome solution or a design prototype (Uluoğlu, 2000). Preferences and constraints affect design specifications, so that a large part of the design process involves the recognition, formulation and satisfaction of
such specifications (Lin & Chen, 2002). Problem specifications help to frame the problem solving context within which the designer acts (Özkaya & Akin, 2005; Schon, 1983). Specifications not only help students understand the complexity of the design problem, and to develop problem solving strategies, but are also used as main criteria in the assessment of the quality of design solutions.

In the last two decades, the relation between design problem solving and learning styles started to capture the attention of scholars who specialize in design education. Nilson (2003), for instance, examines Fleming and Mills’s educational theory about sensory-based learning style that accentuates preferred physical senses involved in learning. In another survey conducted in the field of architectural design, Newland and his colleagues (1987) identify four kinds of experiential learners classified as: common sense, dynamic, contemplative, and zealous learners. Mc Cauelley (1990) evaluates character and temperament profiles dependent on learning behavior in engineering design, and Brown et al. (1994) examines learning styles of students in landscape architecture.

The structuring, constraining, and definition of design problems is a critical stage of the design process that can be affected by the learning styles of the designers. Aiming to gain insight about design studio teaching, some researchers investigated the relationship between learning styles and design constraints. Using Kolb’s Experiential Learning Theory (Kolb, 1984), Kvan and Yunyan (2005) examined the influence of differently structured design tasks on the performance of diverse learning groups. Design situations assigned in that study to architectural students had different requirements and specifications. In one situation, design problem requirements dealing with structural features were largely specified, whereas in the second situation they were more general. These researchers found significant differences among performances of students with different learning styles when the design task was largely unconstrained, as opposed to the other more constrained task where almost no differences in performance were found between the groups of learners.

In another work also based on Kolb’s model, Demirbaş and Demirkan (2003) assessed the performance of design students with regard to their learning preferences in design tasks that were constrained by different types of representations. Results showed that whereas the accommodators performed significantly higher when they were asked to solve problems by means of sketches and drawing representations, assimilators overcame the other groups of learners when they were asked to use mockups. Demirbaş and Demirkan (2003) concluded that a combination of students’ learning styles and the type of representation used to solve a design problem have an effect on design performance.

Following with the above studies and considering Kolb’s Experiential Learning Theory (Kolb, 1984) as a main research framework, the present study continues exploring the influence of design constraints on various abilities of learning groups of students. The major aim is to identify what kinds of relationships exist between design situations characterized by different constraints and specific design abilities of the four learning groups proposed by Kolb (1984).
In the first part, the literature review centers on design learning and the design studio. The focus is set on the design project as an educational tool, and the constraining of design problems. Thereafter, Kolb’s Experiential Learning Theory is presented, and the four learning styles are described and analyzed with regard to design practice. In the second part, an empirical research is presented. Major findings are shown and discussed before main conclusions are offered, with implications for design education.

**Learning in Design Studio**

**The Nature of the Design Studio**

Design studio is a social environment where the interaction among students and studio masters is the backbone of design education (Ledewitz, 1985). In the design studio, communication enables free exchange of ideas and educational experience. It is in this social environment that a personalized teaching takes place, although not always considering individual differences regarding skills, aptitudes, and learning abilities of students.

In addition to providing intellectual stimulus and expertise, an important role of the design studio tutor is to organize the design program, also known as the brief. In response to a given brief, students develop their projects while they receive critiques from their studio tutors (Uluzglu, 2000; Yürekli, 2007). According to Ashton (1998), project briefs are the starting points of design thinking in studios where the interaction among students and the studio master is the main vehicle of learning. In this interactive process, students are encouraged to elaborate on their design projects, and internalize new abilities, values and conceptions (Roberts, 2006), while they learn new graphic and verbal languages, and develop skills of visualization and representation (Schön, 1984).

Among different educational approaches, project-based learning is considered to be central to the design studio curriculum. The benefit of design projects is that they enable students to simulate an actual process of professional action in a simplified way. Hence, the design studio provides an environment where talking, reflecting, discussing, drawing and modeling are among the major activities that aid students to enhance their design thinking (Ledewitz, 1985)

**Framing and Constraining Design Problems**

Design problems are by nature ill-defined, meaning that they have a weak structure that can be characterized by vague initial requirements, partially specified goals, indefinite possible solutions, and limited operators to generate solutions (Cross, 2001; Simon, 1984). Due to the ill-defined character of design problems, an important aspect of design thinking is structuring and framing design problems (Schon, 1983). Rosenman and Gero (1998) consider design thinking as an explorative activity that proceeds from the description of needs and specifications of a design problem, to the description of a concrete solution. In this sense, design specifications play a fundamental role in structuring and framing design problems, and establishing initial constraints. Framing and constraining designs enable designers to set concrete boundaries to the ill-defined problems, as well as to understand potential directions along which design thinking can develop. During the design process, designers actively participate in the definition of problem constraints, which help
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to refine and develop initial design concepts and ideas (Schön, 1988) and to enhance innovative design thinking (Portillo & Dohr, 1994).

An important aspect of the interaction between students and teachers deals with structuring design situations, and fostering design ideas based on initial design specifications and problem constraints. Given a design problem, students are expected to describe the functional, behavioral and structural properties that may satisfy the requirements and programmatic needs of a design problem (Kroes, 2002; Rosenman & Gero, 1998). Teachers, on the other hand, evaluate design solutions by referring to initial design constraints (Portillo & Dohr, 1994). As Harfield (2007) argues, constraints are used to show to what extent initial design goals are attained, and to assess outcome solutions.

The Experiential Learning Theory

In his Experiential Learning Theory, Kolb proposes that knowledge can be obtained by grasping and transforming experience (Kolb, 1984). It considers reflection as a critical learning ability, by means of which it becomes possible to receive and internalize information. The Experiential Learning Theory refers to the process of acquiring knowledge as a dynamic cycle composed of four modes of learning: experiencing, reflecting, thinking and acting in a recursive manner. According to this cycle, concrete experience is followed by observation and reflection; this is continued by the formulation of abstract concepts and generalizations, and thereafter by active experimentation that leads to the creation of new experiences. In experiential learning, learners refer to different stages of this cycle depending on their preferred way of constructing knowledge. (Kolb, 1984; Kolb, 2005; Kolb & Kolb, 2005a).

Individuals’ preferences for receiving and internalizing knowledge are considered to influence their particular learning style. However, Kolb’s theory promotes integrated learning, and thus encourages individuals to become competent in all learning styles.

Learning Styles

Learning styles are not innate features but, are developed through experience (Kolb, 1984). They are rather the combination of how people perceive and process the information that characterizes their own learning style. Kolb structures this process in a four-stage model that encompasses two continuums:

The concrete-abstract continuum (vertical axis) is concerned with how people perceive new information. Consequently, some learners might have a tendency to deal with novel problem situations according to concrete experience (CE), while others will prefer to approach them by abstract conceptualization (AC). In contrast to this, the active-reflective continuum (horizontal axis) is about how we process new information. Some learners have a predisposition to try things out by active experimentation (AE), while others might be inclined to think and evaluate by reflective observation (RO).

The theory maintains that the extremes of each continuum are reciprocally exclusive. If, for example, a learner attempts to perceive new information by concrete experience and by abstract conceptualization, a conflict will emerge (Kolb & Kolb, 2005a; Wu, Dale & Bethel, 1998). This conflict is resolved when the learner acts according to a preference or a learning
style, in order to perceive and process the new information. It should be noted, however, that none of these stages is considered by Kolb (1984) to be superior with respect to the other, and therefore the learner’s preferences are not better or worse. These stages are rather viewed as steps of a learning cycle that can be entered into at any stage.

The two continuums described above represent bipolar axes, where individual preferences can be seen as intersecting coordinates that enable one to identify the relative position of a learner within a quadrant of the model. Each of these quadrants represents one of the following learning styles (see Figure 1):

**Diverging learners**
This type of learners is characterized by preferences for concrete experience (CE) and reflective observation (RO). They are skilled at gathering and synthesizing a broad range of information, viewing it from different perspectives. While they are less interested in theory, they tend to tackle problems in a non-systematic way.

**Assimilating learners**
Assimilators prefer for abstract conceptualization (AC) and reflective observation (RO). As a result, they can understand a wider range of information, which they are able to organize into a concise and logical form. They are interested in ideas and concepts and value the logic and accuracy of these ideas more than their practical applications.

**Converging learners**
Having the opposite abilities of a diverging learner, the main preferences of convergers are for abstract conceptualization (AC) and active experimentation (AE). Their learning abilities rely on logic and organization. They are pragmatic thinkers characterized by having hypothetical-deductive reasoning. They do extremely well at practical applications of theories and ideas.

**Accommodating learners**
Contrary to assimilators accommodators prefer concrete experience (CE) and active experimentation (AE). Their learning tendencies are based on practical experience. These types of learners find pleasure in taking risks and challenges. They are unsystematic, they also prefer to act according to instincts and intuition and learn by trial and error.

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**Figure 1:** Four learning styles of the experiential learning theory. (Source: Authors).

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**Experiential Learning, Reflection, and Design Education**
The Experiential Learning Theory is a propitious framework for design learning. In Kolb’s (1984) view,
learning is defined as the creation of knowledge through the transformation of experience. This implies that different learning styles are related to dissimilar forms of knowledge. The design studio is the place where new knowledge is generated through the modification of design experiences, while simulations of real situations are carried out (Teymur, 1996). In this process, students continually perceive and process information, as they learn by doing, as well as by reflecting on their actions. Reflection is critical in the development of students’ knowledge and thinking abilities as they are prepared for future practice of the profession. Kolb’s learning cycle points to the necessity of reflective observation in order to bring the concrete experiencing of events or experiences to the state of abstract conceptualization.

Constructivist approaches which also emphasize reflective practice, acknowledge that knowledge cannot be transmitted by mere explanations given to the learner, but that it has to be generated and transformed through personal experience (Philippou, 2001). Project-based reflective practice is frequently applied in the design studio to encourage the development of individual experiences. Since design projects pose problems of uniqueness, uncertainty and instability, they require a combination of action and reflection-in-action (Schön, 1983). Reflection-in-action, enables to simulate real professional action in a studio environment. This approach, which requires students to be involved in a dialogue with their tutors, is critical to construct and transform their knowledge, and to decompose and reorganize their design thinking.

Designers construct frames to reflect on and evaluate a design based on their belief, perception and appreciation of a problem situation (Schön & Rein, 1994). Stumpf and McDonnell (2002) refer to the construct of framing and naming through the consideration of premises. In this process, premises, which are defined as facts, truths, presumptions, values and hierarchies (Stumpf & McDonnell, 2002), are considered for establishing design constraints. In this sense, premises are viewed as guidelines that can aid students and teachers in their evaluation of design outcomes as well as instruments for reflective dialogue.

**Empirical Research**

**Aim and Hypotheses**

The aim of the current research is to provide preliminary evidence on the relationship between learning styles, design performance, and constraints used in design problem solving. Two different design conditions are examined with respect to different learning styles, and design performance through four design criteria. (See The Assessment Criteria). While in the first condition, students solved a design problem using specific constraints, in the second one they were allowed to freely choose their own constraints to accomplish the task. By considering strengths and weaknesses of each learning style, we expected to find differences in design performance regarding each design condition.

Different design achievements were expected in each design condition regarding the CE-AC continuum of perceiving information, and the AE-RO continuum of processing information, as proposed by Kolb (1984). In the constrained condition, design performance by concrete experience was expected to overcome
performance by abstract conceptualization. On the other hand, in the unconstrained condition, performance by reflective observation was expected to overcome active experimentation.

Considering the proposition that the design process can be characterized by analytic and synthetic phases (Beckman & Berry, 2010), it is claimed that some of the criteria used to evaluate students’ design outcomes are related to finding and discovery (analysis), while other criteria are related to invention and making (synthesis).

In the constrained design condition, we argue that structural innovation and ergonomics (SE) and craftsmanship (CR) criteria, which are concerned with invention and making, can be better achieved by practical applications and concrete experience (CE) through the available technical information. Hence successful performance on SE and CR criteria are expected to refer to the ‘perceiving information’ axe by concrete experience rather than by abstract conceptualization.

Moreover, in the unconstrained condition we argue that conceptual development (CD) and form and spatial configuration (FC) criteria, which relate to finding and discovery, are suggested to be better achieved by reflective observation (RO) than by active experimentation (AE). Therefore, successful performance on these criteria are expected to refer to the ‘information processing’ axe by thinking and reflecting rather than by active experimentation.

The following statements are presented regarding the relation between learning styles and the criteria considered to assess design performance: In the constrained design condition, Accommodators and Divergers, who perceive information by concrete experience, are expected to be more successful than Convergers and Assimilators, who perceive information by abstract conceptualization, in structural innovation and ergonomics (SE), as well as in craftsmanship (CR) criteria. Newland and his colleagues (1987) refer to the perception of concrete experiencing learners as “a rapid, conscious absorption of the presence and properties of things” (p. 5). Therefore, the tendency of this type of learners to perceive information from specific experiences is expected to improve their performance in SE and CR, since these criteria are more related to invention and making.

On the other hand, in the unconstrained design condition, learners who process design information by reflecting (i.e., Divergers and Assimilators) are expected to perform better than those who process information by active experimentation (i.e., Accommodators and Convergers) in conceptual development (CD) and form and spatial configuration (FC) criteria. In the absence of constraints, students need to frame and define their own criteria, and this requires reflecting and abstract thinking. Newland et al. (1987) refer to reflective observation as a way of handling and combining information from different perspectives. In the unconstrained condition, reflective learners are expected to define their own frame of criteria and to evaluate the situation from various perspectives. Hence they are expected to be more successful in concept development (CD) and form and spatial configuration (FC) since these criteria are more related to finding and discovery.

Participants
Participants were 90 students of the Department of Interior Architecture and Environmental Design, Bahçeşehir University in Istanbul-Turkey,
who enrolled in the course of furniture design studio in two consecutive academic years during 2006-2007 and 2007-2008. In the first group (2006-7), named the test group, 40 out of 41 students completed the learning style inventory, of which 27 (67.5%) were females and 13 (32.5%) were males, in the age range 20 to 25. In the second group (2007-8), named the control group, all 50 students completed the inventory, of which 28 (56%) were females and 22 (44%) were males, in the age range 20 to 24. Detailed instructions were given to all the participants to complete the survey, and the learning inventory. Students volunteered their time to participate, and in compensation were informed about their personal learning style preferences.

**Design Conditions**
Two design conditions in which students were requested to solve a design task were enacted as follows:

**Test condition: Solving design problems with technical constraints**
In this condition, students were assigned a problem consisting in the design of a sitting unit, and a task sheet containing general instructions. They were asked to construct their design products with corrugated cardboard material using a specific technique, which involved intersecting cardboard layers at perpendicular angles (See Figure 2). An advantage of using this technique is that it strengthens the structure of the sitting unit, but on the other hand it prescribes a certain formal language that limits the range of possible design solutions.

**Control condition: Solving design problems without technical constraints**
A problem similar to the previous design condition was assigned to students. However, in this condition they were encouraged to use any other preferred technique to work with the corrugated cardboard material. Likewise, in order to deal with structural and formal requirements of the sitting unit, students were allowed to use additional materials such as any kind of cardboard, wood, and wire, as well as any other construction technique that they might consider appropriate (See Figure 3).

**Design Problem**
Students were requested to design a sitting unit prototype that should meet basic requirements such as comfort, and appropriate ergonomics. The design outcome had to satisfy formal, functional, and structural specifications.

**Procedure**
The design task was carried out during a period of five weeks in the design studio, where students
met with their instructors once a week for six hours. In order to deal with the task, students were divided into two main groups, named the test and control groups. At the beginning of the task, students were given two lectures about the design and development of sitting units. The first lecture focused on functional concerns, and spatial relations of component parts of sitting

Figure 3: Examples of four design products made by students in the unconstrained design condition. (Source: Authors).
units. The second lecture dealt with ergonomics and the act of sitting. An additional lecture about the use of cardboard sheets by means of the interlocking technique was presented to those students who took part in the test condition. All students were encouraged to investigate further the information given in the different lectures. Furthermore, during the first week different groups of 9-12 students participated in 20 minute long brainstorming sessions that were coordinated by two studio instructors. In the consecutive meetings, students developed small scale cardboard mockups, and received feedback from their design instructors in one-to-one critic sessions. At the end of the task, they presented the final design represented by a full-scale mock-up of the sitting unit and main sketches produced during the design progress.

In both the test and control design conditions, students were asked to explain how they developed ideas and concepts during the design process. This provided additional information to understand how the existence or non-existence of technical constraints affected their design decisions and design outcomes.

The Assessment Criteria
In both design conditions, design solutions were assessed according to four major criteria, considered to be critical for the successful design of the sitting unit: (i) conceptual development, concerned with the main idea that guided the design process. It could be retrieved from different inspiration sources such as visual references, iconic representations, metaphors and analogies; (ii) form and spatial configuration, related to the designer’s control of geometry and volume; (iii) structural innovation, dealing with the materials and techniques used to produce an innovative structure, and ergonomics entailing the compatibility of the sitting unit to the human body dimensions; and (iv) craftsmanship, dealing with precision in construction, and consistency in production technique.

Scale of Assessment
An ordinal scale divided into 9 ranges was established to assess the design solutions produced by the students. Scores were assessed according to the following ranges: A (93-100); B+ (88-92); B (83-87); B- (82-78); C+ (75-77); C (70-74); C- (65-69); D+ (60-64); D (50-59); F (49-0). Final scores for each student were calculated by computing the average of the assessments carried out by five referees.

Referees
The design outputs obtained from the two design conditions were scored independently by five judges. All of them were architects with at least 5 years of experience, who were unaware of the design conditions, and received no payment for their participation.

Grades were given by independent judges, and mean scores of different design criteria were examined by T-tests.

Results
Analyses were carried out in order to verify differences between performance scores in the two design conditions with regard to the four groups of learners, through the four assessment criteria. A graphic depicting a distribution of the four groups of learners according to the two design conditions is shown in Figure 4.

Results indicated that design performance scores obtained in each design condition differed among the group of learners with respect to
the two bipolar axes, namely the perceiving and processing axes, through the assessed design criteria. Firstly, two learning groups, namely Accommodators and Divergers (Group A) versus Convergers and Assimilators (Group B) were examined according to AE-RO axis of the cycle for SE and CR criteria of the constrained condition. Secondly, the other two learning groups located at the opposite ends of AC-CE axis of the cycle, namely Divergers and Assimilators (Group C) versus Accommodators and Convergers (Group D) were examined for CD and FC criteria of the unconstrained condition. An illustration of the hypothesized and found results is presented in Figure 5.

In the constrained design condition, Accommodators and Divergers, located at the 'concrete experience' extreme of the perceiving information axe, were found to be more successful in SE design criteria than the other learners, namely Convergers and Assimilators located at the opposite ‘abstract conceptualization’ extreme. No differences were found between these groups for CR criteria since the performance average was similar. Results from the constrained condition showed that:

- Group A versus Group B for SE criteria: $T= 2.023, p=0.031, df=13$.
- Group A versus Group B for CR criteria: $T=0, \mu_A = \mu_B$.

In the unconstrained design condition, Divergers and Assimilators were found to be more successful than Accommodators and Convergers both for CD and FC criteria. Findings from the unconstrained condition showed that:

- Group C versus Group D for CD criteria: $T= 2.484, p= 0.017, df=13$.
- Group C versus Group D for FC criteria: $T=2.018, p= 0.0214, df=13$.

Figure 4: Distribution of learning styles in two treatment groups. (Source: Authors).
Discussion

The present investigation provides further evidence on the relationship between learning styles, design performance, and constraints used in design problem solving. The study fosters prior research carried out by Kvan and Yunyan (2005), who examined the effect of differently structured design tasks on the performance of learning groups, and develops further the research done by Demirbaş and Demirkan (2003), who assessed the effect of design tasks constrained by different types of representations on the performance of learning styles. By considering strengths and weaknesses of each learning style, differences in design performance were observed with respect to the CE-AC continuum of perceiving information, and the AE-RO continuum of processing information (Kolb, 1984) for each design condition.

In the constrained design condition, performance by concrete experience was assumed to be more successful than performance by abstract conceptualization. Structural innovation and ergonomics (SE) and craftsmanship (CR) involve invention and making activities, and therefore they were expected to be better achieved by the learners located at concrete experience side of the axis. However, this hypothesis was partially verified. Technical requirements provided in the constrained condition contributed to the successful performance of Accommodators and Divergers, who are good at perceiving design information by concrete experience. Hence they were able to excel the other groups in structural innovation and ergonomics (SE).

In this constrained condition, design constraints compelled students to follow rules of production technique. Therefore, Accommodators who sense the world continually, and learn by trial and error, and Divergers who tend to readily accept useful information (Newland, Powell & Creed, 1987) found an opportunity in the ready-given information to perform well in SE criteria. In contrast to them, Convergers and Assimilators who prefer abstract conceptualization, and are interested in ideas and concepts were expected to find themselves disadvantageous by the limitations posed by technical requirements on the universe of possible design solutions available in the metaphorical space of searching (Newell and Simon, 1972). So an outcome of the constrained design condition might be the generation of solutions characterized by similar concepts, forms and structures.

On the other hand, no difference in craftsmanship performance (CR) was found between the groups located at the opposite ends of the AC-CE axis. Since technical requirements in this design condition were provided and ready to use, it is suggested that all groups might have found equal opportunities to apply the already available technique to excel in craftsmanship (CR).
Furthermore, according to what was hypothesized in the unconstrained design condition, learners who process design information by reflecting were more successful than those who act by active experimentation. Freedom to use any types of requirements helped Diverging and Assimilating group of learners, who are strong in the processing of information by reflective observation, to overcome Accommodators and Convergers. A reason since the latter group of learners was disadvantaged in the unconstrained condition may be due to the fact that they are pragmatic and their learning tendencies are based on practical experience.

The unconstrained nature of the second design condition particularly encouraged Diverger and Assimilator learners to set their personal goals and establish their own design requirements, as Kolb and Kolb (2005b) suggested for the processing continuum of learning cycle. This might be a reason since Divergers and Assimilators, who are located at the reflective observation end of the AE-RO axis, performed better than the other group of learners in concept development (CD), and form and spatial configuration (FC). As noted above, these aspects of design performance involve finding and discovery.

Findings from this design condition, which can be considered to be more representative of creative design problem solving, are in line with Kolb and Kolb (2005b), who characterized architectural students at the ‘reflective observation’ end of the AE-RO axis on the learning cycle.

**Conclusions**

In their influential study, Kolb and Kolb (2005b) proposed that learning is a holistic process that involves thinking, feeling, perceiving and behaving, during which the adaptation to the world is achieved by the integrated functioning of a person. Considering this holistic view of the learning process, cognitive skills of students were examined in the design studio. Two design conditions were considered to examine the effect of learning styles on design performance through different design criteria that dealt with concept development, structure and material knowledge, innovative form generation and crafts.

Major differences were found with respect to the CE-AC continuum of perceiving information, and the AE-RO continuum of processing information (Kolb, 1984) in each design condition. In the constrained design condition, performance by concrete experience was more successful than performance by abstract conceptualization in SE. On the other hand, in the unconstrained condition, reflective observation learners were stronger than active experimentation ones in CD and FC.

Findings from this study are of great importance for intervention programs of design education that aim to enhance the performance of design students with different learning styles. Considering individual differences among students, and applying the Experiential Learning Theory, which is basically a theoretical framework for understanding learning abilities, can contribute to the enhancement of individual skills and abilities under different design situations. The great advantage of the Experiential Learning
Theory is that findings can be operationalized in the design studio in a straightforward and easy way. Intervention programs based on this instrument can be implemented not only by promoting those design conditions, and design aspects where learners with a certain ability have an advantage, but also by training and strengthening students’ learning skills to match those design situations where they find themselves disadvantaged.

It is imperative for design educators to be conscious of the role of learning preferences in the design studio, as well as to develop awareness of individual differences with respect to how information is perceived and processed. Findings resulting from the present study provide design teachers with a concrete instrument for training students while bearing in mind personal learning styles developed through the learning cycle. In some design conditions certain learners are more successful than others. Hence, teachers should try to adapt the transference of design knowledge according to the particular needs and requirements of each student. Gaining insight into the different learning preferences can provide educators with more refined criteria to assess design outcomes, and better tools to support the design activity.

Acknowledgements

The authors thank Dean Prof. Dr. Ahmet Eyüce from the Faculty of Architecture and Design, who helped with the execution of this research in the studios of Architecture and Design at Bahçeşehir University. Special thanks are due to Övgü Tüzün, for her advice and proof-reading, and to the research assistants for their help in administering the survey.

References


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Cliffs, NJ: Prentice Hall.


support experiential learning in early design episodes.
Design Studies, 23(1), 5-23.


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