

Residential environmental design with nature inspired forms

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Received: November 2019 • Final Acceptance: December 2019

Abstract

Students' works in Environmental Design Project 2 (EDP2) course which focuses on creativity and functional formation were analysed in this study. This study deals with the experiences of the 2nd-year landscape architecture students in the EDP course in regard to developing design and creativity skills and morphological efforts. The landscape architecture education can be defined as decision-making, designing spaces and organizing human activities and in Environmental Design Studios (EDS) these are addressed as a whole. For this reason, "EDS" make up the most dynamic milieu of the landscape architecture education. These are courses that synthesize problem-solving skills built on the information and creativity obtained from other courses. Thus, students are expected both to come up with problem-solving suggestions with their knowledge and use their creative capacities in these suggestions within the scope of the course. Consequently, students are expected to produce creative designs suitable for the objective of the courses. However, the studies on how students perform these tasks in the landscape architecture education are quite limited. In the 1st stage of this study, an approach that will develop the creativity of the students was investigated, and it was aimed to share the experiences on this subject. In the 2nd stage of the study, the students assessed how they utilized inspiration by nature and the benefits of inspiration by nature to their educational and developmental processes.

Keywords

Inspiration by nature, Creativity, Design education.

1. Introduction

Design is a complicated structure that deals with definite and indefinite ideas, systematical and chaotic ways of thinking, imagination and mechanical calculations (Lawson, 2005). Therefore, it is an activity that is difficult to be defined, but it may be described with the help of visual and verbal means that are used during the design process because design process is a combination of activities that the designer do through perceiving - thinking - expressing and with used visual - verbal devices. The devices that are made use of in this process affect the process, the output that is an expression of an idea and its perception (Anderson, 2011). However, designing consists of such activities as creativity, information gathering, thinking, analyzing, deciding, trial-and-error and problem solving. Thus, the process of design is an activity in which intellectual power of thought, the data that all senses gather from the environment and inborn talents are synthesized as a whole. To form creative design, personal experiences, education, enriching and diversifying the thinking are also significant in addition to all these. Therefore, the answers to the questions how the designer thinks in this process, what kinds of things lead their ideas, and in which way they lead them show the relationship between the design and inspiration (Melikoğlu Eke, 2015).

For the designer to make use of visual data in order to improve his / her ideas will support his / her creativity, thus increasing the productivity of the design process because in this process, visual data would facilitate the designer as the ideas of the designer are transformed into patterns. Especially in the first years of design education, it is very difficult for the students to sketch the design they form in their minds. To deal with this difficulty, it is significant that the students benefit from knowledge and experience of their design instructors as well as taking advantage of the visual data that the nature provides them. As form knowledge of the students who are in their early years of education is limited, it is not easy for them to create forms and options. Inspiration of the nature is the

best source for the students to “create patterns”. Thus, students are given the opportunity to discover their own styles / methods. Within the scope of this study, it is aimed to build the skills of the students about how to turn their abstract ideas that are in their minds into concrete ones by making use of the shapes, relationships and colors that exist in nature. As a result, their creativity will also be facilitated. The success in bringing together this stylistic pursuit and the functions that are to be around a building is identified and evaluated by the course instructor.

1.1. Creativity and inspiration

Creativity is the center of new ideas. It is the source of new products and designs, and it is also the vision of perceiving the world in a renewed shape (Canaan, 2003). “Creativity in design” is the ability to think many perspectives, to go beyond the thinking line that is imposed and to think differently from others, and it is also approaching the solutions of the problems from varied aspects, making new relationships or reforming the relationships among the ideas that already exist, being able to think in comfort-fast-independently and quick, and reflecting all these into design (Uzunarslan and Polatkan, 2011). For this reason, in the process of the solution of the problem of design, the way to improve creativity or to teach it is a very important problem of design education (Casakin, 2007; Çubukcu and Gökçen Dündar, 2007) because while creativity is an innate ability, it is also an ability that may be learned, taught and improved by providing the right information at the right time with the help of education (Apaydın, 2015; Weisberg, 2004). In the process of design, the designed form is generated with the help of the sense of creativity that is believed to be related to ability. However, the effect of imagination on creativity should not be disregarded (Çubukcu and Gökçen Dündar, 2007). Imagination is the priority of creativity (Denel, 1981; Çubukcu and Gökçen Dündar, 2007), and inspiration could be a method in development of imagination.

Inspiration is described as the shapes and laws of nature that forms a

sample or a model for art or learning based on a source, inspiring, interpreting and reflecting things (Tunali, 1998; Ziss, 1984). Inspiration could facilitate thinking in design and could function as a trigger to produce ideas (Eckert, 1997; Mete, 2006). Sources of inspiration play an important role in the design process by improving the creativity, originality and imagination of the designer (Mete, 2006) and are effective on the whole design process. Inspiration is used to develop concepts in the first stage of the design process, ideas that affect design decisions in later stages (Goldschmidt and Smolkov, 2006; Cardoso and Badke-Schaub, 2011) and to transform ideas in the final stage (Authors, 2018). Thus, the ability of the designer to observe the environment and his/her ability to identify the inspiration sources could improve both the quality and creativity of his/her designs (Eckert, 1997; Mete, 2006). Thus, inspiration supports the creative process by helping the designer produce unexpected solutions required by the design problems (Authors, 2018).

In the process of inspiration, designers tend to actively collect visual examples for inspiration (Keller et al., 2009). Especially the habit of architectural designers to describe and research the information hidden in visual images supports the use of visual data in the inspiration process and this was supported by the studies that suggested that designers prefer to use visual data (Authors, 2018; Gonçalves et al., 2014; Casakin, 2005; Hanington, 2003; Eckert and Stacey, 2000; Goldschmidt, 1994). Use of visual resources as inspiration tools in design, their fruitfulness, and the perception of the design process as a discovery activity characterized by visual thinking (Goldschmidt, 1994) are explained with the increase in the quality of design solutions and development of design knowledge/skills and creativity (Casakin and Timmeren van, 2015; Goncalves et al., 2014; Cai et al., 2010; Casakin, 2012). Furthermore, additional visual sources could provide simple and intuitive clues that do not require translation between different perceptual methods (Malaga, 2000). Thus, visual resources can be an effective inspiration tool for beginners in

design. One of the challenges encountered by novice design students is the difficulty to transform an abstract design concept into a form and to associate this form with spatial organization (Dogan, 2013). Therefore, visual inspiration sources are very important in design education and nature is an endless source for visual data which the students could utilize to find solutions to design problems during the initial years of their education. Students could analyze and imitate the structure in nature to explain their approaches to a well-defined design problem, to reflect their ideas on design and to express these ideas using drawings. Thus, especially inspiration by the nature was scrutinized in the present study.

1.2. Inspiration by the nature in design

Designers think, fictionalize and design within a system. “Nature” is a very good source to facilitate thinking process and provide difference in design. As a consequence, throughout the history of architecture, natural objects and processes have been a limitless inspiration source for designers. With its features such as shape, color, texture and function, nature plays an active role in forming relationships between the forming of design shapes and their functions. More specifically, designers may easily use the shapes and geometry of the characteristic structures in nature and the visual data related to the worlds of animals and plants (Joye, 2007; Feuerstein, 2002; Lynn, 1999). Thus, nature provides several sources to transform the designer’s abstract ideas into a form. In the present study that analyzed the effect of visual data on creative thinking and creating forms, only “nature” was used as the visual data source. Within the context of the study, similarities with the shapes in nature were examined as “inspiration by the nature”. The concept of inspiration by the nature in design is transferring the samples in nature by evaluating their shapes, functions and systems to design (Joye, 2007). For a designer to transfer these relationships that exist in nature to design starts with reaching the right visual data, continues with the appropriate analysis of

those data for the aim and ends with its formal and intellectual transferring to the design. Inspiration to nature reflects on design in two ways:

1. Having the form of the natural object and transferring it to design by imitating it due to formal considerations (Hagan, 2001; Kellert, 2005)

2. Inspiring from the form and function in nature (material, form and structure) and with experimental data, it changes into architectural form (Arslan Selçuk and Gönenç Sorgu, 2007).

Why does the designer inspire from nature? The answer to this is that nature has already solved a great number of challenging design problems with the help of its relationships that exist in it, that it has endless data required for imagination and that it enriches the shape knowledge of the students who are at the beginning stage of their education because the process of design is a process which is based on visual thinking and in which the idea of design is improved and shaped. In this process, designers develop and express their ideas through sketching and the final shape is designed step by step. Benefitting from the shapes in nature is a very important contributor for the designer. Especially in the first stage of design education, forming shapes by imitating the lines in nature and sketching these enable the designers to change their dialogues with themselves into shape through concretizing their ideas (Lawson, 2005). As a result, the designers who are in their first stage of education may develop a design understanding which is consistent, readable and that has high creativity when they form a successful connection between the inspiration sources in nature and design problems.

In the education of landscape architecture and especially in the first environment design studio in the second year, improving design abilities and creativity is of great importance. Nevertheless, improving design and creativity is a challenging process that includes uncertainties for the students and instructors in terms of the method because environmental design studios are the places where the students first experience their profession in real terms in the education of landscape

architecture, and there the future landscape architects both experience design and learn how to design. During the education of landscape architecture, environmental design studio continues for seven semesters. However, the studio in the second year is the first course in which the students first experience sketching and they firstly turn their abstract ideas that they design in their minds into concrete ones by sketching without having any pre-learning related to turning ideas into shapes. This course is a place that the students both have the anxiety of generating forms and try to match the shape and function, and also it is a place where they need to improve their creativity. Therefore, within the scope of this study, based on the idea that visual thinking is more important in order to improve the ability of the students to create forms, the effect of inspiration by the nature on generating forms is examined. Consequently, the present study aimed to provide an insight for the students who newly experienced the process of design and “how to improve their knowledge of shape” and to help them “gain the ability of generating forms” through inspiring from nature and giving them the opportunity to create similar correlations. Thus, environment design studio courses enable the students in their first year of education to enrich their creative thinking with the help of the approaches like inspiration from nature and enrich their visual memories with the opportunities of generating forms. While the students primarily learn how to generate forms through inspiring from nature, they will gain the ability of creative thinking without realizing it. This would become an effective tool to solve design problems and improve their creativity.

Creativity is from innate but it is an ability which can be learn and develop, consequently this research is based on the following questions:

- What is the contribution of inspiration from nature to students' learning and development?
- What is the contribution of inspiration from nature to the ability of produce form?
- How do students use nature inspirations?

- Do students' inspiration forms from nature support their creativity?

In this context, this research practiced of two stages; the evaluation of the inspiration approach from the nature by the faculty members and students.

2. Materials and method

2.1. First stage: Assessment of the instructor on the inspiration by nature approach

2.1.1. Environmental design studio definition

Environmental design studios are the courses which constitute the education of landscape architecture and where all the concepts of deciding, designing spaces and organizing human activities are dealt with as a whole (Authors, 2017; Eren and Var, 2017; Rodiek, 1998). In these courses, the basis of the education of landscape architecture is formed. "Environmental design studios" constitutes the most dynamic atmospheres of the education of landscape architecture because in the scope of these courses, all the information obtained from all other courses is synthesized with the ability of problem solving that is based on creativity. Therefore, in this course, the students are encouraged by the instructor both to find solutions to the given problem and to use their creativity in these solutions. The design studio environment is a space where thinking takes place through dialectical conversation between the faculty member and the student, and through external representations such as sketches (Schön, 1984; Schön, 1987; Dogan, 2013), and thus, providing the students with a space where they could use their creativity and intellectual capacity.

In the environmental design studios, the students are quite dependent on their instructor in their first stage of studies and it is very important to get complete guidance and approval from them related to their projects to make progress because the critics that they have in these courses is crucial for the learning performance of the students. Therefore, the relationship between student-instructor is like master-apprentice relationship. Studios are the places where the instructor conveys the

knowledge and experience to the inexperienced students. Moreover, in this course, the instructor will encourage the students who have newly begun designing to learn, will have positive evaluations, and the instructor has the role of being a source that has varied information and is a guide for the students. On the other hand, the faculty member could be observed as role model by the students and as the person who possesses various types of knowledge they desire to acquire (Goldschmidt et al. 2010).

2.1.2. Environmental design project 2 (EDP2)

This study was conducted in environmental design studio belonging to 2nd year and 3rd term in the Department of Landscape Architecture at KTU. In the 3rd term environmental design studio, as a design problem "Design of Building Environment" was determined and the students were given a villa and its environment as study area. This process takes 12 weeks and the studio course is 8 hours a week. It happens twice a week and each lesson lasts four hours. During the course, the students present their studies, they discuss their studies with their instructor, and they get feedback from their instructor. Feedback is given to the students one by one and each lasts about 30 minutes. The students take notes about their feedback, in the next course they describe the improvements they make to their designs, and they define the feedback. This method means "learning by doing" or "trial-and-error" for the students. The stages of the course are as follows:

2.1.3. Research on the topic

This stage consisted of two steps and this process is completed in two weeks. In the beginning of this stage, the instructor inform the students about how to create original ideas - shapes inspiring from nature, about what kind of natural shapes will help them in generating forms and about what kind of activities may happen in the environment of a building.

In the first step, the students do research on activities in the building and they think which of these activities

may also happen in the environment of the building. While they gather information for this research, they are free to use varied sources such as books, magazines or the Internet, and the research should include information about functional needs of the building and information defining the building and its environment. Especially this information is supported with visual samples that consist of plans and images. A report is written along with these studies.

In the second step, the students prepare varied photo samples that they can inspire from nature through using the sources they want. The instructor expects the students to find samples that are readable and show unity of characteristics in terms of form. These samples make it easier for the students that are in their first stages of education to generate form and create options, and they provide them a starting point.

2.1.4. The process of generating form

This stage consisted of two steps and this step of the study is a process that is aimed to improve the creativity of the students. It lasts between the 3rd and 6th weeks. The aim is to develop students' form generating abilities. In the first step, the students define the formal and characteristics feature of the photos of nature that they choose. The design process that starts with the photo samples that the students find interesting and they may inspire from them continues with the analysis of the samples. In this stage, on the chosen nature photos, the students are enabled to have sketching activities to generate forms, and thus it is enabled for the students to understand the lines of nature and how to imitate it. Later, the instructor evaluated the sketching studies on these photos and they are minimized to five who form understanding is successful.

In the second step, form understanding in sketches that are developed on five nature photos continues to improve with the feedback that the instructor provides to the students. In this step, the students start to reflect their own designer identities to the lines they inspired from nature through reflecting their own abilities to the cre-

ating process that they imitate from nature by the help of sketching (Table 1). In this step, each sketching that the students form constitutes the next one and the form pursue of each sketching has more characteristic lines.

At the end of this stage, the instructor reevaluated the forms that were improved from five nature photos that the students studied on and the most developed sketching was chosen. In these evaluations on sketching, it is seen that the efforts that the students gave to generate forms were generally successful. The instructor find out that the forms that the students generated inspiring from nature had strong relationships with each other and they had a structure that functioned well like in nature.

2.1.5. The relationship among form-space-function

In this step, the forms that were improved independent from function were changed into spaces. In this study, the students managed to bidimensionally express the form that they generated through inspiring from nature and the functions that they imagined in their minds or they succeeded in changing an idea into form by inspiring from nature and explaining this in architectural terms. The students were enabled to interpret based on the model they chose, to decide the type of open space they design and the kind of activities that take place in it by improving the model and planning the form - function relationship. In this stage, combining the form that was generated through inspiring from nature and the function was completed (Table 2). However, certain students, who construct the correlation between form, space and function at this stage went beyond the mere replication of the form in the relation between de-

Table 1. Generating form from the sample inspiration from nature.

General view of the sample inspired from nature	Detailed view	Inspiring from the forms	Generating forms
			

Table 2. Changing the forms generated from the sample inspired from nature into spaces.

Sample inspired from nature	Generated form	Sketch I (Transforming forms into spaces)	Sketch II (The relationship of form-space - function)
Integration of the produced form to be defined similar to the nature			
	<p>Inspiration by the nature: To reflect the natural forms in the design, the forms should be repetitive and similar.</p>		
	<p>Inspiration by the nature: As the form is similar and repetitive, its scale and direction changes. To remove the monotony in similar and repetitive form, orientation and size of the forms should be varied. Thus, the contrast between the size and direction of the forms would lead to non-monotonous systems similar to nature.</p>		

sign and nature by analyzing both the form and functions and relations in the nature (Figure 1). These students (Students 1-2-3) attempted to construct how the forms present in the nature come together. Based on their professional experience, the researchers considered that students reflected the ideas they obtained from this

construction the their final product as follows:

Similar to nature, shapes (that were transformed into spaces) repeat themselves in terms of direction and dimension and contain similarities. Thus, the forms are combined in harmony and aim to create a holistic impact.

The repetition in nature is not monotonous, especially since it contains contrast in size and direction. The students attempted to prevent monotony in their designs by utilizing the variations in direction and scale when designing the spatial construct of the forms they produced by emulating nature in their designs. A group of students (Students 4-5-6) considered the idea of inspiration by the nature as a mere imitation of the forms (Figure 1). Similar to nature, shapes (that were transformed into spaces) repeat themselves in terms of direction and dimension and contain similarities. Thus, the forms are combined in harmony and aim to create a holistic impact, however due to the lack of a significant change in dimension and direction, it was concluded that the products produced by this group were monotonous compared to the students in the other group. The products of these two groups are presented in Figures 1.

2.2. Second stage: Survey about the student assessments on inspiration by nature approach

The survey was applied to 73 students, who took the same course in different semesters (2015-2016 fall semester, 2016-2017 fall semester), to determine the achievements in the course at the end of the semester. The survey was conducted to determine the contribution of the inspiration by nature method to form creating skills of the students in the course and its effects on learning. Students responded to two groups of questions in the survey: the first group of questions aimed to assess how the students utilized the inspiration by nature concept to create forms and the second group of questions aimed to assess the benefits of nature visuals for their learning and development (Table 3).

The first group of survey responses ensured the analysis of the inspira-

	Inspired Model	Generated Form	Sketch	Detailed Design
Student 1				
Student 2				
Student 3				
Student 4				
Student 5				
Student 6				

Figure 1. The examples of student studies.

tion by nature by the researchers and the second group of responses enabled the researchers to assess the students' learning and development processes. The responses were assessed using a 5-point Likert scale that ranged between 1 = "very poor" and 5 = "very good".

The survey was conducted after the announcement of students' grades in order to eliminate the students' possibility to respond to survey questions with a concern to get better grades. Thus, objective student responses were ensured.

2.2.1. Data analysis

The collected data were analyzed on Statistical Package for the Social Sciences (SPSS, Version: 27.0) Software. At this stage, whether the correlation between the students' responses to questions on the contribution of inspiration by nature to the process of form-creation and creativity of the students was significant and the arithmetic means for these questions were determined. The results of the statistical tests demonstrated that the contribution of inspiration by nature to the students was statistically significant ($p / 0.01$), and it was found that the correlation between inspiration by nature and the form analysis process was statistically significant ($p / 0.01$).

3. Findings

The contribution of the inspiration by nature approach to the environmental design project 2 course was evaluated by the students. Averages for the responses given to each question were calculated for the general assessment on inspiration by nature. Comparisons of the use of inspiration by nature by the students were evaluated with ANOVA test.

3.1. Findings on the contribution of inspiration by nature to form-creation skills and learning

The highest arithmetic mean value in the questions posed to determine the most effective quality of inspiration by nature on the form-creation skills of the students and the correlation between this quality and its benefits for the learning and development

Table 3. Survey questions.

1st GROUP QUESTIONS	The analysis of inspiration by nature	What are the methods used by the students in inspiration by nature?
Q1	I used it to analyze the form of nature visuals, to develop their lines to produce new forms.	
Q2	I directly copied the form of nature visuals	
Q3	I analyzed the systems in nature visuals and utilized the principles/organic relations in these visuals to establish a form, space and function relationship	
Q4	Nature visuals support form creation and learning creativity	
2nd GROUP QUESTIONS	Learning and development process of students	How inspiration by nature contributes to the learning and development of the students?
Q5	It revealed my creative powers and potential	
Q6	It develops aesthetical thinking and awareness	
Q7	It helped me to concretize my mental designs	
Q8	It helps me acquire the skill to transform abstract thoughts into concrete	
Q9	It facilitated drafting	
Q10	It develops understanding of basic design concepts such as repetition and rhythm and transferring these into drawing	
Q11	It improves the skill to transfer analyzed samples into drawing	
Q12	Inspiration by nature supports learning creativity and increases my motivation for creativity	
Q13	Inspiration by nature teaches to establish links between unrelated concepts and visual elements	
Q14	Inspiration by nature enables flexible thinking	
Q15	Investigation and inquiry about all types of relationships in the nature should be a part of the design process to obtain sustainable products or design	
Q16	Inspiration by nature had a positive impact on my perspective on nature	
Q17	Inspiration by nature made me realize the amazing harmony and balance in the nature	

of the students was identified in the first group question of "I used it to analyze the form of nature visuals, to develop their lines to produce new forms (Q1)" and "Nature visuals support form creation and learning creativity (Q4)". The highest mean was observed in the following second group questions: "It develops understanding of basic design concepts such as repetition and rhythm and transferring these into drawing (Q10)" and "It helps me acquire the skill to transform abstract thoughts into concrete (Q8)". Also, high arithmetic mean values were observed in the second group questions of "It facilitates drafting (Q9)" and "Inspiration by nature teaches to establish

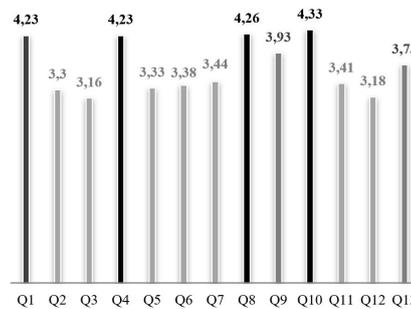


Figure 2. Arithmetic mean figures obtained in the responses.

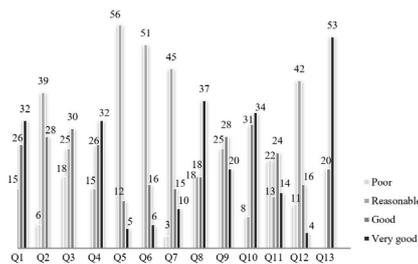


Figure 3. Response frequency distribution graph.

Table 4. Skewness/kurtosis values for the analysis of nature visuals.

	Std. Deviation	Skewness	Kurtosis	Chi-Square	df
Using nature visuals by copying their forms	.697	.018	-.892	11.534 ^a	2
Using nature visuals by analyzing their system	.789	.074	-1.382	1.014 ^a	2
Using nature visuals by analyzing their forms	.809	.205	-1.440	1.342 ^a	2
Supporting form-creation and creativity with nature visuals	.786	.412	-1.259	27.110 ^b	3

Table 5. Assessment of the methods of using inspiration by nature concept Anova.

	Sum of Squares	df	Mean Square	F	Sig.
Using nature visuals by copying their forms	Between Groups	25.178	3	8.393	.59,037
	Within Groups	9.809	69	.142	
	Total	34.986	72		
Using nature visuals by analyzing their system	Between Groups	32.218	3	10.739	.58,538
	Within Groups	12.659	69	.183	.000
	Total	44.877	72		
Using nature visuals by analyzing their forms	Between Groups	40.263	3	13.421	134,994
	Within Groups	6.860	69	.099	.000
	Total	47.123	72		

Table 6. The concepts with a correlation with form analysis process.

	2nd GROUP QUESTIONS												
	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17
students' learning and development process													
Q5		.841**	.948**	.511**	1.000**	.605**	.702**	.917**	.825**	.926**	.805**	.764**	.786**
Q6			.856**	.583**	.841**	.691**	.817**	.764**	.787**	.903**	.786**	.782**	.603**
Q7				.538**	.948**	.638**	.728**	.935**	.856**	.886**	.779**	.759**	.823**
Q8					.511**	.901**	.819**	.457**	.698**	.517**	.670**	.812**	.314**
Q9						.605**	.702**	.917**	.825**	.926**	.805**	.764**	.786**
Q10							.884**	.541**	.772**	.613**	.712**	.841**	.372**
Q11								.632**	.794**	.731**	.778**	.835**	.466**
Q12									.831**	.842**	.809**	.701**	.861**
Q13										.783**	.759**	.842**	.752**
Q14											.823**	.767**	.675**
Q15												.789**	.533**
Q16													.599**
Q17													
Form Analysis	.913**	.880**	.959**	.567**	.913**	.671**	.758**	.904**	.884**	.858**	.765**	.767**	.848**

Table 7. Correlation between “form analysis” and “students’ learning and development process”.

Highest level correlation (r=0.959**; r<0.904; p<0.01)	It revealed my creative powers and potential
	It helped me to concretize my mental designs
	It facilitated drafting.
High correlation (r=0.880**; r<0.758; p<0.01)	Inspiration by nature supports learning creativity and increases my motivation for creativity
	Inspiration by nature teaches to establish links between unrelated concepts and visual elements.
	It develops aesthetical thinking and awareness
	Inspiration by nature enables flexible thinking
	Inspiration by nature made me realize the amazing harmony and balance in the nature
Intermediate correlation (r=0.567**; r<0.671; p<0.01).	It improves the skill to transfer analyzed samples into drawing
	Investigation and inquiry about all types of relationships in the nature should be a part of the design process to obtain sustainable products or design
	Inspiration by nature had a positive impact on my perspective on nature
	It helps acquire the skill to transform abstract thoughts into concrete
	It develops understanding of basic design concepts such as repetition and rhythm and transferring these into drawing

links between unrelated concepts and visual elements (Q13)” (Figure 2).

The frequency distribution of the scores given based on the assessment scale for each question are presented in Figure 3. Thus, the concepts with high arithmetic mean values, namely Q13, Q8, Q10, Q4 and Q1 were scored by the subjects mostly as “very good,” the highest score on the assessment scale.

3.2. Findings on the analysis of inspiration by nature

The mean, standard deviation, and skewness-kurtosis values for each variable assessed by the subjects were identified to demonstrate the impact of inspiration by nature on form creation and the process of learning creativity. Since the skewness and kurtosis values for the data presented in Table 4 were between +1.5 and -1.5, it was deter-

mined that the data exhibited normal distribution (Tabachnick and Fidell 2011). Thus, parametric tests (ANOVA and correlation) were used in subsequent evaluations in the study.

ANOVA analysis findings demonstrated that there was a statistically significant difference between the values of the variables that constituted the analysis of nature visuals (p <0.01). ANOVA analysis results are presented in Table 5. Based on the presented data, “using nature visuals by analyzing their forms,” which had the highest F value (F = 134. 994, p <0.01), demonstrated the strongest difference. Based on this finding, it was revealed that “using nature visuals by analyzing their forms” contributed the most to form-creation and learning creativity processes (Table 5).

Correlation analysis was conducted to determine the relationship between “using nature visuals by analyzing their forms (form analysis)” and “students’ learning and development process” (Table 6).

Based on the analysis results, it was determined that the highest correlation between “form analysis” and “students’ learning and development process “ in Q5, Q7, Q9 and Q12, high level correlation was determined in Q13, Q6, Q14, Q17, Q11, Q15 and Q16, and intermediate correlation was determined in Q8 and Q10 (Table 7).

4. Discussion

Concretization of the ideas about a design problem is quite important in design education. Nature could be a good resource to facilitate this process of thought and to create a difference in design. Thus, throughout the history of architecture, natural objects and processes have been an infinite source of inspiration for the designer. The perfect system in nature was expressed by Galilei as follows: the universe is written in the language of mathematics and its letters include triangles, circles and other geometric forms. Without them, not a single word could be understood, without these, the universe is like navigating in a dark maze (Galilei 2008; Alpak et al., 2018). Understanding the language of the nature facilitates the designer’s work; the nature, color, tex-

ture, and functions in the nature could play an active role in the formation and the correlation between the functions of the design product. Thus, while inspiration from nature is significant for the disciplines that focused on design and it is a source of inspiration that is commonly used in those disciplines, it a quite new concept for the education of landscape architecture. This study aims to share student experiences in this issue by focusing on how to create a form in the design of a residential environment by inspiring from nature. Creativity is a process that occurs with a source of inspiration. In this course, especially the creativity of the students was supported through creating forms with inspiration by nature. For, it was aimed to provide ease for the form and alternative producing efforts of the students, who have limited knowledge on forms since they are in the initial period of their education. Hence, each student was given a chance to discover his/her own way. It was eventually aimed to provide students with the ability to transform abstract mental ideas into concrete images using the forms and relations in nature. In the first part of the study, the final products of the process of the quest of creating a form by the students were assessed by the researchers based on their professional experiences. It was observed that a group of students could easily reflect the geometry and relationships within the nature (form, size and direction) in their designs through inspiration by the nature, while the other group of students perceived inspiration by the nature as a simple process of imitation, concluding their query for form as such. It was observed that they were not very successful in reflecting the relationships (size and direction) in the nature in their designs. However, it was observed that students in both groups are able to create new information from what they have revealed with their studies and when they confront with a design problem, they have the ability to find different and creative solutions because when the students do research on forms in nature and when they understand the order very well, they feel comfortable not only generating forms but also changing them

into spaces and forming functional relationship. As a result of this, it was found that self-esteem of the students also increased. The assessment of the researchers on the final products of the students was consistent with the statement by Dogan (2013) that inspiration by nature enables the comprehension of the rhythm of the nature and transformation of this rhythm to designs.

In the second part of the study that included the survey, students were given the opportunity to assess how they used inspiration by nature and the benefits of inspiration by nature for their learning and development. The assessment findings demonstrated that inspiration by nature was mostly used by the students to develop their drawings by analyzing the form of the inspired sample, it supported form creation and learning creativity, allowed them to concretize their ideas and facilitated drawing sketches. Based these results, the inspiration by nature means inspiration rather than copying nature, taking the nature as an example, and developing their drawings utilizing the aesthetic approaches in the nature. These results are supported by the study by Ruskin, who indicated that the nature is a source of inspiration and an example (Ruskin 2009; Doğan, 2013; Alpak et al., 2018). The views of Viollet le Duc, who stated that architecture is an art and we have to follow its path and the logical relationships it uses, were consistent with the findings of the present study on the methods adopted by the students in using nature (Viollet-le-Duc, 1990). In particular, findings on the development of creativity by inspiration by nature were similar to the findings in literature that visual clues develop creativity (Casakin and Goldschmidt, 1999; Çubukcu and Cetintahra, 2010; Chai et al., 2015).

Based on the results on the correlation between form analysis and the students' learning and development process, inspiration by nature improved the students' creativity and contributed to their ability to create solutions for design problems such as linking unrelated concepts and visual elements, reflecting the harmony and balance in the nature on the design via analysis and the relationships of aesthetics and inte-

gration in the nature and harmony on the design. Based on the findings, the approach that is acquired by the students through inspiration by nature is a significant instrument that strengthens the creative thinking skills of designers (Casakin and Goldschmidt, 1999; Casakin and Goldschmidt, 2000) and to facilitate sketching. One of the important relations between form analysis and students' learning and development process was their ability to analyze the forms in the nature and to facilitate their efforts to transform abstract ideas into concrete forms. Because, for the novice students, it is more difficult to express their ideas when compared to those who are experienced in reflecting their ideas on design and in creativity. Inspiration by nature facilitates this process, especially the findings of the present study demonstrated that visual data are very useful in stimulating creative thinking for the novice students. These findings are also consistent with previous studies in the literature (Çubukcu and Cetintahra, 2010; Çubukcu and Gökçen Dünder, 2007; Dogan, 2013). Visual data can also support the development of creativity since it can provide the opportunity to imitate and interpret the things they observe for novice students without the need for prior knowledge. Because, novice students organize their knowledge based on the superficial characteristics of information, while experienced designers could analyze the information they acquire (Lawson, 2004; Gonçalves et al., 2014).

Unlike the findings of other studies in the literature, the present study demonstrated that inspiration by nature helps students to concretize basic design principles and to understand these concepts. However, the basic design principles are abstract for novice students and it is quite difficult for them to comprehend the relationship between the visual world and these principles. Thus, the inspiration by nature could inspire innovative ideas that both facilitate the resolution of design problems and provide different perspectives for designers, and to allow novice students to comprehend abstract concepts via concretization.

5. Conclusion

Design students experience problems in formulation of an abstract design concept at the initial stage of design and to relate this idea to spatial design (Doğan, 2013). Thus, inspiration sources are powerful tools at every stage of the problem-solving process for these students. Therefore, it is important to understand how and what kind of inspiration sources are used by students in design education and to develop new strategies in the design studio. Nature is an important source of inspiration due to its diversity; the relation between nature and humans is always the mobilizing aspect of arts (Dewey, 1958). This fact supports the idea that nature could be a source to nurture the artist's soul. In order to shape the landscape as a master artist, the designer should understand and reconstruct the relations in nature (Dee, 2012). In particular, if novice designers examine the formation and development of the forms in nature, they would easily find forms for their abstract ideas.

The present study involved the attempt of landscape architecture students to emulate selected natural forms in order to create original forms. Thus, the study focused on how to create forms in landscape design through inspiration by the nature and shared the experiences of novice designers and the impact of the inspiration by the nature on their development. The study findings demonstrated that inspiration by the nature was used by novice designers by analyzing the form of the sample of inspiration and developing the lines accordingly, and they utilized the forms of integration in nature. The inspiration by the nature supported students' learning on the form and creativity, concretization of the ideas, and facilitated sketching skills. Based on these results, inspiration by the nature meant utilizing the nature as an example, comprehending the aesthetics in the essence of the nature, and utilize this comprehension for the solution of the design problem rather than simply imitating the nature.

In the present study, differences in students' efforts to develop their creativity and knowledge of forms by inspiring from nature were determined,

however, the underlying reasons were not investigated in this study. It is considered that these differences may result from students' personal characteristics, design skills and differences in perceiving the subject. All of these are the focus of future studies, and the reasons for these differences can be shown in a detailed way.

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