THE EFFECT OF TEACHING THROUGH THE SCENARIO PLANNING METHOD ON CREATIVITY IN ARCHITECTURAL STUDENTS' DESIGN

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Abstract

Countless studies have been conducted on architectural teaching in the recent years; however, only a few have focused on scenario planning methods, especially scenario planning in architectural teaching, which, in turn, shows the necessity for more research on different dimensions of the issue. This study reveals the results of a reflection upon a report including the documentation of the teaching process in an architectural design workshop entitled 'designing my villa'. Therefore, this study aimed at investigating the effect of teaching through the scenario planning method on creativity in architectural students' design. To this end, in a semi-experimental design, 104 students of University of Tehran were selected as the statistical sample using the random-sampling method. First, the pretest of the architectural design under the title of 'residential villa' was run. Then, the participants were divided into two homogeneous groups including the experimental group (teaching through the scenario planning method) and control group (routine academic teaching), and both groups participated in a 6-week teaching protocol. Later, the participants took a posttest on designing the residential villa. The pretest and posttest results were evaluated by 3 raters. To ensure normality of distribution of the collected data, the Kolmogorov-Smirnov test was run. Having confirmed the inter-rater reliability using the Cronbach's alpha method, the data were analyzed to determine the progress of creativity in each group using the paired samples t-test and to determine the difference between the two groups using independent samples t-test. The results indicated progress in the architectural design creativity in both groups while the rate of progress in the group using the scenario planning method was significantly higher. Therefore, it can be concluded that using the scenario planning method in teaching architectural design can lead to greater creativity in students of University of Tehran compared to the routine academic methods, and this method can be regarded as a suitable way of enhancing creativity and improving architecture teaching processes. The findings of the present research can be used in instruction, curriculum development, and designing new buildings.

Keywords: Architecture Teaching, Creativity, Scenario Planning, Architectural Design.

INTRODUCTION

Equating traditional and academic methods of architectural education, enumerating the characteristics of each and then prioritizing one over the other, or proposing the mixture of these two methods are what have so far been done so many times but achieved nothing,

because nowadays education in architectural schools, without regard to conventional methods and groupings, has avoided both modern and conventional ways of accepting theoretical formats. Traditional architectural education, Beaux-Arts-style education and Bauhaus-style education, is all on the one side, but education of architecture in the last two decades is on the other side (Nikezić & Marković, 2015). Architectural education is an important type of education that requires attention and continuous development due to the continuous change in the nature of architectural practice (Ghonim & Eweda, 2019). The most traditional process in the design studio requires the design instructor to give each student a copy of the project's brief so that they can read it and start working. This method of teaching depends on the individual student's ability to follow the design process to submit the project. The results often require trial and error process, which reduces the level of productivity in the early stages of design process (Emam et al., 2019).

Designing and learning are two sides of the same coin. Design practitioners constantly have to adapt to new situations and contexts (Thoring et al., 2018). Learning is the main goal of education (Kryukova, E. M., et. al., 2021; Mirza, E. A., et. al., 2019). Therefore, providing suitable conditions for learning in architectural workshops is one of the most important educational concerns in the field of architecture. To do so, it is necessary to describe, illuminate, and interpret existing architectural heritage using suitable educational and research methods and relying on rules, laws, and documents so that the education becomes more aligned with these rules, to figure out the causes of problems and barriers in the realm of architectural education so that the shortcomings in the fields of art education, especially architecture, are identified, compensated, and accelerated the attence of a suitable defenseable position in the possible future (Paker Kahvecioğlu, 2007). On the other hand, architectural education requires strong and decisive theoretical frameworks with a systematic approach (Coleman, 2010). As most scholars acknowledged, how to teach architecture is the biggest issue in architecture schools (Salama, 2006).

The architectural design process can be described as the procedure of drawing ideas from one's unconsciousness. It originates, as an abstract idea, from the thought and experience of a person and gradually develops into a tangible novel subject through a process of conversion of subjectivity to objectivity, which is mediated by creativity (Daemei & Safari, 2018). There are a variety of sources of the formation of the design ideas, one of which is inspiration. Inspiration from a source happens when an internal or external factor is the source of the formation of the design ideas. The range of inspirational resources for architecture is very wide. The designer may use his memories and experiences in design or use the surrounding environment and/or other works of art such as painting, music, and nature as a source of adoption (Fernandez-Marquez et al., 2013).

Research studies and scenarios are the prerequisites of concept formation in architectural design (Duerk, 1993). Scenarios are a means of evaluating the qualitative characteristics of the architectural space. One of the appropriate architectural tools under the circumstances of uncertainty is scenario-based planning and policy-making (Lee et al., 2015). A scenario is a summary of a user's interaction with the architectural space. In evaluating architecture, the difference between the scenario and user case is that the user case shows the behaviors of users when they are in the architectural space, but the scenario also includes other interactions with the architectural space such as modifying the space to maintain the architectural space (Bass et al., 2003).

The construction of a spatial scenario is a factor for the interpretation of a building or design. The scenario can emerge in various architectural fields such as design tools, interaction with the city and user, and interpretation of buildings and architectural space (Gane & Haymaker, 2012).

The scenario expression step, in architectural design options, is one of the guiding steps in the type of designs and, of course, the amount of expresiveness and clarity of students' answers to the architectural design problem (Demirbaş & Demirkan, 2003).

The scenario planning method in content education is one of the active teaching methods. The use of the scenario planning method in different branches of university education such as engineering, medicine, military, etc. has just begun (Brewer, 2007).

Scenario planning is one of the strategies for teaching architectural design for the user-oriented design that prepares students' minds to consider the user and space relationships (Tvedebrink & Jelic, 2018). The use of the scenario planning methods in design education for architectural students can be both skill-oriented experimental designers and the education-oriented professional designers (Lameras et al., 2017).

The scenario-based design is a systematic way of thinking creatively about uncertain and possible futures so that creative thinking and ambition to progress are prerequisites of an acceptable scenario planning (Peterson et al., 2003). Therefore, the purpose of this study was to use the scenario planning method to promote the creativity of architectural students. Therefore, the present study investigated this issue with regard to students of architecture and the architectural design course at University of Tehran.

Research Questions

The present study tries to show how scenario planning education has an effect on the creativity of architectural design students. Comparing the two academic (traditional) and the scenario planning methods, how does scenario planning influence the idea creation process in architectural students' design?

Literature Review

Designers of all disciplines are required to be creative if they are to arrive at new and useful solutions to the problems that they address. Design tools and design processes are often claimed to unlock this creativity by inspiring designers to undertake a wide-ranging exploration of the design space (Crilly & Cardoso, 2017).

Scenario Planning in Architecture

Human experience in spaces is defined as the impact of the space on people's mood, level of comfort, and interactions with surroundings and change with architectural design features. Architectural design features are the elements that constitute a space and gives it its unique characteristic where people interact with (Ergan et al., 2018).

Architecture has two aspects: art and technology. One of the most striking differences between architecture and construction is the aesthetic aspect and sense of architectural location. Every human being's daily life and activities in the architectural space is a narration. Before designing any building, all architects plan a scenario. This scenario is usually effective in the function and communication of spaces and the sense of place of the work (Hashemnezhad et al., 2013). In fact, it can be said that the sense of place is a collection of individual and collective anecdotes and narratives that occur in the place. One of the important architectural roles is the objective realization of the sense of theplace so that, through such a sense, abstract space converts into a concrete place and gains its character (Hashemnezhad et al., 2013). This physical environment, which includes the range of personal atelier, home, design site, city, and cosmos, has the ability to create subjective concepts. The interpretation of the environment and its communicated message is a completely unique and designer-dependent process. Making metaphors and narrating narratives are the ways to understand architecture and think about it. Narratives and stories can be used in architectural design of buildings. Also, the architecture of each building has a narrative and scenario in its various stages and aspects. In other words, the structure of narrative literature and architecture has undeniable similarities. Narratives have a great impact on

the transferance of architectural ethics and professional values from one generation to another (Schaumann et al., 2017).

The review of the previous studies conducted on architectural education and scenario planning and the effect of educational methods on the architectural students' creativity shows that different methods of education are effective on creativity.

Studies on scenario planning in architectural design showed that scenarios can determine how all important ideas that may be expressed separately can be planned in more detail (Nielsen, 2013).

A scenario is a short story about an audience that uses a system (here, the architectural space) in a specific context and situation for a specific purpose. Given that narrative storytelling in the architectural design process often has a more limited opportunity than its own free context, and also considering the importance of the role of a character in it (as an audience of the architectural space), the scenario planning approach or narrative scenario seems more appropriate than many other forms. A narrative scenario with a fictional structure based an imaginary character provides a creative tool for exploring design requirements and ideas (Nielsen, 2013). Also, by creating an impression of the presence of the audience or the designer himself in the architectural space, it can pave the way for the real understanding of the subject of design and recognition of the problem (Pallasmaa, 2012).

Scenario-based design refers to selecting a family using ways in order to explore effective situations in the design process. Taking into account the diversity and dynamism of situations on how to use an architectural space improves creative thinking and offers a reference frame for evaluating design decisions (Van der Linden et al., 2019).

In addition to advancing the process of design thinking and creativity in their ideas, students are encouraged to "take responsibility" toward others and the living environment in scenario-oriented design studios (Charalambous & Christou, 2016).

The scenario can come into existence in the very first steps of the design and the initial moment, or it appears in the more advanced stages and the next steps. Any way, one cannot ignore its existence and significance. To design a scene, components from the most general to the most minor are arranged based on a mental arrangement (Van der Linden et al., 2019).

Scenarios help clarify needs in an architectural design. To strengthen the relationship between needs and design in the early stages of a design, a designer needs a plan that will help visualize the development process of a building from oral explanations to practical work (Østergård et al., 2016). One can look at a subject with different scenarios and from different perspectives and explore, evaluate, and search all its different dimensions (Weller, 2008).

In the scenario planning process, the student tries to describe and analyze the example design he has designed to different audiences by putting himself in different users' shoes in different situations so that the skipped parts in his design or ineffective and incomplete parts in his design can be understood (Oygür, 2018).

The philosophical discussion of the scenario has psychological and qualitative aspects and considers our mental states as well as our behaviors, is as the supporter of the subject of art and artist, and is less visible in technology. The scenario is also manifested as a story and hierarchy in order to achieve the ultimate goal, and the separation of each of the components causes it to be incomprehensible and incomplete (Cynthia et al., 2015). In a research, Eilouti (2018a) pointed to the structural similarities between story and architecture and described the application of the architectural scenario planning in line with a responsive design to future functions of the building (Eilouti, 2018a).
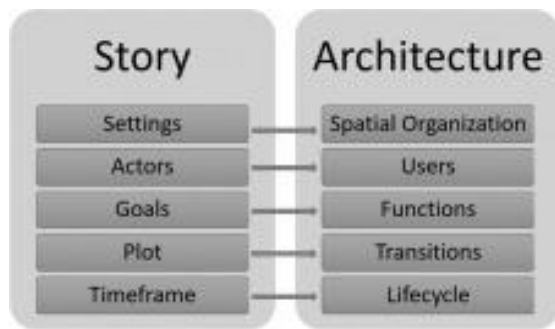
Figure 1. Story-architeture analogy (adopted from Eilouti, 2018a).

In another study, Eilouti (2018b) introduces the structure of scenarios as a proposal for team design collaboration. The scenario could help students explore new dimensions of the architectural design and direct the usual focus on form to a new function. The results were unique and innovative compared to other classes. That research gave birth to new viewpoints and insights into the dsign.

Vincent and Blandford (2015) showed that in most designs designed products are used for a limited period of time, while the period in which a building can be used is unlimited. The scenario planning method is able to help plan effectively throughout the process of designing buildings compatible with real-life situations.

In examining studies conducted on the architectural design education, Duerk (1993) concluded that designers, when confronted with a complex problem early in the design process, stick to 'a relatively simple thought'. This, in turn, limits the designers' thought so that they do not look for other possible solutions (Hsiao & Chou, 2004). El-Latif et al. (2020) emphasized that, in the process of the architectural design, the goals must be achieved in accordance with the priorities. The first goal of the architectural design, as the highest priority, is to solve the design problem. Then, the key features of the solution must complement the important problems and ideas. The basic traditional arrangement of the design stages includes sketch, schematic design, final design, and the stage of collecting information. However, the specific arrangement of the design process depends on the goals and priorities of the stages of each design project.

Architects' focusing on and utilizing imaginary paintings are necessary, which can be claimed to be in line with the first stage of idea creation in the present research. According to Salama (2008), instructors tend to give students hypothetical methods in the form of hypothetical design projects that do not take into account many conceptual variables. In this regard, learning from the real environment should be taken into account. Real-life experiences can get students familiar with opportunities in order to understand executive realities and various variables that influence real-life situations.

Pleasantly experienced indoor and outdoor environments require more than just the absence of negative stimuli. The aim should be, therefore, that of conceiving flexible and adaptable settings where, through form, space, and materiality, the opportunities for well-being can emerge. This includes envisaging how such settings might change over time, responding to diverse purposes, accommodating varied requirements, being transformed based on user profiles and needs, and how the role of occupants might evolve from passive recipients of deterministically pre-set conditions to active, aware, and engaged inhabitants securing their preferences and aspirations (Altomonte et al., 2020).

Architectural Education

Studies have shown that the general process of architectural design education in most schools of architecture is such that each student presents their proposals to professors during the semester after performing practice and designing at the class or home, and they fix the problem or so-called correction with their professor's help and guaidance. Of course, this happens after performing the initial exercises and collecting the initial studies by the students. In other words, each of the students, after presenting their plans to the professors and fixing the problems, resolves the problems and repeats this throughout the semester several times in order to finally get an acceptable plan. A very important point to consider is the difference between architecture and other sciences. In architectural design education (as

the main units of this field), unlike other sciences, students are not given reference books as a curriculum introduced by professors (Ozkan & Dogan, 2013).

Students ignore the hirarchy and sequence of the design process. As a result, unwillingness to go through the design process along with a desire to focus on form disrupts restoring the logical foundations of design and creating ideas in the workshop (McAllister, 2010).

Creativity in Design

The architectural design studio course is generally considered the backbone of any architectural curriculum and follows a particular method of problem solving, which makes it a distinctive course (AboWardah, 2020). In the fields of art, especially in the field of architecture, in addition to applying the above-mentioned talents, one is obliged to use creativity and innovation, and this issue lies within the fields of art. It should be noted that creativity, creation of new and innovative designs, is one of the most important parameters for measuring the success rate of architects and students of this field with respect to the architectural design. Therefore, having a clear picture of what it is and the possibility or impossibility of nurturing and developing creativity can be very effective in the future of architectural design education. Creativity in this article means creating any innovation in architecture whether in concept, or style, or concrete structure. Creativity is considered as an ability, a mental process, or a unique response that can uniquely solve a problem (Ozkan & Dogan, 2013). The nature of design embraces imagination too much more than it embraces science and logic. In creating and designing dreams, ideals, and imaginations, the designer's mind functions as if s/he is in an imaginary context. On the other hand, the work formed in this context also draws the audience to the imaginary world. This is a continuous process mixed with the subconscious. It is not possible to teach a designer how to live his imagination, but the formation of the themes of the imaginary space can be manipulated. Changes in the designer's inner attitude, thought, and belief are prerequisites for a

change and improvement in the quality of an innovative work on any scale: either small (paintings, sculptures, poetry, and literature) or large (architectural and urban design) (Guy & Moore, 2007). Creativity is a kind of cognitive activity that leads to a new way of looking at the problem and does not need to lead to practicality of the solution (Doheim & Yusof, 2020).

Increasing the students' drawing and design abilities has a great impact on increasing their motivation, and by increasing their motivation, their mind will be more able to create new ideas and expand them through acquiring abilities, which means that the creativity of the student has increased (Fasko, 2001).

There is a significant relationship between interactive learning style and creative academic performance of students.

In summing up the results of the above research studies, the active and influential role of the teaching method in creating ideas and creativity of students and designers can be pointed out. In most architectural designs, even with the usual and academic methods, executive power and its applications in design quality are still not responsive and do not coherently and systematically accompany the design process and creativity in architectural design (Cagiltay, 2008).

Today, after more than 60 years of scenario planning, the scenario planning method has become one of the common methods for studying future uncertainty, and its theoretical literature is seriously discussed (Randt, 2015).

This study aimed to use a method that can flourish creativity of architectural students of University of Tehran using the scenario planning method in architectural design.

Research Methodology

This study is a semi-experimental rsearch with a control group. The statistical population consisted of all undergraduate students of architecture studying at University of Tehran in 2018 who have passed at least architectural

design unit 1 (designing villa). From among them, 104 students were randomly selected as the sample. These students should be as homogeneous as possible in terms of design knowledge and sketch skills (Mou & Ho, 2008). After similar preliminary education to all subjects and reviewing the previous learnings, the pretest of the residential space design was administered. Then, based on the pretest scores, they were homogenously divided into the control and experimental groups (52 each). The education protocol for the experimental group lasted six weeks (one 4-hour session per a week) of designing the residential space by the scenario planning method. During the same period, the control group underwent routine academic education and relevant exercises in designing residential spaces.

Scenario-based Training Process

Scenario-based training is based on six principles of the process mentioned in Eilouti's (2018a) research:

Nurturing ideas: This is among the strategies related to "how to design" to "architectural decision making" to advance the design at this stage: perspective drawing with real and human perspective, providing simple examples for conveying the concept, choosing the appropriate type of drawing (based on the expectation from drawing in order to achieve the desired goal), questions and followingly answers, ambiguities simultaneous with drawing the clear, and paying attention to the role of "graphic method" (which shows the extent of the designer's "ambiguity" and "confidence" of different parts simultaneously to him and the user), drawing plans in large sizes, full of information (including objects, persons, details of space, and man in the space, with a recognizable scale), drawing all kinds of vision from a local perspective to a broad and general perspective, precision at selecting the angle of view to introduce the design and apply the effect of selecting materials in how to design (so that by selecting any material, the lines and the selection of openings, windows, and entrance will be different in drawing). In general, nurturing the idea is contingent on

practicing drawings many times, and this is not possible in mind without practical drawing. Also, the judgment phase on the project can only happen if the drawings are correct, complete, and expressive. At the beginning of the course, first, relying on each student's skills, the first practice was done by building and designing ideal spaces with a completely abstract expression through teaching and using the scenario planning method.

To show the design process in six steps, the process of a student's work is presented in the following figures. In Figure 2, the student's plan is presented in the step of nurturing ideas, and the process of design of the same student is shown by the scenario planning method in the next steps.
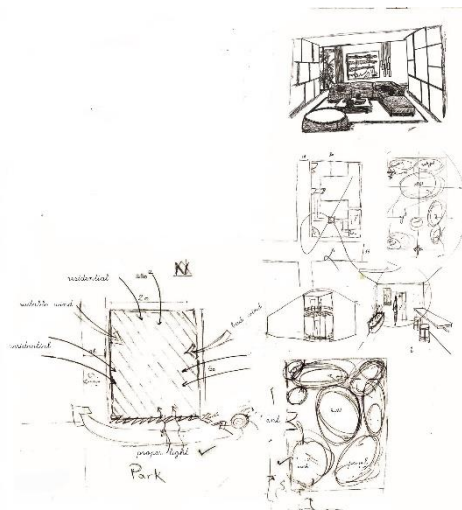

Figure 2. Student project in the step of nurturing ideas.

Planning and conceptualization: According to the provided site for the design of a duplex villa, first, based on the general characteristics and needs, the students were be obliged to present their detailed plan to the professor based on the theoretical concepts and principles of designing a villa, and after confirmation they would design the concept of villa mass, based on the lessons of the design field and other patterns of residential spaces on the site. Figure 3 is an example of the same student's plan in the planning and conceptualization step. Here, the student expressed his interpretations of the presented scenario.
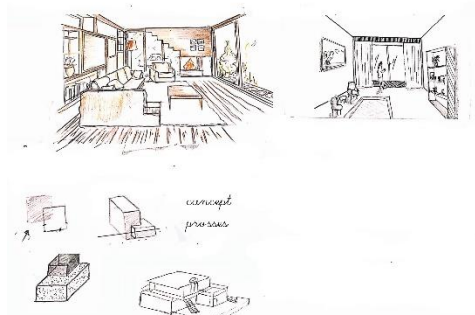
Figure 3. Design of the same student in the planning and conceptualization step.

Imagining a villa: The design practice during this period included designing "My Villa" with the "My Family" scenario, and to achieve this plan, the participants of the scenario group were taught to initially assume the problem was solved so that the interiors were first designed and then expanded and finally reached the whole design. This process was chosen because the main character of a residential unit is its interior spaces and the user makes the most of the interior spaces of the house. Interior space is much more important than the index of residential building as an urban element. In the interior space, the factors of light, materials, color, and their togetherness are influential. In the academic design, the first process that comes to mind is to first give a mass concept, to design circulation relationships and spaces in plan and section, and to finally select light, color, and materials. However, in this plan, in which problem was assumed to be solved, the participants were asked to first choose light, color, and materials, and then visualize the spaces, and finally expand the plan and mass. Figure 4 is an example of the same student's design in the process of imagining a villa for the third test, in which the student refers to the interpretation of the scenario as well as the design ideas.
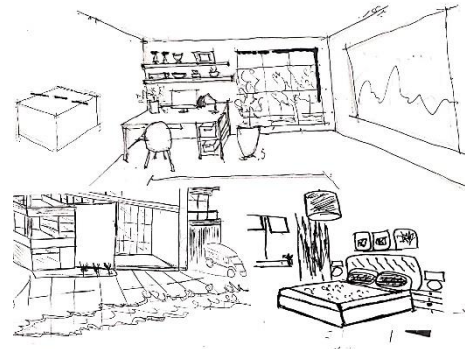

Figure 4. The design of the same student in the step of imagining a villa.

Strengthening memory and creativity: According to the theme "Design My Villa", each person needed to create interior spaces according to his or her life. To achieve this goal, the visual tool method of "My Family" scenario was used. "Image" in architecture represents the tools by which we think we can introduce a palpable reality. To achieve these goals, there are different practical methods. The important thing is that the findings obtained from applying this method can be taught to others. When we are in front of these images, it revolutionizes our visual and imagination power and creates actions and reactions. Figure 5 is an example of the same student's plan in the step of strengthening memory and creativity for the fourth test, in which the student pointed out how to use the given scenario in his design process.
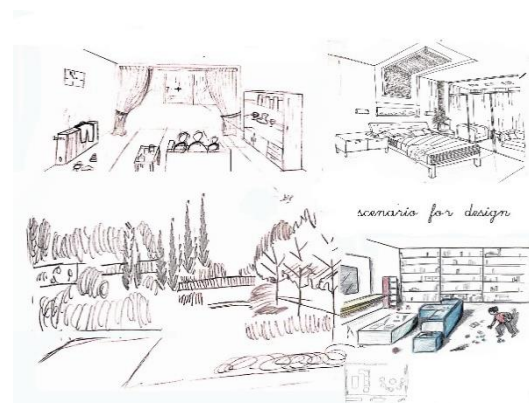

Figure 5. Design of the same student in the step of strengthening memory and creativity.

Space scenario: After creating the images by scenario planning, the students sketched. In these schethes, they tried to introduce the

enclosing elements of spaces, surface differences, light sources, and the overall nature of the space. Based on the written scenarios, each person began to do conceptual schethes to continue their work, which has an image of the villa spaces and can be placed in the center of the house. After that, this scenario was examined more closely, and, of course, other images were used in creating details of the design. Figure 6 is an example of the same student's design in the space scenario step, a part of a student's work for the fifth test, in which the student expressed his interpretations of the given space scenario.

Figure 6. Design of the same student in the space scenario step.

Final design: After receiving the general concept of a villa, its functional design was carried out based on the program and diagram of the relationships between spaces in the form of plans, elevations, views, sections, and site plans. This stage is efficient if we go through various sessions and corrections in order to achieve the desired spaces in "My Villa". In this process, in addition to responding to the family's spatial demands and needs in each scenario, students should also discuss how to build and use the materials, equipment, and facilities necessary for a safe and relaxing life in the villa. Providing a favorable arrangement of interior spaces with regard to the use of color, light, and texture is necessary in order to achieve a pleasant atmosphere in the villa. Figure 7 is an example of the same student's design in the final design step.
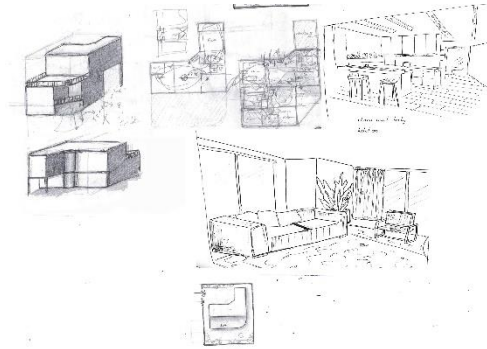

Figure 7. Design of the same student in the final design step based on 'my villa' scenario.

How to Run Design Tests

Both groups were tested before and after the six-week course in order to assess the effectiveness of architectural design training on creativity by the scenario planning method. The tests were administered in a quiet and calm atmosphere. Students were required to read the test and ask their questions before the test started, and they were not allowed to ask questions during the test. Also, the distance between the tables was such that the participants did not see each other's work. Since the tests were related to the initial design ideas and there was no complete supply (such as Rando), a limited time was dedicated. In similar studies (Dixon, 2011; Goldschmidt, 2014), almost 40 to 60 minutes was usually alloted for the test. So, 45 minutes was dedicated to this test. Participants were required to implement all the ideas of designing a residential villa on the A3 paper and present what they thought at the time of design. After completing the test, they were given 15 minutes to write additional explanations about their experiences. These conditions were observed both in the pretest and posttest for all participants. In the posttest phase, the test of the two groups was held in separate spaces, and each group was asked to design based on their learnings during the training period (the treatment period). In the time given to write additional explanations about the project, the participants of the scenario group were asked to mention the characteristics and points about the family members who have been effective in the design of the building in their scenario. These written explanations, along with sketches, can

help raters better evaluate design ideas. Similar to previous studies, the tests were evaluated by three raters (Merchant et al., 2014). Two raters were from Shariati Technical and Vocational College and a fellow professor was from the University of Applied Sciences and Technology, Branch 49 of Tehran, all of whom were unaware of the idea of research. The raters were asked to score their creativity from one to five according to each participant's sketches and writings, which is a 5-point scale (1: very weak, 2: weak, 3: average, 4: good, and 5: very good). Each rater's score for each student was independent of the other two raters. Data were analyzed using descriptive and inferential statistics. Descriptive statistics such as mean and standard deviation were used to show the participants' scores in the two stages of the pretest and posttest. Then, according to the number of participants in each group, Kolmogorov–Smirnov test was used to determine the normality of the data distribution. Paired t-test was used to determine the differences within each group, and independent samples t-test was used to determine the differences between the groups. In addition, Cronbach's alpha coefficient was used to determine the inter-rater reliability. Data analysis was performed using SPSS software (version 21) at a significance level of $p<0.05$.

Samples of a Student Udergoing Traditional Training and Another Student Udergoing the Scenario Planning Method Before and After the Treatment

Participants should present design ideas in a limited time, and written explanations along with sketches can help raters to better evaluate design ideas. Students' written explanations about design ideas consist of two parts: the scenario of residential spaces that can also be used in the answer to the problem and can complete their design ideas. The samples of the designs of a student using the traditional method before and after the treatment were presented in Figures 8 and 9 and another student's using the scenario planning method in Figure 10 and the design of the same student using the scenario planning method in Figure 11.
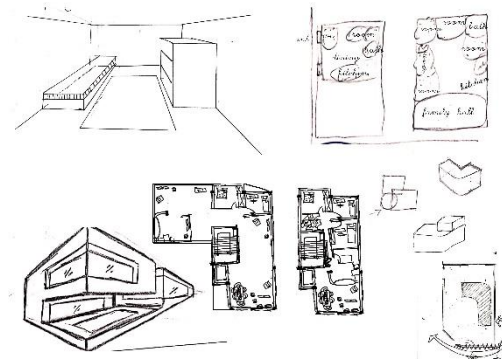

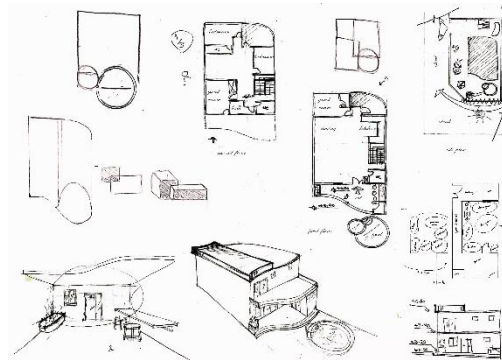Figure 8. Student design before using the traditional method.

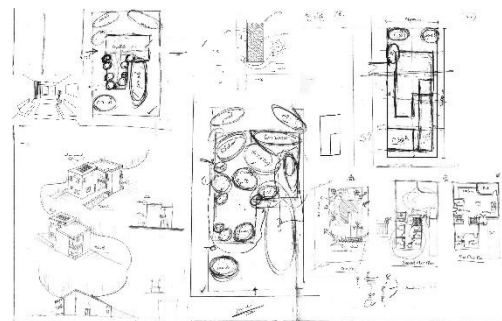Figure 9. Design of the same student using the traditional method.

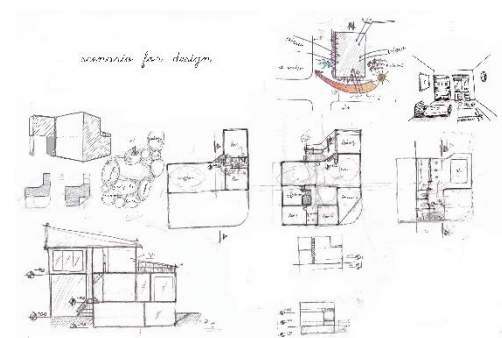Figure 10. Student plan before the scenario planning method.

Figure 11. Design of the same student using the scenario planning method.

Results

First, the normality of the data was confirmed by examining the results of Kolmogorov–Smirnov test ($p > 0.05$). Then, to determine the participants' mean score, the inter-rater reliability was obtained using Cronbach's alpha coefficient, the results of which are shown in Table 1.

Table 1. Results of Inter-rater Reliability in the Pretest and Posttest

Group	Step	Cronbach's Alpha Coefficient
Academic Education (Control group)	Pretest	0.88
	Posttest	0.94
Scenario Education (Experimental group)	Pretest	0.85
	Posttest	0.92

As Table 1 shows, the inter-rater reliability is good ($0.85 < ICC < 0.94$). Therefore, an average score can be used to compare scores in each stage. To determine the effectiveness of each method of academic training and scenario planning training on the creativity of students of University of Tehran in architectural design, paired t-test was used in each group. Table 2 shows the results of paired t-test in the control and experimental groups.

Table 2. Results of Paired T-test in the Experimental and Control Groups

Group	Step	M±SD	T	P
Academic training (Control group)	Pretest	2.82 ± 1.00	1.154	*0.000
	Posttest	3.34 ± 1.02		
Scenario training (Experimental group)	Pretest	2.54 ± 1.09	10.79	*0.000
	Posttest	4.07 ± 0.83		

* Results are significant at $p < 0.05$.

As shown in Table 2, there is a significant difference between the pretest and posttest of both groups. By comparing the means, it can be stated that both the academic training method and the scenario planning method have significantly improved the creativity of students of University of Tehran. Independent samples t-test was used to determine the difference between the two groups. Before comparing the posttest of the groups with each other, the homogeneity of the groups and the absence of significant differences in the pretest scores were confirmed by independent t-test ($p = 0.45$). Therefore, the difference between the two groups was determined by comparing the posttest results using independent t-test. Table 3 shows the results of independent t-test both in the pretest and posttest.

Table 3. Results of Independent Samples T-test in the Pretest and Posttest

Step	Group	M±SD	T	P
Pretest	Academic Education (Control Group)	2.82 ± 1.00	1.36	0.45
	Scenario Education (Experimental Group)	2.54 ± 1.09		
Posttest	Academic Education	3.34 ± 1.02	3.95	*0.04
	Scenario Education	4.07 ± 0.83		

* Results are significant at $p < 0.05$.

According to the results of Table 3 and due to the lack of significant difference in pretest scores, any difference in independent t-test results of the posttest can be attributed to the effectiveness of two training methods on creativity. Based on these results, there is a significant difference between the two groups of the academic training (control group) and the scenario training (experimental group) ($p = 0.04$). By comparing the mean scores of the posttest, it can be argued that the scenario training significantly improved the creativity of students' architectural design compared to the academic method. Figure 12 shows the average scores of the residential villa design test and changes in creativity score in the architectural design after completing the training period in the experimental and control groups.
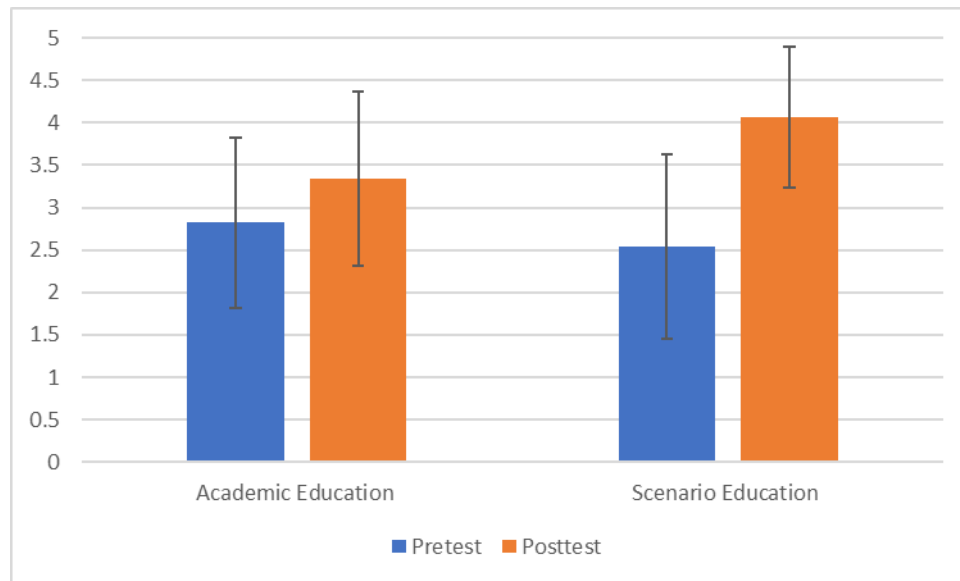
Figure 12. The mean scores of creativity in the pretest and posttest of the two groups.

CONCLUSION

The present study was conducted with an emphasis on the scenario planning training in promoting creativity of students of University of Tehran. By analyzing the basics and concepts, it was found that scenario planning and architectural design have a common conceptual framework, and that techniques and characteristics of senario planning can be used for idea-creation in the field of architecture.

The design process is the process of creating a work of art that involves a variety of methods. In scenario planning, the designer tells a story that can be used to interrelate the main features of the design. In general, designing is a kind of problem solving that can have different solutions. Since various factors are influential in designing, and it also includes different stages and aspects, the scenario-oriented design solves the design affairs more seamlessly.

In fact, planning a scenario by directing the student to imagine what he wants to build confronts him with the space he has in his mind. Investigating the scenarios planned by the students shows that some aspects of the design have been emphasized which have been revealed in the next stages and have highlighted the outstanding and distinct points of each design from other designs. Also, referring to

the scenario during the design process can be effective in organizing the information and decision making for the next steps of the process. Moreover, rechecking the scenario from the designed space continuously in different stages of design is an effective way to strengthen the student's thinking in the workshop and can reveal the strengths, weaknesses, defects, and possible shortcomings of the project for the student by imagining the presence of the audience in the space.

According to Van der Linden et al. (2019), the main audience of architectural design is users of the project. Today, this goal has been ignored by designers due to the complexity of architectural design. In order to achieve more creative architecture and to go beyond the conventional language of other architects, due to the similarities of scenario planning and architectural design, scenario planning can be used in the space design. For example, to solve the design problem, an architect chooses a scenario depending on the subject of the problem, he forms its architectural spaces and experiences within the scenario, and he experinces a different design process by analogy with that scenario.

The present study compared the traditional and the scenario planning methods and showed that in the scenario planning method, students' focus is on performance. In the scenario planning

workshop, based on the analysis of the workshop instructors about the progress of the designs, the design process has distanced itself from the dominant formalism approach in the design studio and got close to spatial considerations in accordance with real life, presence, behaviors, and activities of the hypothetical audience. The findings of the present study showed that students explain the space on behalf of the user. Whereas in the academic education method, the result of design is usually resulted from the designer's experience. In Bashier's (2014) research, in the study of academic architecture design, a poor relationship between studies and final product has been shown in most cases. By examining the previous studies, it was shown that the scenario is a coherent narrative with which it is easier to communicate than the logic of specialized design. Students' designs showed that scenarios provide understandable spaces.

In response to the research question about comparing the two methods, although the basis of the design process is the same, more opportunity is provided to create ideas in the scenario planning method.

By examining the characteristics of scenarios and their impact on the design process and by comparing the scenarios with the design samples and the works of students in the academic (traditional) method, the necessity of concentration and utilization of the scenarios is consistent with the first stage of creating ideas in the present study. In addition, scenario planning has helped to produce new user-oriented and event-oriented concepts in architectural design. Students have invented a creative solution in the scenario planning method to solve the challenges of each scenario.

Based on the instructors' analysis in this study, besides all the positive roles of scenario-based exercises, the weaknesses and damages can be noted by comparing what has been achieved with the research objectives and analyzing the findings. These damages are: (a) The students who are weak at writing skills are unwilling to participate in such exercises, (b) some aspects of the project remain in the form of imagination

due to the lack of accurate and comprehensive scenarios, (c) there is not a clear relationship between scenario education and the stages of development and accomplishment of the design, and (d) there is the possibility of putting scenarios in the path of unrealistic imagination to the project. Also, due to the limitation of time and limited knowledge of students about the possible audience of the space, and the conditions and requirements of their age and gender, it is not possible to match many aspects of life with the real audience of the project, and paying attention to the limited aspects of what the students' minds and imagination can access is realized. If it is possible to gather more information at the beginning of the project or define the design issue in a real context and the possibility of more detailed field studies with regard to the age, cultural and mental conditions of potential audiences, scenarios can be more realistic and, as a result, more effective.

Finally, according to the findings of the research, the effect of the scenario planning education on the amount of creativity in design of architectural students of University of Tehran showed that the scenario planning method improved the idea creation process in design of architectural students of University of Tehran.

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