Experiences in Architecture Creativity Education in Iranian Universities with an Emphasis on the Effects of Divergent and Convergent Thinking (Case Study: Faculty of Art and Architecture, Iran University of Science and Technology (IUST))

Mohammad Ali Kazemzadeh Raef [1], Mostafa Masoudinejad [2*], Behzad Vasigh [3]

1. PhD student in Architecture, Department of Architecture, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran.
2. PhD in Architecture, Assistant professor, Department of Architecture, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran.
3. PhD in Architecture, Visiting Associate Professor, Department of Architecture, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran / Jundi_shapur University of Technology, Dezful, Iran.

ABSTRACT

Designers and architects design architecture and create ideas by taking the advantage of the design process, and architecture professors play vital roles in this way because they consider design paths and lines of thought for designers and architects and give them the freedom to create creative designs. Undoubtedly, the final output of each designer and architect is related to the thinking of professors who have been or will be under their education. Given that the selection of either convergent or divergent thinking in the design process yields different results and affects the urban landscape and the architecture of any country, the present study sought to investigate the effects of divergent and convergent thinking on architecture creativity education in Iranian universities (case study: Faculty of Art and Architecture, Iran University of Science and Technology (IUST)). The research was applied in terms of purpose and had a mixed-method descriptive-analytical, survey, and case study method. Two tests were utilized to determine the effectiveness of the creativity education process for architecture students, namely Abedi's creativity test (ACT) and Torrance test of creative thinking (TTCT) in divergent thinking, and the Kolb Learning Styles Inventory (KLSI) in convergent thinking. The research data were collected using the field method with ACT, TTCT, and KLSI. The research examined 21 male and female students in the architecture discipline of the Faculty of Art and Architecture, Iran University of Science and Technology. Data analysis was performed using SPSS21. Therefore, the research referred to the concept of education in general, and architecture creativity education in particular, and then discussed education methods and models in architecture in an analytical approach. Finally, the research findings indicated that students with divergent learning thinking had greater creativity.

Keywords: *Divergent thinking, Convergent thinking, Creator education, Architecture, Iranian universities*

1. Introduction

Architecture is a multidimensional phenomenon that has a complex nature. Architectural design has been multi-dimensional and sometimes indescribable for designers. Therefore, teaching this phenomenon to an entity with mental, individual, personal, and cultural-social complexity should be performed with thought.

---

*Corresponding author: Mostafa-asoudinejad@iauahvaz.ac.ir

A part of educational errors originates from ignoring the students' capabilities and tendencies. The existence of these differences is a fact that can be experienced by every meticulous teacher due to the multi-dimensional nature of human beings but we rarely come across a correspondence that gives these differences a conscious and deserved place in the body of the architecture education program. Most of the written content and conventional methods were designed and implemented for audiences of the same level with the same characteristics. Are co-curricular programs beneficial and suitable for learners with different abilities?

Architecture is a multidimensional complex phenomenon. Teaching architectural design to an entity with complex mental, individual, personal, and cultural-social dimensions is worthy of thinking [1]. The architecture profession, and consequently, architectural education is a process that is strongly affected by the cultural factors of each country. Since the basic course of architectural design is an important period of the education course, it plays an important role in the formation of the student's personality and their approach to architecture and its related issues, including culture [2]. The architectural design subject is considered the most prominent axis of architectural education in most educational centers worldwide. The importance of this category is owing to the creation of a connection between two valuable topics in the architecture profession, i.e. theoretical topics, on the one hand, and executive and professional activities in design, on the other hand. Therefore, paying attention to architectural design course teaching is always a priority for the planners of the architectural education system [3]. The most important points to increase the architecture richness and education in Iran are to increase student's awareness of the glorious culture and history of Iran, create and stimulate the national and patriotic spirit of the youth, and teach architectural thoughts [4]. The designers' intellectual bases and thinking power during the design process are topics that are affected by cognitive psychology. The types of thinking and approaches adopted by designers play direct roles in the thinking process from question to answer and their results can be seen in the design outcome. In this regard, design teachers and educational planners in architecture must become familiar with the characteristics of thinking and the way of using the students' talents, and take measures toward the achievement of educational solutions [5] .

Architecture education with the aim of training inner talents and transfer of architectural concepts seeks to educate creative and knowledgeable people in this field [6] and is always an effort to fulfill the original human needs, in other words, being present in the world of life which is greatly affected by the basic knowledge about the most desirable form of human life[7].

The architecture education structure is formed around a core called design. The most important mission of architecture education is to form comprehensive thinking that provides the ability to take steps toward the architectural design process for architecture novices. The dynamic and living nature of architecture and two-way communication between two awake minds (teacher and student) will not accept a fixed and specific instruction. If we consider the training of architects, who have talent and ability, are proficient in specialized knowledge, and use this talent and knowledge for the right purposes, as the goal of architecture education, we can call the ability (interests, capabilities, and talents), knowledge (sciences and knowledge), and insight (direction of applying skills and knowledge in the creation of architecture) as the three main bases of architectural education [8]. The characteristics of design learners are the same as the characteristics of all humans that are placed in a category called personal differences. In other words, design learners are different in their ability to have knowledge and insight and transfer them to design activities [9].

There are architectural design courses in bachelor's and master's courses as the main axes of the course, and they are predicted as the most important courses in the field of architecture education based on various topics. In the teaching of these courses, there are usually no special resources for presentation and teaching; hence, the teaching and understanding of concepts are created based on the teacher-student relationship. Different teachers usually use different methods in teaching the design program according to their knowledge but the general work process is almost the same[10]. Architecture education imparts skills and knowledge from teachers to students. In this regard, it provides little opportunity for students' creative experiences. Significant changes have been observed in architecture education in prominent schools worldwide and an arena has been provided for creativity in recent years. Therefore, it is necessary to consider the thinking of the professors, who are under their training, to achieve the creative designs of architecture students.

Two types of thinking, divergent and convergent, are effective in architecture creativity education. These two types of thinking can be measured by Abedi's creativity test (ACT), Torrance test of creative thinking (TTCT) (divergent thinking), as well as the Kolb Learning Styles Inventory (KLSI) (convergent thinking) on architecture students to develop creativity in architecture education.
Research question: To what extent are convergent and divergent thinking effective in architecture students' learning about architecture creativity education?

2. Theoretical bases of research
2.1. Education and learning styles:
The professor's teaching method is a variable that can affect the students' competence. Professors need to use active teaching methods and use skills that will help in this matter [11]. Professors should create a favorable framework for students' learning with an ideal combination of different teaching methods and provide a way to achieve their goals and develop their competencies by organizing various teaching methods and making them available to students [12]. Professors know that the learning process and identifying people's learning methods are very important in improving education but their most important challenge is to know the learning characteristics of each learner and provide appropriate learning opportunities for them. This issue is extremely important in the training of professional skills because such skills must simultaneously have a combination of knowledge, attitude, and action [13]. Learning has several definitions, but in general, it is the process of creating a relatively stable change in behavior that is the result of experience. In learning, personal differences are extremely important, and a different learning program should be considered for learners with different abilities, talents, and experiences. The learners' learning styles are a topic related to personal differences in learning and it should be taken into consideration by educators to improve the quality of teaching, increase learning motivation, and the effectiveness of the teaching-learning process. Learning style is defined as the way of receiving and organizing information and is based on inter-individual differences in preferring the methods of receiving, organizing, and processing information and experiences in learning new concepts. On this basis, students also have unique learning styles as learners. Therefore, identifying students' differences in terms of learning styles is an inevitable necessity to improve the quality of learning [14].

David Kolb (1984, 1985) performed a type of classification of learning styles that is more compatible with the educational goals of design courses. This classification is based on a four-stage cycle according to the figure, called the experiential learning cycle that is extracted from his learning theory. According to Kolb's definition, "learning is the process by which knowledge is created through the transformation of experience." He means the interaction experience between the learner and the environment. Kolb's theory about his model or experience cycle is defined as follows: First, objective experience forms the basis of observation and thinking. Dimensions of these observations and reflections become abstract concepts and generalizations. Guidelines for action can be extracted from these abstractions. These guidelines can be thought of as hypotheses that guide actions and can be tested in new objective situations, thereby obtaining new objective experiences. "Even though Kolb's model places learning in four categories with great order, it also conveys the message that learning is a process and a smooth cycle that consists of a combination of elements and it should be taken into consideration while studying or teaching others." According to [15] , Kolb believes that learning occurs in a four-stage cycle in which each stage represents a learning method.(Figure 1).
Four learning styles arise from the two-by-two combination of learning methods:
1.Adaptive learning style: Objective experience+ active experimentation [16]
2.Convergent learning style: Abstract conceptualization+ active experimentation [17]
3.Divergent learning style: Objective experience+ reflective observation [17]
4.Absorbing learning style: Abstract conceptualization+ reflective observation [17]

2.2. Convergent and divergent education from the perspective of Dr. "Isa Hojjat"
Dr. Issa Hojjat offers a new definition of architecture education under the title of "convergent" and "divergent" education. He believes that "Traditional architectural education is the flow of skills and sustainable and stable principles of traditional architecture from the master's actions in students' opinion. In the education under the control of École des Beaux-Arts, the way and customs, and vision of École des Beaux-Arts- with sometimes western,local, and eclectic examples- are reflected in the teacher's words in the expression and drawing of the student. Education in the Staatliches Bauhaus
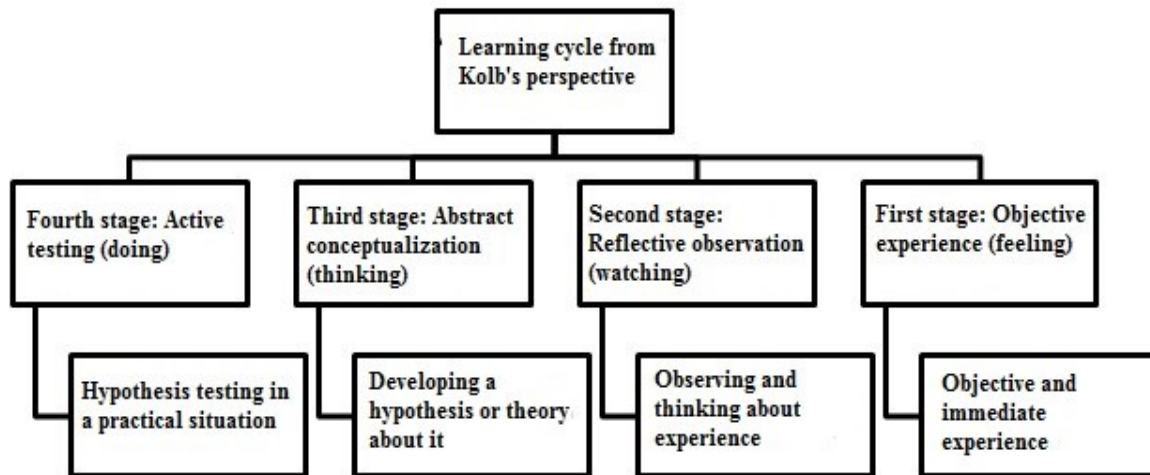
Figure 1: Kolb's learning cycle (source: author, taken from [15])

system refers to learning and sometimes imposing the ideas of the elders and pioneers of modern architecture from teachers to students. The common feature of these two methods is the existence of principle determination and the mediating role of teachers between principles and students. Convergent education means traditional education and the student's absolute obedience to the teachers, and divergent education means education in the modern era and non-acceptance of the teacher by the student [18].

2.3. Divergent thinking and its application in architecture education

Some environmental designers, including architects, consider design as a series of actions that are internal and indistinguishable. In this approach, it is assumed that the design process consists of analysis, synthesis, and evaluation, in which the designer is like a "black box" that transforms the received data into a presentable result in a complex process. Numerous design processes are manifested unconsciously and based on powerful mechanisms of mental logic; however, the general nature of the decision-making process is understandable [19].

Divergent thinking is defined as thoughts that lead to appropriate, desirable, and at the same time, unusual answers to a special problem. In divergent education, the teacher is not obliged to teach certain principles, and the students do not consider themselves obliged to accept specific and predetermined rules; hence, there are no well-defined principles and rulings for education and judgment [20].

Divergent thinking represents a much more open and free type of intellectual practice which is characterized by a large number of associations and possible solutions [21]. Divergent thinking allows people to leave the closed circle of their experiences and look beyond their experiences. Guilford believes that a person can create a new thought in a situation despite weak and little data and even a lack of previous information in divergent thinking [22]. Divergent thinking is usually spontaneous, occurs in a free flow, and discovers many solutions in a short time. It is thinking that goes in different directions and solves a problem with very different and new solutions [23].

Therefore, divergence thinking is considered a type of creative thinking [24] and it is thinking based on a general and sensory attitude and related to the right cerebral hemisphere[5] . Divergent thinking is a type of intuitive thinking [24] that is related to a huge flood of ideas and options and is also known as horizontal thinking.

Many new ideas are produced for some mental tasks in divergent thinking, in other words, many different solutions are possible to solve a task [25]. The design process has an internal type in this case. In other words, the designers internalize the question and look for an answer in their subconscious or meta-consciousness and then present its external form [26].

Table 1: Typology of divergent education in architecture ([8] ; [20])

Typology of divergent education	
Unbiased education: Everyone with their taste	**Much-biased education: Everyone with the taste of the day**
➤ The teacher as a messenger and steward of the latest achievements in the world (western) ➤ The last thought of the day as the best thought ➤ Encouraging the students to follow the latest achievements of architecture in the world (Western) and the taste of the day ➤ The work judgment criterion, and the degree of closeness to the taste of the day (The closer it is to the taste of the day, the more value it has.)	➤ The professor's avoidance of participating in valuable and useful discussions ➤ Playing the role of a teacher in an unbiased way for the explanation of numerous diverse architectural philosophies and ideas ➤ Equipping the students with the necessary skills and knowledge and leaving them alone with all thoughts to choose their vision and behaviors. ➤ The teacher's judgment about each plan in line with the same Plan

Architecture education has become diverged since the beginning of the 1380s when the number of architecture schools reached three- the School of Fine Arts, the Shahid Beheshti School, and the School of Science and Technology) Because there was no longer a

2.4. Convergent thinking and its application in architecture education

Some models of the environment design process are rational [19]. Convergent thinking is of this type and it refers to thoughts that lead to a usual answer or the only correct answer that is known in advance. The teaching environment and subject in the convergent method have specific, specific, and predetermined principles, and thus, the teacher's duty and student's task are clear. In other words, the teacher teaches the necessary principles and the students learn and use the principles [20].

single unit of architecture, the era of following schools and single principles had ended, and it gradually turned into "door-to-door" education owing to the multiplicity and shortening of the styles[8].

Convergent thinking is a kind of thinking based on analysis and logic and is related to the left cerebral hemisphere[5]. It proceeds based on logical steps and is considered a kind of unificationist thinking [5]. [5],[24] Convergent thinking uses dominant mental processes that are only used to solve a task [25] and is a kind of critical thinking [24]. The design process is external in this type of thinking. The designer answers the problems through logic and reasoning [26].

Table 2: Typology of Convergent Education in Architecture ([8]; [20])

Traditional education	Tradition-oriented education	Ideological education
Its manifestation can be seen in the traditional architecture of Iran which is a manifestation of common thinking Fixed and clear principles, which are derived from facts, are taught by the teacher, who knows them, to the student who receives them.	Traditionalist education leads to adapted architecture (repetition of past patterns) and eclectic architecture (e.g. collective housing with a multi-story central courtyard) in pursuit of the revival of unsuccessful traditional architectural values and patterns to respond to new needs and understanding the limitations of today's efforts to revive the traditional education method and the teacher-student relationship during construction and it lacks or violates the advantages of traditional architecture. Tradition-oriented education- both in the method and in the example- refers to clinging to the benefits of the past and ignoring the reality of the day. This education results in "hybrid" buildings that present a modern function in an ancient form.	It works when, firstly, there are certain principles, and secondly, these principles are accepted by society. Definitive, irrevocable, and non-violent instructions are taught. The instructions rang from political-philosophical principles to architectural principles (e.g. the five principles of Le Corbusier and the resolutions of Siam)

The architecture of each land is a symbol of its identity. Iran, with its brilliant background in civilization and the spread of Islam, has a strong historical, Iranian, and Islamic identity which requires knowledge of the theoretical bases of architecture. In the past, the principles and values were mostly transmitted through the teacher-apprenticeship system in the cultural context of society, but this kind of education does not exist in today's architecture schools [27]. Traditional architecture depends on four factors: time, place, culture, and a special meaning. Paul Oliver defined traditional architecture as architecture that has a special cultural burden transferring from one generation to another over time [28]. Modernism thought has brought a fundamental change to people and their culture owing to the influence of its intellectual and philosophical foundations on architecture and the emergence of its principles in architecture and urban planning, and it has sometimes unintentionally pushed them in a direction that has shown abnormal consequences years after their occurrence [29]. The school of architecture in Iran, which was derived from the ideas of École des Beaux-Arts and the Staatliches Bauhaus and continued until the late 1970s, is related to convergent education because it had a specific policy and principles, and this made the movement of the students to be guided in that direction and the corrections were made according to them [8].

Architecture creativity education
According to studies, learning is an important platform for increasing creativity [30]. Creativity has been taken into consideration as one of the most important functions of the educational system because it is the most prominent feature of humans and plays a special role in human progress [31].

Mayer and Weisberg, quoted by Dr. Marzieh and Panahi, define creativity as the time when a person uses a new solution to a problem. The two elements, namely being new and providing a solution to a problem, are important in this definition. Guilford, who is an important psychologist in the field of creativity, considers creativity a set of abilities and characteristics that lead to creative thinking. He was the first researcher who differentiated between intelligence and creativity. He considered intelligence as convergent thinking, and creativity as divergent thinking [32].

According to him, the difference between them is that the result of thinking is already known in convergent thinking, in other words, there is always a right or wrong answer, while there is no definite answer in divergent thinking and there may be many possible answers all of which might be logically true. In Guilford's theory, quoted by Ghasemi and Oghlidos, divergent thinking consists of several factors, the most important of which are as follows: (Figure 3)
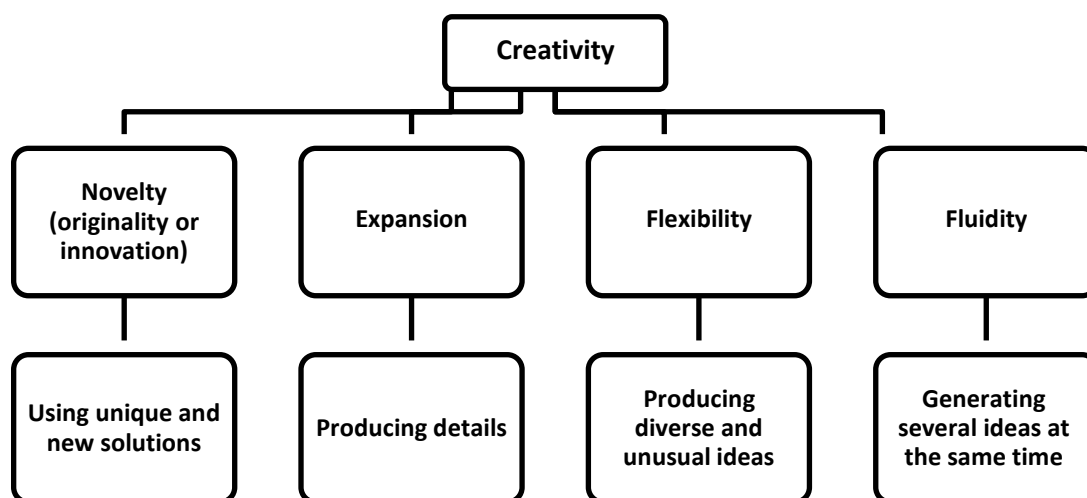

Figure 3: Aspects of creativity and divergent thinking in Guilford's theory, source: [15]

The American humanist psychologist, Maslow, believes that creativity originates from the unconscious mind. He mentions two types of creativity, primary and secondary. He believes that finding complete compatibility with reality leads to a personality gap because people deprive themselves of everything that is inside them as well as the joys of life. Protecting themselves against the inner hell according to Maslow, they also distance themselves from their inner paradise which is the source of their pleasures, the ability to express love, and most importantly, to be creative [33].

The experiences, which we gain at home and in the environment, and the education received at school, make us accustomed to convergent thinking and common life. Therefore, it is necessary to meet two main conditions to be able to teach creativity:

1-First, we should abandon the idea that creativity is inherent and only a few people have it. Few people indeed have much creativity, but the rest can also benefit from sufficient creativity if they are trained properly.

2-The educational environment should be changed in a way that the possibility of the development of creative thoughts and actions is provided. Divergent thinking should be combined with convergent thinking in education and not be satisfied with dry and flexible criteria [34].

The examination of theoretical principles of research indicated that the two types of thinking, divergent and convergent, were effective in architecture creativity education. These two types of thinking can be measured by Abedi's creativity test (divergent thinking) and The Kolb Learning Styles Inventory (convergent thinking) to provide architecture creativity education for architecture students.

3. Research method

The present research was applied in terms of purpose because it sought to provide a solution to improve the quality of teaching architecture courses, and it had a developmental type since it sought to develop and optimize the existing systems.

The stage before starting the educational model is necessary to measure the creativity of students owing to the following reasons:

1- It helps the teachers and professors to have a prior and relative knowledge of the creativity level of the class to choose and formulate the problem-solving process of the plan correctly. Therefore, the teacher can test the students and get acquainted with the level of creativity in the classroom.

2- The professor can get acquainted with the students' relative abilities and choose the educational model and the content of the job description based on the abilities of the majority of students or relatively. In other words, it is possible to choose an educational method by paying attention to the abilities, talents, capabilities, and general competence of the classroom

3- The ability and intellectual level of each student can be determined by the teacher; hence, in addition to creating motivation and self-confidence, every student can be directed according to their characteristics and the intellectual background of each can be organized in a desirable path. Therefore, concurrent validity and content validity were used in this section.

The data of the present research were collected using the field method and questionnaires. ACT, KLSI, and TTCT were utilized to collect data and discover the individuals' opinions. The validity and reliability of KLSI were examined several times in Iran based on the questionnaire translated by Largani (1998), Rahmani Shams (2000), and Taghvaei (2002). On this basis, Cronbach's alpha coefficient was accepted; hence, there was no need for re-examination [35]. Furthermore, Anil et al. (1994) stated that more than two thousand articles were published in which the Torrance test of creative thinking was used as a measure of creativity[36]. Therefore, the validity and reliability of this questionnaire had no need for the re-examination. This research examined 21 architecture students in the Faculty of Art and Architecture of Iran University of Science and Technology. The sample size was obtained using the cluster method. Analysis of raw data of the research was performed by SPSS21.

A- Abedi's creativity test: This test was developed by Abedi in Tehran in 1993 based on the Torrance test of creative thinking. In 1986, Abedi and Schumacher "reconstructed the test items in America due to lack of access to the original version. The new version of the test was revised many times and was first described by [35]. The test had three-option 60 questions, consisting of fourteen subtests of "fluidity, expansion, innovation, and flexibility". They examined the level of creativity in four sub-questions: fluidity and buoyancy of thought, or in other words, mental fluidity; the expansion and generalizability of concepts and the placement of options in affairs; initiative and the degree of dissent in creation and creativity; flexibility and the ability to accept issues outside the background and mental assumptions [36].

B- The Kolb Learning Styles Inventory (KLSI): This scale was published by David Kolb in 1971 to measure the experiential learning model and has been revised five times since its publication, and it includes 1985, 1993, 1999, and 3.1 (2005) versions. The Kolb Learning Styles Inventory (KLSI) consists of 12 terms and 4 options for each sentence. Each option respectively represents one of four learning styles: objective experience, reflective observation, abstract conceptualization, and active experimentation. The sum of the scores of these options is four, representing four learning methods [37].

4. Research findings

The student participants included 16 females and 5 males in the Faculty of Architecture of the University of Science and Technology. The morning and afternoon classes were merged according to the nature and purpose of education, and the length and lack of time to teach creativity models and techniques:

1.Sex: The students included 16 females and 5 males.

2.Age: The students' age was from 22 to 27 years. The wide range of students' age made it necessary to emphasize more variety and scope in the selection of general methods of teaching creativity under divergent and convergent thinking; hence, each group could adapt to their age and change their mental presuppositions and preconceptions and views to achieve a creative process of architecture.

The Torrance test of creative thinking (TTCT) was performed on 21 sample students in the third session to obtain the correlation coefficient of the two tests. The following table presents the correlation coefficients between the sub-tests of the Abedi and Torrance tests. Calculating the correlation between subtests of the Torrance and Abedi tests is necessary because the four categories in creativity tests are not completely separate from each other and there is a relative relationship between them. Therefore, the relationship between the creativity categories of the two tests was calculated to determine their correlation with each other [38].

Table 3: Correlation of subtests of Abedi's creativity test and Torrance test of creative thinking

| Abedi's creativity test and Torrance test of creative thinking	Fluidity	Expansion	Innovation	Flexibility
Fluidity	0.419	0.314	0.101	0.346
Expansion	0.316	0.361	0.431	0.236
Innovation	0.548	0.469	0.439	0.341
Flexibility	0.479	0.367	0.698	0.471

According to the above table, the highest correlation of 0.548 was obtained between Abedi's creativity-innovation subtest and the fluidity of Torrance test of creative thinking, and the lowest correlation was 0.101 between the innovation and fluidity subtest.

Table 4: Comparison of the mean scores of the divergent learning cycle

| Variables	Mean	Sd	T-value
Fluidity	49.54	4.36	0.48
Expansion	47.98	3.73	0.56
Innovation	63.74	4.53	1.89
Flexibility	57.34	3.98	1.33
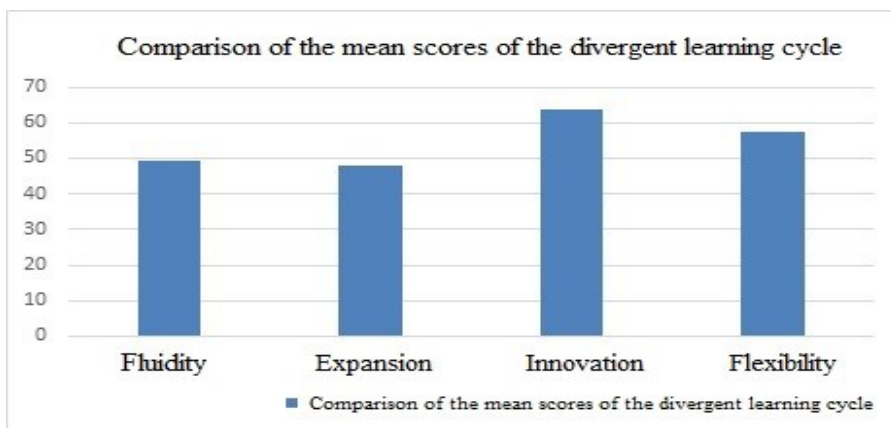
Diagram 1: Comparison of mean scores of the divergent learning cycle

According to the results of the table above, the mean obtained for the innovation component (74.63) was higher, indicating that divergent thinking had a positive effect on students' creative learning and improved their fluidity, expansion, innovation, and flexibility.

Table 5: Comparison of mean scores of the convergent learning cycle

| Variable	Mean	Sd	T-value
Active experimentation	27.30	3.36	1.98
Abstract conceptualization	29.69	4.39	1.36
Reflective observation	30.41	4.56	0.98
Objective experience	33.97	4.31	0.74
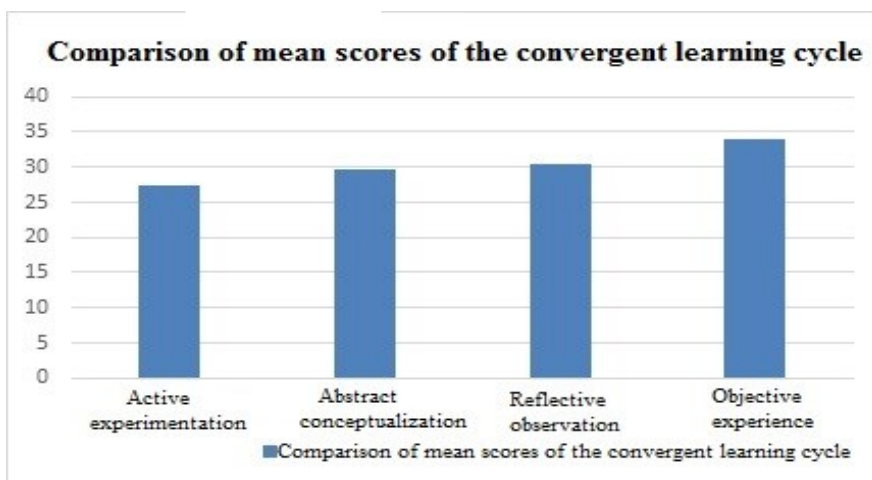
Diagram 2: Comparison of mean scores of the convergent learning cycle

Table 6: Dominant learning style

Learning style	Mean	Sd	T-value
Divergent	65.31	6.74	1.41
Convergent	41.14	3.96	0.68

According to the results of the diagram 2, active experimentation was the dominant style in convergent thinking. According to Table 6, the mean score of creative thinking in students, who had divergent learning styles, was higher than the convergent style. In other words, students with divergent learning styles had a higher level of creative thinking.
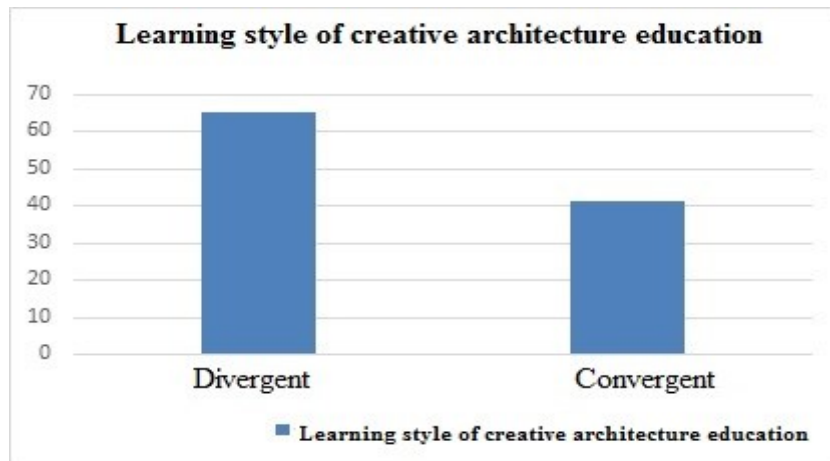
Diagram 3: Mean score of dominant learning style

5. Discussion and conclusion

The present research examined students' creativity levels and types of learning styles before receiving specialized education by conducting standardized tests to detect personal differences and educational needs and develop and implement suitable educational strategies because if there were any significant differences among students, providing common educational programs for all learners would decrease the efficiency of architecture education. The results indicated that architecture students had different learning styles. Studies on learning styles in different countries reported different results on dominant learning styles of architecture students, as presented in the following table:

Table 7: The dominant learning style of architecture students

Dominant style	Research on learning styles
Divergent	Kwan and Yunyan, 2005 Akinyode and Khan, 2016 Maturakarn and Moorapun, 2017 Mirmoradi, 2017
Convergent	Demirbas and Demirkan, 2003 Demirbas and Demirkan, 2007

Based on the research findings, students with divergent thinking had higher creativity. The architecture students mainly discussed in the classroom while examining their creativity. The initial sessions of the class were about identifying the current creative abilities of the students through Abedi's creativity test and Torrance test of creative thinking. In creativity education, the teachers' main task is not to prepare and impart knowledge to students, but their task is to facilitate the acquisition and understanding of knowledge and wisdom by students themselves. What their students get is much deeper and more lasting than what is given to them. Programs of creativity education must be designed in a way that they force students to experience and discover new points in various fields. Educational programs can start with the design and explanation of questions, moving in the unknown, and aligning the way to reach the information according to the power of revelation and the mental strength and creativity of students. According to the author, creativity education continuously puts stimuli in front of student's minds and always waits for a moment that makes them ecstatic to understand the concept of creating a work. This requires using opportunities that can be used by the teacher to start discussions according to the class conditions. Torrance test of creative thinking was used as a validity index together with Abedi's creativity test to determine validity. Except for the expansion category, which had no significant correlation with other sub-tests in both tests, the correlation coefficients of other sub-tests indicated a higher correlation level than the correlation coefficients of other usual tests. The non-significance of expansion correlation coefficients may be due to the difference between Abedi's creativity test and Torrance test of creative thinking.

The divergent style was dominant in the present research. Even though these differences can be caused by several factors such as culture, basic education, and methods of admitting architecture students, it is necessary to note that these differences can primarily be caused by personal differences among students. Different and sometimes contradictory results of these studies prove this claim. Therefore, achieving a dominant style for students to plan education in line with its characteristics causes neglect of other learners with different styles.

It is thus necessary to study students individually and plan educational methods in a unique way. It can be explained that students' lack of knowledge about personal capabilities, abilities, and talents does not make it possible to teach correctly according to each person. Even though most people believe that creativity and its use in all areas of life are limited to certain people who are inherently creative, scientists believe in the naturalness of this process and also put absolute priority on the education of creativity methods, as well as examining the characteristics of creative people to provide the emergence of this vital process. The studies indicated that there were strong and weak creativity talents in all people and they could be taught and nurtured.

It is also found that the left hemisphere of the brain is responsible for mental activities in the field of convergent thinking, such as memorizing, and the right hemisphere of the brain organizes activities in the field of divergent thinking. Unfortunately, the educational system of Iran mostly uses the left hemisphere of the brain and prevents the development of individuals' creativity. Teachers and professors must force students to think in a new way by presenting problems and activities with more than one solution and breaking old and traditional frameworks. A characteristic of creative people is their independence of personality and self-confidence. By strengthening these characteristics in them, they can provide new thoughts and not be afraid of being mocked by others. Since architects are the creators of space and beauty, and often need spatial perception, imagination, and innovation according to their profession, and as explained earlier, all these cases are the tasks of the right hemisphere of the brain and it creates divergent thinking, all these issues indicate the importance of paying attention to divergent thinking and its use and teaching to architects.

It reveals the important task of universities and architectural education centers because these centers teach students the correct policy of proper thinking, the examination of all possible options, and the selection of the best and most efficient options. If the above-mentioned cases are taken into consideration, they will lead to creativity in the students and these young architects will create creativity and innovations in cities, and build creative cities with more creative people.

Reference

1. Hosseini, E. S., Flamaki, M.-M., and Hojjat, I. (2019). The roles of creative thinking and learning styles in architectural design education, Andisheh Memari biquarterly journal, 3 (5) 125-140.

2. Gharibpour, A. (2019). Assessing the possibility of paying attention to cultural components in teaching the basic course of architectural design, Hoviate Shahr, 13(38), 5-20.

3. Mahmoudi, A. S. (2002). The challenges of teaching architectural design, and examining the views of professors and students, Fine Arts, (12), 70-79.

4. Mohammadi, O. (2017). A study on architectural education in Iranian colleges, A National Conference on New Approaches in Civil Engineering and Architecture, 1, 1-12.

5. Mahmoudi, S. A.S. (2014). Design education, fine arts, (interactive thinking), thinking in design. 20, 27-36.

6. Bastani, M.,and Mahmoudi, S. A.S (2018). Methods of idea and concept creation in architectural design process, Fine Arts, Architecture, and Urbanization Journal, 23(1); 5-18.

7. Norouz Borazjani, V. (2011). The relationship between questions and architectural education, Honarsou, 1 (1), 5.

8. Hojjat, I. (2012) Architecture is in our heart, Tehran: Elme Memar.

9. Hatamian, M.; Moeini, S. H. (2018). The position and characteristics of the architectural design course 1 at the University of Kashan (undergraduate course) and the importance of the personal differences of learners. Safeh Biquarterly journal. Vol. 28. No. 80.

10. Sharif, H.,and Nadimi, H. (2013). An Interaction between idea generation and processing in architectural design thinking, 62, 19-26.

11. Zolfaghari, M., Bidokhti, A. A., and Jafari, S. (2018). The structural relationship between teacher and student interaction, and the professors' active teaching method with the development of students' competencies, mediated by knowledge acquisition. Journal of research in educational systems. No. 40.

12. Roberts, A. 2006. Cognitive styles and student progression in architectural design education, Design Studies, Volume 27, Issue 2, pp.167-181.

13.   Ali-Beigi, A.H., Athari, Z., and Geravandi, S. (2011). The relationship between learning style and personality dimensions of students in agricultural education centers in Kermanshah province. Research in educational systems. Vol. 5. No. 12.

14.   Moradi, Kh, and Papzan, A. (2014). Identifying the learning styles of students at the Kermanshah University of Technology to provide effective teaching methods. Research in educational systems, Vol. 8. No. 26.

15.   Mansouri, N. (2000). A study on the relationship between personality traits and learning styles with the academic progress of female high school students in Tehran. Master's thesis, Al-Zahra University of Tehran, Tehran.

16.   Seif, A.A. (2011). Modern educational psychology; psychology of learning and education, Doran publication.

17.   Cesur, M.O. (2011). A model explaining the relationship between strategies, learning styles and success in reading comprehension, journal of Education.41, pp 83-93.

18.   Parnian, L. (2018). School of art and architecture with a sustainable architecture education approach. Master's thesis at the University of Tehran. Tehran.

19.   Lang, J. (2015). The creation of architectural theory: The roles of behavioral sciences in environmental design (translator: Alireza Eynifar, 8th edition), Tehran: University of Tehran.

20.   Gorji- Mahlabani, Y. (2018). Teaching modern architecture and future challenges. Educational technology scientific-research journal. Fourth year, Vol. 4, No. 3.

21.   Zare, P., and Mousapour, N. (2013). Providing a basis for divergent thinking through games in elementary school books. The Conference of the Iranian Curriculum Studies Association. The University of Birjand.

22.   Beyrami, M. et al. (2011). A study on the level of co-oscillation of theta band brain waves in convergent and divergent thinking. Advances in Cognitive sciences. 13th Year. No. 50.

23.   Akbari Chermahini, S, Sajjadinejad, M.S., and Molaei Yasavoli, M. (2019). Psychometric characteristics and factor structure of the Persian version of Remote Association creativity test (convergent thinking). Cognitive psychology. Vol. 7, No. 1, Serial No. 19.

24.   Sadeghi Mal-Amiri, M., and Raeisi, M. (2019) Presenting a conceptual model to measure creativity. Bimonthly Journal of Human Development of Police, 9(30), 129-1997.

25.   Azar, E., Bigdeli, I., and Ghanaei Chamanabad, A. (2019). The functional role of synchronizing alpha wave activity in divergent and convergent thinking. Shafaye Khatam neuroscience. Vol. 7. No. 2. 33-43.

26.   Tayefeh, E. (2014). How can we design architecturally? Yaghmaei publication, Tehran.

Samkhanian, M. R., 2005. Creativity and innovation in educational organizations, first edition, Tehran, Resaneh Takhasosi publications.

27.   Mansournejad, H. 2017. The relationship between architecture education and students' intellectual preference. Safeh publication. Vol. 27. No. 77, pp. 35-48.

28.   Sadeghpey, N. (2009). A contemplation in traditional architecture. Safeh, Vol. 18. No.48. 7-16.

29.   Naghizadeh, M. (2000). Qualitative features of desirable housing (the basics of design and its acquirement methods). Safeh. Vol. 10. No. 31. 90-103.

30.   Valian, Sh. (2019). Engineering (architecture) of educational spaces and creative thinking, Tehran: Aria Danesh.

31.   Amabile, T. (2019), Nurturing children's creativity, translated by Hassan Ghasemzadeh, first edition, Tehran, Donyaye Now Publications.

32.   Marzieh, A., Panahi, Gh. (2015), New theories and approaches in creativity, Cheshmandaz-e Ghotb Publications, Nasser edition, Torbat-e Heydarieh.

33.   Maslow, A. H., (1992), Toward Psychology, translated by Ahmad Rezvani, Astan Qods Cultural Deputy Publications.

34.   Samkhanian, M. R.(2014), "Creativity and innovation in educational management organization", Tehran.

35.   Karimi-Moshaver, M. (2012). The relationship between learning styles and students' performance in an architectural design workshop. Bagh-Nazar Quarterly, Nazar Architecture and Urbanism Research Center. Tehran.

36.   Daemi, H., and Moghimi Barforosh. (2014). Creativity test standardization. Journal of Cognitive Sciences updates. Year 6. Nos. 3 and 4.

37.   Bahrami, M. (2015). The relationship between math anxiety and learning styles by solving verbal problems in Algebra and the Third Probability in Mathematics in Karaj. Ph.D. thesis, Islamic Azad University of Tehran, Science-Research Branch, Tehran.

38.   Anjam Shoae, A. (2011). An epistemological approach to the effect of criticizing the institutionalization of tacit knowledge in architectural design education. Ph.D. thesis in Architecture, Islamic Azad University of Tehran, Science-Research Branch, Tehran.