Examining the Components of Teaching Creativity in Architecture with an Emphasis on Semiotics

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Research Article

Abstract

The design process is a set of steps that a designer goes through consciously and unconsciously to achieve a solution to the design problem. What is more important than the design itself is the design process. The goal of a design is to achieve creativity that shows itself in a specific spatial or physical composition. By applying the science of semiotics in design, creativity can be increased in people and people's mental schemas can be strengthened to remember different spaces in people. This research aims to extract and categorize design education components based on semiotic opinions. The methodology is a combination of qualitative and quantitative nested types with quantitative analysis units. In the qualitative stage, semi-structured interviews were used to identify the variables after extracting the concepts, to conduct interviews to clarify the components of the

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theoretical field effective in design education, and semi-structured interviews were conducted with 28 experts in this field. The results are entered into the ATLASTI version 9.1 software for ease of doing the work. The components were extracted and based on them, a questionnaire with a Likert scale was compiled and distributed among 384 architecture students. The data are analyzed in ORIGINPRO software version 9.9.0.225. The results show that the components of training to observe the principle of holistic view and training to create spatial levels with a value of (1.000) have the highest factor contribution and the least related to the use of different types of light with a value of 0.331.

1. Introduction

The process of architectural education is assumed to be a fluid and dynamic process that also benefits from the scope of research and research related to the cognitive process of architecture. Therefore, it is not possible to make creative design possible without knowing and understanding the problem to be designed on the one hand and, on the other hand, creativity in the sense of its application in the process of architectural design in terms of form, function, materials and technology. Although there are many definitions for design, they mostly agree on the point that "design is the process of inventing physical things, the result of which is order, organization and a new physical form in order to respond to some human needs (Alexander, 1964). But since there is no formulation or pre-determined steps to convert performance into physical form and nature. They consider design to be more of an art than a science, and they consider design to be a repeatable process of trial and error, which relies heavily on knowledge, experience, and intuitive knowledge, and this intuition has become the basis of many design theories or black box theories. The imbalance between values in architecture has led to the separation of science and practice, and strengthening this attitude has caused architects to rely more on creativity (Boyce, 2003).

In the field of theoretical literature and regarding the process of problem solving in design and creativity in architecture, the category of creativity in architectural education is one of the new concepts that can be considered with the help of new educational technologies. The training of creative minds in architecture students for creativity in design has become one of the necessities and at the same time challenges of the higher education system in this field (Karbasi and Sadram, 2015: 17). Therefore, the development of creative teaching patterns and methods in architectural design is one of the main priorities in the architectural education system, and considering that professors should try to use effective teaching methods to create the basis for the emergence of students' actual abilities by fostering creativity and the use of suitable schemes in the design of providing facilities doubles the necessity of dealing with this issue (Redeemer, 2003: 115). Looking at the importance of cultivating creative power in students and the models related to architectural education, as well as the important role of the scheme in architectural design, it can be understood that according to the type and content of architecture education, a thinking model should be selected or designed for teaching skill courses in this field, including Conducted skill courses in practical workshops in schools, institutes and schools of architecture (Thaghafi et al., 2014: 83). Because recent experiences have shown that the types of thinking and the designer's thinking power during the design process have a direct role in achieving creativity and creativity in design, and the result will be clearly evident in creative architectural designs (Nikkar et al., 2012: 28). On the way

to reach this problem, design teachers and architectural planners should understand the characteristics of thinking, its dimensions and especially creative thinking, how to take advantage of students' hidden talents and take the necessary measures to achieve new educational and educational solutions. act This research seeks to extract and evaluate the effective components in teaching creative design with an emphasis on semiotics and tries to answer the question that what are the effective components in teaching architectural design based on semiotics?

2. Theoretical Foundation

2.1. Semiotics

Semiotics refers to the knowledge that examines the social function of signs and finds the mechanisms of meaning generation through sign systems (Sojodi, 2007: 132). In other words, the application of the science of signs with regard to all cultural manifestations in the form of layers beyond tangible and perceptible signs and paying attention to the implicit meanings and discovering the absence of the text is called semiotics (Dinah and Anne, 2001: 119). Architecture, like any other means of communication, in the conversation process of any social text, carries a message or a set of messages that are conveyed to the audience by means of semantic nodes and intertextual relationships. The audience also tries to receive the messages of the text or create meaning for the text according to the network forming the text and the layers and relationships within the text and through social conventions, issues and mental perceptions and the type of look and angle of view (Ahri, 2017: 401). Therefore, each text opens a system and network of meaning to the audience, and each of the components of this vast network points to another member (Boyce, 2003: 451). Each of these components is a sign that invites the audience to "reproduce" the text, so every text is a network of signs (Asgaripour, 2023: 26). These signs do not have a specific meaning in isolation and show their significance only in the context of the text network. As a result, in order to recognize, interpret, interpret and make meaning of the text, there is a need for a coherent knowledge that deals with the recognition of the micro elements of the text network and the internal relationships of the text and the interpretation of the meaning of the text; This knowledge is called semiotics (Dabbagh and Mokhtabad, 2010: 70).

In the European approach, the Swiss linguist Ferdinand de Saussure was one of the first to emphasize the importance of semiotics, so that he may be considered the founder of semiotics in its European approach. According to Saussure, semiotics is the science of researching systems of meaning (Ahmadi, 2008: 12). From this point of view, semiotics is a closed military and emphasizes the relationship between Dali and symbolic in its abstract form. On the one hand, Saussure's sign gave importance to the necessary relationship between the signifier and the signified, and on the other hand, he considered this relationship optional, which could not be justified from the point of view of the value system. Therefore, Saussure's symbolic sign describes the final and finished certainty (Sasani, 2009: 46).

The choice of the term sign-semantics for this science is related to the development of semiotics. This word was not chosen to make it look beautiful and modern (Shayiri, 2015: 1). The huge development in linguistics that started from Saussure's period, continued with the studies of Yilmazlev, Barthes and others and reached Grams. In fact, it was the same position that the study of meaning found in linguistics (Chandler, 2007: 52). These developments caused the term semiotics to replace semiotics in the field of the Paris school.

In Saussurean and even philosophical semiotics, signs are placed in a systematic and necessary relationship between the signifier and the signified and outside the linguistic process (Majdi and

Zarabadi, 2011: 51). In Peirce's intended semiotics, the relationship between the signifier and the signified is an asymmetric relationship. According to him, this relationship has a sensory-perceptual characteristic (Asadi Jafari et al., 2022). Because the connection between the object and the mental image of the same object is made from the point of view of the subject. Therefore, it is possible to consider the existence of a living presence that has both a look and an angle of vision and receives the sign in a dynamic process; But for two reasons, we still cannot speak of discourse semantics:

a) No place has been seen for the body as the base from which all sensory-perceptual activities are formed; b) Absence of value system; A system without which no intelligence can be attributed to the process of meaning (Majdi and Zarabadi, 2011: 89).

2.2. Dimensions of Semiotics

Sensory-perceptual dimension of semiotics

The semantic sign discourse is connected with various sensory, perceptual, emotional, aesthetic, physical events and tension flows. In literary creations, sign-meanings are formed as a result of human sensory-perceptual connection, so that feeling and perception can be considered as the origin of signs and meanings (Bagheri and Aini Far, 2015: 7). The problem that linguistic sciences such as phenomenology and sign-semantics are faced with is how meaning is formed through feeling and perception. The formation of meaning through feeling and perception is always faced with a fundamental problem, and that is that in literary discourses, there are sensory currents. There are things that Grems calls escape from reality (Asgari, 2022). Based on this fact, it remains hidden behind a curtain of appearance, and in order to compensate for the distance from the semantic reality and to achieve the foundations of sensory perception of signs and meanings, one must refer to phenomenology. Phenomenology makes it possible to achieve these foundations by creating zero knowledge, and such a concept means the study of meaning in the heart of life and in line with the reality close to it, for this reason today, the sign of semantics is to search for the contexts of creating meaning through the sensory and perceptual process.

Sensory-visual dimension

This type of sense has very wide dimensions compared to other types, and it has all the characteristics of other types of sense, such as interactive, transference, ambivalence, internal reflection, symbolic stage, simultaneity, and reversibility, but the most important feature of the visual sense type is that it precedes other senses. That is, the sensory-visual process can cause the stimulation and movement of the agitator and his connection with other sensory streams, or vice versa, it can cause the connection to be closed and the sensory activity to be interrupted. Therefore, this sensory type can be placed at the top of other sensory types and provide the basis for their expansion or disappearance. The sensory-visual dimension is the possibility, reproduction, reproduction, expansion and interaction between functional types or other sensory types (Fuladi and Jafari, 2012: 3). This kind of feeling with the ability to detach a shell can separate everything from its shell and reveal it with a new shell. Light is one of the elements that can change the skin of external species. Soft light, sharp light, dazzling light, reflected light, full light, transparent light, absorbing light, weak light, fixed light, moving light, all are effective in the detachment of the shell and cause semantic fluidity (Ahmadi, 2008: 127). The Table 1, shows some of the meaning-making factors in architecture in the form of various sensory qualities, formal qualities and the qualities that evoke signs.

Table 1 How signs appear in architecture (Falahat and Nouhi, 2013: 21)

Meaning (interpretation)	Example	Slab
Associations resulting from the principles of morphology and associations resulting from patterns	Configuration of architectural building -Use of symbolic forms in building components -Application of some symbolic factors in the direction of the designer's intentions Shaping the architectural space Shaping large and small spaces, scattered and dense, enclosed and open, vertical and horizontal	Formal quality
Associations resulting from patterns, repetition, reinforcement of cultural contexts	Use of architectural materials Symbolic use of materials	Sensory-perceptual quality
Associations resulting from cultural, religious and iconological principles. An association resulting from social principles and the process of repetition.	The use of light in architectural space Using natural light, artificial light, concentrated light or linear light and... The use of color in architectural space	

Creativity

Scientists have provided several definitions of creativity in different dimensions; Some of these definitions are as follows: Creativity means the recombination of ideas, thoughts, thoughts, imaginations and ideas that are already known to a person, but in a new and different way. Creativity is the creation of new thoughts and ideas that have social utility (Nick Kar, 2013: 106) according to Stephen P. Robbins, creativity means the ability to combine ideas in a unique way or create continuity between ideas (Mahmoudinejad, 2011). Another author considers creativity to be the creation of something that did not exist before and gives it a new nature, either in the mind or in the eye. There is something that has not been seen due to the mental blindness of habit. Creativity is a curious and exploratory look at an old phenomenon that finds and reveals it. Creativity is the use of mental abilities to create a new thought or concept. Creativity is the ability. Seeing things in a new and unusual way, seeing problems that no one else recognizes as existing and then providing new unusual and effective solutions for them (Keshtkar, 2013: 23).

1- Types of creativity:

Four types can be considered for creativity:

Practical creativity: Today, there is a need for people who have creative thinking instead of mere technical knowledge.

Mental creativity: Today, there is a need for a mind that can guide a person to new ideas.

Artistic creativity: Art, as one of the main pillars of human life, has a high place in everyone's work and profession. This type of creativity is not only used in the classification and painting of halls and building architecture, but also in industrial and technical design.

Non-verbal and imaginative creativity: In the organization, sometimes it is necessary to free oneself from the shackles of systematic and reasoning thinking and engage in imagination. Today, organizations need scientific and creative imagination in order to be ahead in the field of

competition. In this type of creativity, the human mind flies and flies to the unknown world and hunts for new theories. It puts forward new hypotheses and presents novel models. It may be safe to say that the most comprehensive theory of creativity was presented by Guilford, an American scientist. Guilford, with a lot of research, finally came to the conclusion that human intellectual abilities cannot be summed up in one dimension and call it intelligence or something like that. He found that human intellectual powers can be divided into 150 separate factors, each of which can be measured alone, in his opinion, some of these characteristics are directly effective in the emergence of creativity.

2.3. Teaching Architectural Design Courses

Architecture is the art of mediation; It mediates between the person and the society, personal behavior patterns and human institutions, public and private realms, past and future, etc. and takes over space, time and technology for the purposes of human life, in other words through the unbreakable link of architecture with individual, social and The cultural values of the people can be considered as one of the most significant cultural and artistic manifestations of the society, and also one of the important challenges facing the higher education systems in the third millennium is teaching, learning, how and its quality (Ahmadi, 2012: 11) Architecture is a multidimensional phenomenon that Nature itself is complex. Teaching architectural design to an entity that has complex mental-individual-personal and cultural-social dimensions is worthy of reflection. Architectural profession and consequently architectural education is a process that is strongly influenced by the cultural factors of each country. Since the basic course of architectural design covers an important part of the education course, it plays an important role in the formation of students' personality and their approach in relation to architecture and its related issues, including culture. Is. The importance of this category is due to the establishment of a relationship between two valuable issues in the architectural profession, i.e. theoretical issues on the one hand and executive and professional activities in design on the other hand; Therefore, paying attention to the teaching of architectural design courses is always a priority for the planners of the architectural education system.

The intellectual fields and the designer's thinking power during the design process are among the topics that are discussed today under the influence of cognitive psychology. The types of thinking and approaches adopted by the designer have a direct role in the thinking process from question to answer and its result can be seen in the design product. In the meantime, it is necessary for design teachers and educational planners in the field of architecture to get acquainted with the characteristics of thinking and how to use the talents of students and take action regarding the achievement of educational solutions. Architecture education is aimed at cultivating inner talents and transferring architectural concepts to educate creative and knowledgeable people in this field (Mahmoudi, 2007: 76). The structure of architecture education is formed around a core called design; the most important mission of architecture education is to form a comprehensive thinking that provides the ability to step into the architectural design process for the novice.

If we consider the goal of architectural education to be the training of architects who have talent and ability and master specialized knowledge and use this talent and knowledge in the right direction, it can be considered as ability (interests, capabilities, talents), knowledge (sciences and know-how), insight (applicability). introduced abilities and knowledge in the creation of architecture) as the three main foundations of architectural education. There are design courses in the associate, bachelor and master degrees, as the main focus of the course, which has been identified as the most important courses in the field of architecture education today, based on

various topics. Therefore, the necessity of paying attention to the topic of architecture and dealing with the effective factors in its learning provides valid and acceptable reasons for choosing it among other academic fields as in the previous speeches, from different perspectives such as environmental psychology and curriculum hidden and... the body of the educational space was mentioned as one of the influential components, it can be said that the educational space can influence the education by using the dynamic organization in its physical space and thus improve the quality of education.

2.4. Semiotics in Architecture

Studying to truly understand an architectural building, which is the same as its meaning, must understand the primary concept that created it. Understanding this relationship between the concept as the signifier and architecture as the signified depends on the knowledge of semiotics; Therefore, semantics in architecture has a close relationship with the science of semiotics, and it is necessary to address these two issues to better understand the relationship between semiotics and architecture. Based on the most important theoretical foundations of the semantic field, the effective factors in the definition of meaning are divided into the main areas of "architectural work", "work audience" and "work designer". The knowledge of semiotics is also active in three main single constructions on signs, relationships between signs and audience reading (Talischi et al, 2011: 18). Therefore, the sign is considered as one of the most fundamental factors affecting the perception and reception of the implicit meaning and as a factor in the field of characteristics related to the architectural work and the audience and the designer of the work. To consider the attention of the audience. Semiotics is the knowledge that examines the social function of signs and finds the mechanisms of meaning generation through sign systems. In other words, the application of the science of signs, taking into account all the cultural manifestations in the form of layers beyond the tangible and invisible signs, and paying attention to the implicit meanings and discovering the construction of the absence of the text, is called semiotics. Architecture, like any other means of communication, spread the conversation of any social text carries a message or a set of messages that are conveyed to the audience by means of semantic nodes and intertextual relationships. Social problems and mental perceptions and the type of view and angle of view strive to receive the messages of the text or create meaning for the text (Bagheri and Ainifar, 2015: 9).

Therefore, each text opens a system and network of meaning to the audience, and each of the components of this vast network points to another member. It is one of the signs, these signs do not have a specific meaning in isolation and only in the context of a diverse network, they show their indicative text. As a result, in order to recognize, interpret, interpret and make sense of the text, there is a need for a coherent knowledge that recognizes the micro elements of the network. the text and the internal relations of the text and the interpretation of the meaning of the text; This knowledge is called semiotics, practically semiotics deals with everything that can take the name of "sign" and this knowledge can be considered as understanding and receiving the phenomena of the world, which is obtained through reading and reciting the signs in it. and creates and produces meaning based on symbolic relations for social phenomena, semiotics searches for meaning through the discovery of layers.

This knowledge covers the entire reading of a text or phenomenon and includes all readings resulting from decoding or ideas. Semiotics in architecture is related to the design approach from performance to perception. The classification of signs is basically dependent on the way they are used and the specific contexts of their use. Signs in architecture can be separated into four categories (1) icon (tangible metaphor) (2) profile - intangible metaphorical icon) (3) metaphorical

profile (composite) and (4) the symbol of the icon itself into the sub-branches of diagram image and metaphor. It is noticeably divided. A large number of architectural buildings have a superficial and tangible meaning in appearance. This discovery of meaning in the appearance may be done in the external view of sections, plan or internal and external perspectives. The significant volume of buildings with this feature caused a separate category called profile-icon to be considered in semiotics. In order to describe the characteristics of the profile and the symbol, their characteristics are compared. The first characteristic of the symbol is its scope in architecture, which defines it only within the scope of architecture for perception, which means that symbolic architecture was not created for any specific function and the purpose of its creation is only its perceptual and semantic aspect. The second factor in recognizing the boundary of the symbol and sign is the strong dependence of symbolic architecture on the text and the context of its formation in order to show the meaning of the building as much as possible (Broadbent, 2015: 21).

The cultural background is one of these texts that does not have such a relationship between the building and the text. The third difference between profile and symbol in architecture is the plurality of meanings received by the perceiver of architecture. In this way, in symbolic architecture, there is a unity of perceived meaning, and in indexical architecture, there is a plurality of meaning received by the viewer. Semiotics is less arousing due to the conventionality of the type of relationship between the signifier and the signified, and has less clarity in conveying concepts, so the fourth difference between the profile and the symbol will be the degree of clarity and discoverability of meaning in them. In the symbol, the meaning is in more hidden layers, and entering the field of discovery is only with the knowledge of the contract that creates it. The symbolic meaning of the specific patterns of the built environment also depends on their spatial context. Charles Morris named three levels of meaning under the title of conceptual and functionalist syntax. Syntactic meanings result from how a building is placed in the surrounding environment. The conceptual level refers to the norms, ideas or attitude that an element presents or suggests. Functional meaning relates the symbol to the users of the environment (Ahri, 2017: 44).

2.5. Design Education with a Semiotic Perspective

In the field of architecture, one of the most important but obscure and unknown concepts is the concept of design. Design is an artistic phenomenon that occurs in the mind and has a multidimensional nature, and therefore it is necessary to know the processes and stages of its process. Architecture education is meaningful with design education (Zahakri, 2013: 32). The academic education of architecture has tended towards individuality from the beginning, but the education of architecture is naturally incompatible with the teacher-centered education of the university that originates from the objectivist educational design. For this reason, following the usual methods of university education cannot be beneficial for teaching architectural design (Antoniades, 2018: 33), so in studies aimed at the development of architectural design teaching methods, it is possible to take advantage of the developed capabilities of constructivist educational design approaches, because Constructivist educational design consists of providing environment, resources and support for learning processes (Khabanian, 2008: 51). It is also emphasized to pay attention to principles such as the active participation of the learner in learning processes, inclusion of learning in authentic and real contexts, solving learning problems on the basis of participation and social interactions, therefore, benefiting from audience-centered design training in the shadow of semantics with a semiotic perspective and the nature of a constructive educational environment. oriented and in the shadow of paying attention to the components of the method and content of housing design education, researching in design education requires research in a specific field of

uses, because education processes require different methods and stages based on the content of the subject. In the meantime, dealing with residential space is a priority; Because the residential spaces occupy about half of the city levels and it is the crystallization place of culture, tradition, life form, technology and civilization of any society. On the other hand, most of people's lives are spent at home (Arjamandi, 2013: 25).

Designers analyze the data and discover and extract aesthetic aspects from the perspective of the audience of the design platform and develop ideas based on it (Beamish, 2002: 134). Ideation is formed based on observing psychological dimensions along with aesthetic aspects, and then it creates an effect in the form of designing form, body and space, and after the visualization of the idea, it is evaluated (Mahmoudi, 2007: 76). Evaluation does not mean what is implemented today at the level of design education based on the taste of professors, which means the evaluation of the audience community based on their perception of signs that express the aesthetic views of users in the form of design. The cycle of the process of identification of the substrate and the application of signs in the direction of aesthetic and psychological satisfaction in the form of design, as well as the evaluation of signs by the audience, are the most important aspects of communication between the factors affecting the education of housing design (Alexander, 2013: 271). Psychological aspects mainly influence ideation in the process of design and education, but aesthetic aspects, in addition to influencing ideation, directly affect the design of spatial relations and the evaluation of signs. Another partial cycle in the education process is formed between the stages of form and body design and spatial relationship design, which emphasizes the need for professors to pay attention to the adaptation and harmony of body and space in students' design. The cycle of research-based analysis - ideation - design of spatial relations - evaluation of the collective reading of signs also points to the need to guide students to the realization of ideas in the form of designing spatial relations in line with the satisfaction of the audience (Lawson, 2007: 36).

In the Figure 1, the theoretical consensus of the theoretical foundations is depicted:
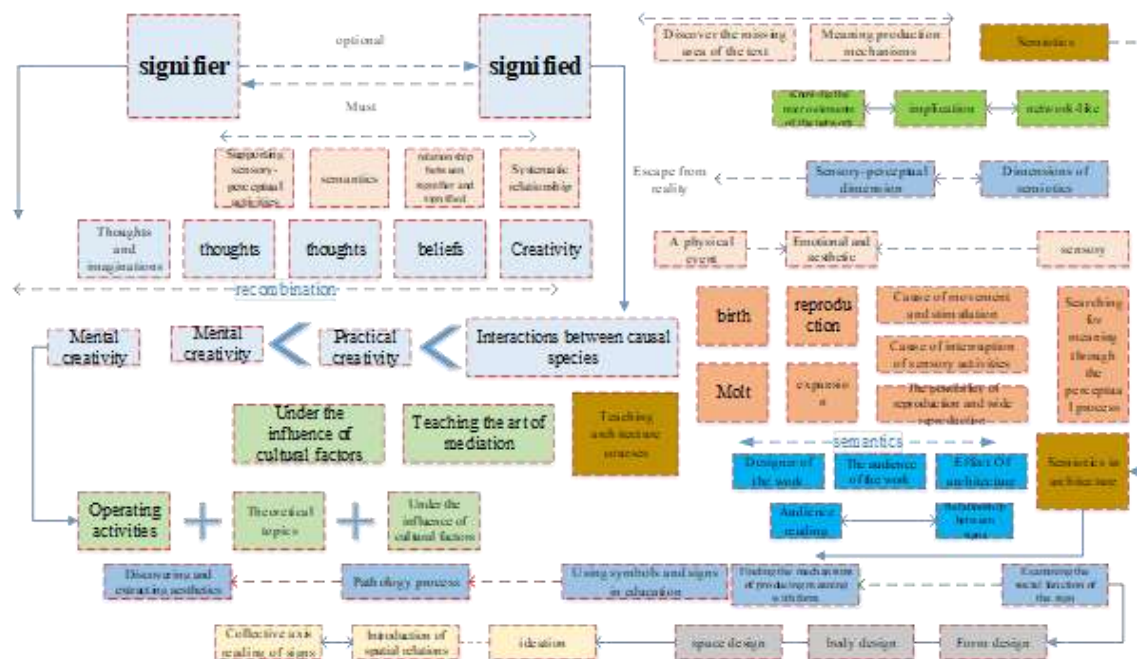

Fig 1 Opinion summary diagram

3. Research Methodology

In terms of developmental-applied type, this research has a nest-to-nest combination in terms of method. To answer the research question, qualitative research method is used in nest-to-nest quantity. In the qualitative method, the system of semi-structured interviews with researcher-made criteria is used to extract and verify the components of education in architectural design with emphasis on semiotic opinions. Research questions are used on the basis of extracting and developing the main research questions. The results of the questionnaires are entered into the NVivo software in the form of textual data and are subjected to open coding with a description and interpretation approach. The results are extracted in the form of spider diagrams. The 24th person repeated. Then, based on each component, a question based on what it is and 5 Likert scales is designed and given to 76 students. The statistical population is 95 fourth-year architecture students. The results are entered into the Grapher 19 software and the results are analyzed with numerical and graphical inferential statistics. For the correctness of the qualitative questions, it is checked and scored by experts using the Delphi method. The validity of the questionnaire using the CVI formula is 0.78 and the reliability is 0.72 using Cronbach's alpha. For convenience, a pre-designed coding table is used. Interview analysis is done using Atlas T software and using open and axial coding.

4. Research Findings

4.1. Qualitative Findings

Based on the interviews conducted with experts, 41 people were interviewed, and from the 24th person onwards, the data is not saturated and repeated. First, 35 codes were extracted, which were limited to 25 codes after summarizing the data. The most prominent code is related to creating an image and image in the mind of the audience with a prominence of 23, and the least related to teaching light design with a prominence of 8.

Fig 2 Extracted codes in the form of components and spider diagram

4.2. Descriptive Statistics

In this section, one question has been formulated for each variable. The questions are closed with a Likert scale that has answers from very high to very low. To convert them in the JMP software, they are given a range of 1 to 5 points. Based on the general questions, it is determined that the largest number is related to the group of men with the number of 56 people and women with the number of 39 people, the age groups are between 22-25. The highest frequency is related to the training of integration and cohesion with the value of 471 and the lowest is related to the training of using light with the value of 198. The support of the moving average of the data distribution shows the high accuracy of the measurement.
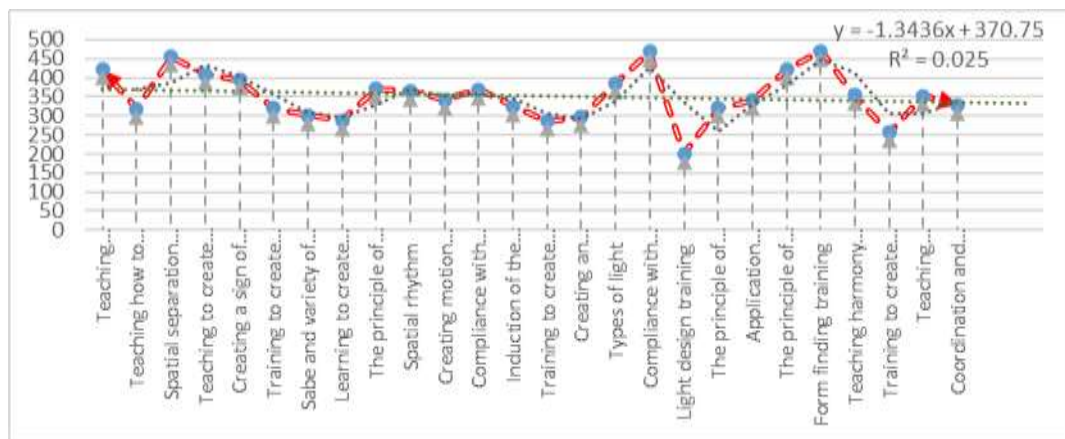

Fig 3 Frequency chart of design education components based on semiotics

4.3. Inferential Statistics

Two-Sample Kolmogorov-Smirnov Test is used to check the parametric and non-parametric type of data.

Table 2 Kolmogorov-Smirnov test to check the normality of decorative pattern variables (Source: Authors)

p	Z Kolmogorov Smirnov	Standard Deviation	Average	Variable
0.585	0.893	28/5	25/41	Design education components based on semiotics

As can be seen in the table above, the Kolmogorov-Smirnov test is not significant (p=0.585), and therefore, the design education variables based on semiotics do not have a normal distribution, and non-parametric analyzes can be used for them. Based on the data correlation results, it is determined that the highest correlation is related to the education of creating order and unity with a value of 0.920 and the lowest is related to the principle of alignment with a value of 0.265.

Table 3 Pearson's correlation coefficient of design education variables based on semiotics (Source: Authors)

Variable	Correlation coefficient	Meaningful
Teaching compliance with the principle of holism	0.883	0.001
Teaching how to use materials	0.619	0.007

Spatial separation training	0.836	0.006
Teaching to create order and unity	0.920	0.006
Creating a sign of focus and emphasis using the design teaching method	0.654	0.004
Training to create an image in the audience's mind	0.625	0.002
Sabe and variety of components	0.546	0.004
Learning to create a light hierarchy	0.681	0.008
The principle of alignment	0.265	0.007
Spatial rhythm	0.429	0.001
Creating motion cues using design tutorials	0.623	0.009
Compliance with the aesthetic principle	0.685	0.003
Induction of the principles of psychology	0.621	0.004
Training to create behavioral diversity	0.652	0.002
Creating an invitation through design education	0.612	0.003
Types of light	0.381	0.008
Compliance with coherence and continuity	0.484	0.005
Light design training	0.464	0.001
The principle of personalization	0.421	0.007
Application Release, Break, Pass	0.631	0.004
The principle of spatial proportionality	0.124	0.002
Form finding training	0.311	0.006
Teaching harmony proportions	0.325	0.002
Training to create spatial hierarchies	0.425	0.011
Teaching transparency and spatial continuity	0.223	0.021
Coordination and integration	0.529	0.024

4.4. Regression

To use the type of linear or multivariate regression, the internal correlation matrix diagram of creativity education variables is used. After drawing the correlation matrix diagram, it was found that the factors have no linear relationship; Therefore, it is correct to use multivariate regression.

Fig 4 Internal correlation matrix of variables (Source: Authors)

Based on the results of multivariable regression, it is determined that the components of training to observe the principle of holistic view and training to create spatial levels with a value of (1.000) have the highest factor contribution and the lowest is related to the use of different types of light with a value of 0.331.

Table 4 Multivariate regression of design education components with emphasis on semiotics (Source: Authors)

Variable	t	β	F	Meaningful	Coefficient of determination
Teaching compliance with the principle of holism	522.46	623.643	222.527	0.001	1/000
Teaching how to use materials	152.42	683.849	122.405	0.007	0.920
Spatial separation training	223.40	603.349	343.217	0.006	0.803
Teaching to create order and unity	239.38	945.184	943.199	0.006	0.746
Creating a sign of focus and emphasis using the design teaching method	958.8	748.276	612.201	0.004	0.681
Training to create an image in the audience's mind	134.11	943.199	623.643	0.002	0.816
Sabe and variety of components	441.18	034.499	683.849	0.004	0.650
Learning to create a light hierarchy	144.19	034.523	603.349	0.008	0.846
The principle of alignment	173.49	258.147	945.184	0.007	0.814
Spatial rhythm	963.47	564.321	748.276	0.001	0.546
Creating motion cues using design tutorials	226.46	371.492	943.199	0.009	0.795
Compliance with the aesthetic principle	228.47	658.471	034.499	0.003	0.243
Induction of the principles of psychology	288.25	987.650	034.523	0.004	0.895
Training to create behavioral diversity	256.45	960.542	258.147	0.002	0.978
Creating an invitation through design education	552.41	362.214	564.321	0.003	0.462
Types of light	356.21	0.401	371.492	0.008	0.331
Compliance with coherence and continuity	321.58	0.411	222.527	0.005	0.745
Light design training	694.19	0.421	122.405	0.001	0.752
The principle of personalization	879.24	0.589	343.217	0.007	0.920
Application Release, Break, Pass	587.44	0.521	943.199	0.004	0.803
The principle of spatial proportionality	566.48	0.542	612.201	0.002	0.746
Form finding training	522.46	0.545	623.643	0.006	0.681
Teaching harmony proportions	152.42	0.411	683.849	0.002	0.816
Training to create spatial hierarchies	223.40	0.309	603.349	0.011	1/000
Teaching transparency and spatial continuity	239.38	0.517	945.184	0.021	0.846
Coordination and integration	958.8	0.517	748.276	0.024	0.814

Based on the regression findings, it is determined that the highest factor contribution is related to geometric shapes with a value of (1.000) and the lowest is related to Maher tiles (0.215).

4.5. PN Modeling

In PN modeling, it was found that the biggest contribution to answer the questionnaire questions individually is related to teaching how to use materials, and the answers indicate the accuracy of the results and data accumulation to 95% in the answers, also to increase the maximum efficiency for the application. The components of design training are used from the following combination:

Teaching how to use materials, coordination and assimilation, teaching to create spatial levels, the principle of spatial proportions---> 26%

Teaching spatial rhythm, teaching harmony proportions, teaching creating order and unity, teaching spatial separation, teaching form finding--->16%

Kinds of light, teaching to observe the principle of holistic view, teaching to create order and unity, teaching to create spatial diversity--->9%
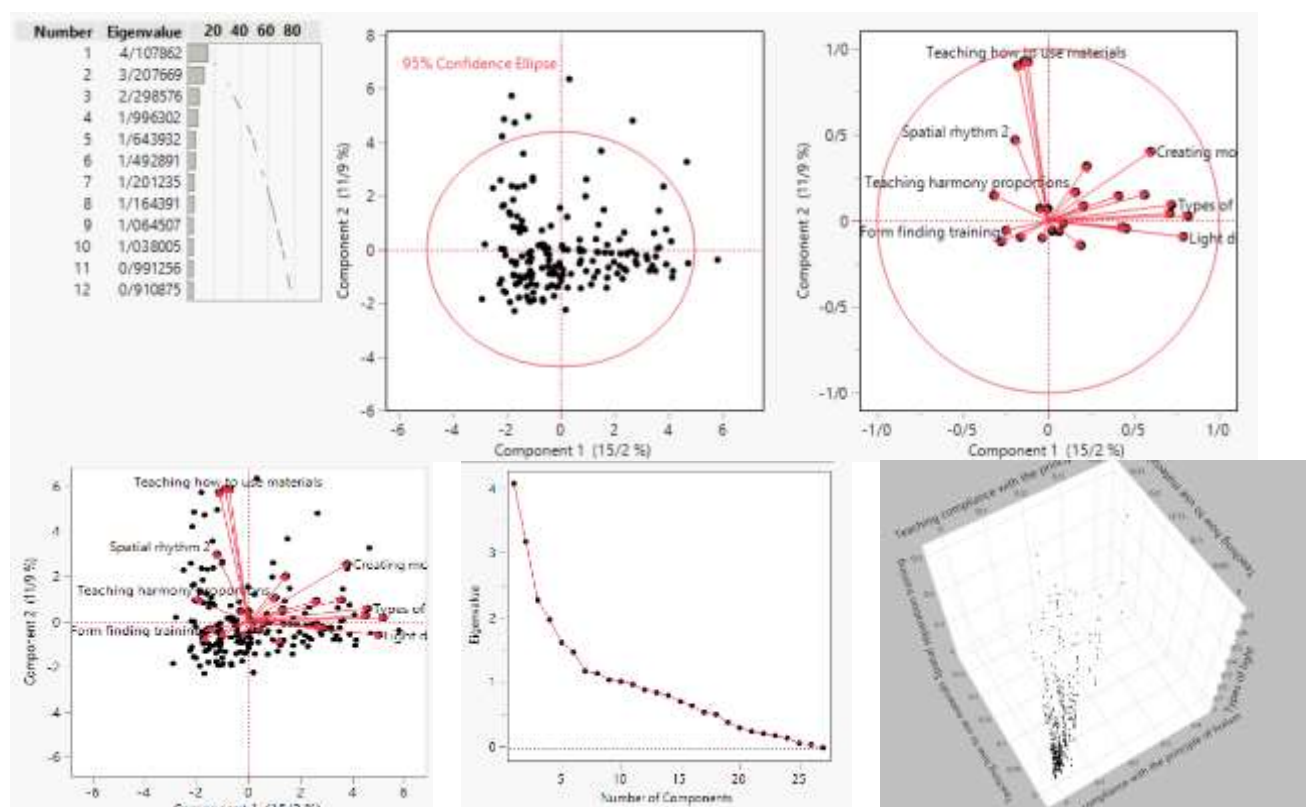

Table 5 PN modeling of design education components (Source: Authors)

Based on this, the simultaneous use of 10 components can significantly improve students' creativity. The three-dimensional model of its distribution indicates that the effectiveness of the components is increasing and over time it plays a more significant role in creating students' creativity. It seems that teaching objective aspects derived from semiotics have a more decisive role than mental components in promoting creativity.

5. Discussion

In the qualitative part, a number of 25 components were extracted, the most prominent of which was related to the training of creating an image and image in the mind of the audience, which seems that the experts put a lot of emphasis on creating an image and illustrating the display of data in the mind of the audience based on symbols and signs. Torrance's questionnaire was used to measure students' creativity (Torrance, 1970). According to them, creating a mental schema is a mental illustration and slideshow of events in relation to environmental components and attention-grabbing symbols in educational spaces. According to them, light design education has very little influence on the formation of students' creativity, perhaps on this basis, objects by experts play a more prominent role in sign-based education.

The results of descriptive and inferential statistics have significant differences with each other, and inferential statistics should be used for data analysis of the results. Descriptive statistics show that when the pillars in the space have integrity and coherence, it is easier to play a role in people's minds as a symbol or sign. Continuity and cohesion in design for students in the field of body and space design training and creating harmony between them emerges, if they are based on order and unity in design, it has a double effect on other components to achieve an increase in creativity. It acts separately and has less impact on other components. In the regression results, it is re-emphasized to create unity among all objective and non-objective elements in the design by students. Also, creating detail in the design of space for students and creating quiet spaces is a main factor in It is to promote people's creativity. Light and how to deal with it in design, due to its lack of physical nature, cannot encourage students to design creatively.

6. Conclusion

The final goal of teaching architecture to students is to encourage and increase their ability to achieve creative design by using the elements of a building in the form of a coherent phenomenon and in a single shell. The sign and productivity of it can encourage students in a way that they can use different methods to depict meaning in the form of a physical work in several different ways. This research showed that different elements can be extracted from the components of design education in sign, which will lead to the education of students based on increasing creativity, and at least 10 of them should be used together. This research showed that there are different elements of education that should be paid attention to. Below are some strategies for teaching architecture;

- Teaching theoretical concepts on the same basis as design concepts and how to illustrate and illustrate based on the physical nature of objects in the design of various buildings.
- Rereading the concepts of signifier and signified and conceptual semantics based on spatial elements and conceptual narrating of a unified and coordinated body.
- The use of natural and spatial elements in the design of the architectural education environment, such as stairs, fountains and green spaces that encourage students to gather and talk, which is considered as the center of a space.
- The use of students' opinions in developing creative lesson plans based on conceptual convergence and eliminating the difference between the degree of importance of the components of creativity in architecture education based on signs
- Typology of the objective and subjective aspects of the elements of the space and how they are symbolized by interpreting multiple meanings in the intermediate spaces.

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