A Creative Cycle of Promotion: From Architectural Creativity to the Sense of Place and its Resulting Creativeness

Hossein Rezaei *

Department of Architecture, Faculty of Engineering, Kermanshah Branch, Islamic Azad University, Kermansha, Iran.

Received: 26 March 2018 - Accepted: 18 February 2021

Abstract

Creativity is one of the most prominent humankind properties, which has a particular worth in human communities and has been a pivotal subject of many scientific researches in various fields of knowledge. Environmental Psychology is a leading scientific area related to this topic that studies the relation between the physical environment and space users' mentality including the creativity process. In this regard, this paper tracks the answer to the inquiry, "What are the environmental factors' impacts on user's creativity and the role of architecture in orientating them?". Therefore, the main purpose of the research is a prototypical determination of characteristics and mechanisms of creativity-inciting places to lead more creativity by designing places creatively. From a methodical point of view, the research is based on an amalgamated methodology to conclude a theoretic framework and validate it statistically in a case study. The case study of research consists of architecture learning environments where postgraduate students are questioned to describe inciting behaviors of their creativity and the physical features of stimulation of such activities. Due to the present survey, some special characteristics, functional spaces, and respective environmental affordances are introduced as the main features affecting the augmentation of creativity. Ultimately, they are classified and graded as some environmental attributes, by a heuristic factor analysis, considerably are seemed to be the main factors increasing the sense of place. It should be noted that the prominent aspect of this study is its systematic problem-solving approach and its findings consequently which are realized in two schemata: Firstly, as an expanded instrument for the evaluation of an environment in the provision and improvement of users' creativity, and secondly, as the theoretical foundation of a structural pattern for designing creativity enhancer environments. Therefore, it might be cited the findings of this research points to a cycle of promotion: From Architectural Creativity to the Sense of Place and its Resulting Creativeness.

Keywords: Environmental Affordances; Spatial Behavior; Sense of Place; Cycle of Creativity

1. Introduction

Creativity is an important human asset that today is considered noteworthy more than ever in various fields of science. Therefore, the attempt to support it is considered as an inevitable policy of all societies (Castells & Hall, 1994). The subject of creativity has been emphasized in Arts more than other Humanities and meanwhile, it has always been accounted for the most challenging pedagogical-professional notion especially, in architecture. Spite of the long endeavor to identify the essence of creativity, this topic has remained one of the most mysterious subjects in human intellectual behaviors. Some scholars assume creativity as a social event rooted in society's demands. But some assume it as a personal capability influenced by factors such as individual motivation, emotion, and experiences. In other words, psychologists introduce it as a cognitive concept that interacts with supreme processes of the mind. Eventually, some regard it as a multi-dimensional concept that is affected by many different factors. They see the creativity coming under the influence of both individual and environmental effects (Golestan Hashemi, 2008), which the first is related to personal characteristics and the latter clear, the term "environment" could be used as social, cultural, and physical, influencing creativity in each category, but what was questioning in this study is certainly the physical and built environment. Because the aptitude for creativity is instinctively situated in humans and its realization is possible to be learned, and thus, the required contextualization is necessary to augment it. Then, following sure impacts of the physical environment on the human mind, it should be acknowledged that the field of environmental design and especially architecture is one of the most substantial contexts for the promotion of creativity. In one of its psychological functions, architecture is a medium whereby the meaning of a place emerges and influences the human body and mind. Hence, deliberate architectural processes affect the way of formation of human mental and behavioral characteristics, including creativity. An accurate review of the literature illustrates that some recent researches pointing the notable impacts of physical factors of the environment on users' creativity, but not to detail it and suggest respective principles of design fundamentally. Regarding, the main object of the research is the achievement of correct answers for the questions "What are the environmental factors influencing creativity and the role of architecture in orienting them?" consequently, "What relation is between the potential creativity emerged in an

* Corresponding Author Email address: hus.rezai.art@iauctb.ac.ir

environment and its realized sense of place?". In this order, the investigation of the correlation between environmental semantic levels arising from environmental affordances and creativity as a mentally motivational phenomenon is essential about the creativity-stimulant places.

2. Literature Review

One of the most important behavioral fields of the human mind is when facing his surrounding environment. The importance of this subject has eventuated a branch of science, called environmental psychology. In this context, the living environment of human is assumed as a container for his behaviors. Therefore, the main presumption is that behaviors and experiences cannot be considered without attention to environmental conditions. Therefore, it is essential to pay more attention to personal motivations and their relevancy to the concept of human demands as behavioral stimulants. So behaviors emerge by motivations to satisfy needs, and also specific features of an environment, which are perceived for everyone uniquely, are the stimulus of mind to perform behaviors in meeting needs. In this regard, the concept of affordance must be noticed to elicit an explanation of the process. The word "affordance" was first coined by Gibson in 1977. He believes that the man changes levels of the physical environment to adjust its affordances to his demands (Motallebi, 2001). Following Gibson's opinion, an environment proposes something by itself (Lang, 1987). However, it should be noted that the affordances of an environment are perceived as related to properties, experiences, merit, and demands of users. In other words, an environment might own particular affordances for a user, whereas these affordances could be meaningless for another (Motallebi, 2001). Therefore, it can be cited that human feelings and actions are restricted by the affordances of environments (Lang, 1980). In other words, environmental meanings lead to users' behaviors probably (Kamrani and Behzadfar, 2016; Rezaei, 2019). In this context, creativity is one of the most important human motivational behaviors to respond to the environment, also a significant capability to accord the surrounding environment with existing demands. Thus in this research, the meaning of every environment is commensurate with elicited users' creativity, which is the consequence of the interaction between the environmental affordances and their desires.

There are many definitions for creativity that one of the most common of them is presented by Amabile, (1983): Creativity is a process of generating novel ideas and innovation in the successful application of them. Then, the creativity comprises three fundamental features that were illustrated for the first time by MacKinnon (1962) and accentuated by Mayer (1999): (1) The initiative; (2) The realism and purposefulness; and (3) A time-sequential nature. Therefore, this concept in general that encompasses subjective and objective aspects, might be defined and evaluated in practice by three individual indicators: (1) Cognitive system of mind, flexibility, genuineness, and fluidity; (2) Personality system in terms of freedom in self-declaration; And (3) Value system and authority for validating and choice (Strzalecki, 2000). In categorizing creativity, Boden (1999) introduced it in two types: Historical creativity, which revolutionizes the history and culture, and personal creativity without any prominent historical or cultural importance. Parallel to this, other classifications have been presented. For example, instant and everyday creativity. The instant creativity leads to alterations in the society, depending on the person's capability, like Boden's historical creativity, and the everyday creativity is a kind that because of it, people are dealing with solving their issues and improving their work and life conditions (Amabile, 1983; Simonton, 2005).

The first model of creativity that points to its sequential nature was elucidated by Poincare in 1913 and formulated by Wallas in 1926 in four phases that include preparation, latency, intuition, and substantiation. Afterward, this model was developed by Evans and Russell (1989) with an additional condition named "failure" that turned this model from linear into a cyclic mode. Csikszentmihalyi (1996) also adjusted Wallas's model with a cyclic model where the phase "substantiation" is divided into two stages "assessment" and "codification". Considering this sequential essence reveals that creativity is not just an intrinsic characteristic feature of the human without any alteration. By contrast, it is completely reinforced by the effects of some specific factors and weakened due to limitations (Rezaei, Keramati, Dehbashi, and Nasirsalami, 2018; 2020). Amabile (1988) mentions the personal factors influencing creativity like diverse characteristics, self-motivation, cognitive abilities, a tendency to risk, and multiple experiences. Furthermore, she specifies the environmental factors affecting creativity as liberty in action, sufficient resources, adequate time, appropriate atmosphere, and suitable search plan.

The first techniques to enhance creativity were presented by Osborn emphasizing on team working and brainstorming (Osborn and Scribner, 1984). Then, enormous efforts were performed to regulate models of creativity enhancement during the 1960s and 1970s and led to Nickerson's twelve processes until the end of the second millennium, based on people's obtained abilities, experiences, and knowledge (Nickerson, 1999). Likewise, some researches were done about environmental factors with influences on creativity, which seems negligible compared to the importance of the subject. Because the environment has a more prominent role rather than personality factors and targeted interventions to enhance creativity by according environmental factors are much easier than changes in individual characteristics and aptitudes (Amabile, Hill, Hennessey, and Thige, 1994). However, most of the researches about enhancing creativity by focusing on the environment barely regarded the subject and often concentrated on the study of only one particular category of environmental factors (mainly non-physical) affecting some (not all) aspects of creativity in a predetermined class of environmental users. So their

results are confined to partial scale solutions. One of the few existing apparent surveys in this regard, for example, is the Toker's research (2003) that investigated the subject of innovation in research centers by studying the effects of the spatial organization of different research offices on face-to-face technical consultations and innovative decisions of researchers with the method "space syntax". Similarly, Bisadi et al. (2013) in their research "The Efficacious Spatial Attributes in Increasing the Creativity of Scholars in Architectural and Urbanism Research Centers" surveyed the quality of collective spaces in research centers special to the built environment studies. Their purpose was to depict some principles for designing architectural and urbanism research centers leading to increase creativity and innovation of scholars. Accordingly, the spatial features such as privacy, beauty, diversity, flexibility, continuity, and visibility were recognized as the items that are effective on the increment of creativity, built upon factors like physical comfort, motivation, interaction, and thought. Also, Azemati et al. (2016) in a paper titled "Design Principles Effective on Creativity Enhancement of Students in Educational Spaces (Case Study: Girls High Schools of Lahidjan)" focused on some physical factors including the presence of natural materials such as green space and water, the flexibility of forms, the changeability of light, colors, and furniture, in inciting creativity indices. Moreover, in their research titled "Design Principles of Residential Spaces by an Approach to Increase the Creativity of Children between Ages 3 to 7 Years Old in Iran (Case Study: District 4 of Tehran)", Karimi Azari et al. (2016) concluded that the application of natural elements and provision of safe, complex, and flexible spaces can improve the creativity. They mentioned that it is through their positive influences on children's motivation for mental peace, curiosity, innovation, and play. In the Same way, Shafai and Madani (2010) proposed some tactics for stimulating the sense of curiosity and imagination of children in educational environments in a paper titled "The Design Principles of Children Educational Spaces Based on Creativity Model". They emphasized the open spaces and natural materials feasibility of free operation for children. Gharebigloo (2012) in her paper "The Role of Environmental Factors in Nourishing the Children's Creativity" also considers the open urban space as a context for the education of children and the realization of their creativity. The results of her research point to the role of every child living environment and its accessible facilities for free movement, expanding the physical skills, and creating emotional and spiritual bonds with the environment.

It seems that among all these researches, the study of Williams (2013) titled "A Grammar of Creative Workplaces" has considered the subject much more profoundly and determined an updated systematic process capable of describing the enhancement of creativity under influence of environmental factors. However, her research has been performed in the field of organizational management and concentrated on the concept of environment in diverse dimensions "physical" and especially "social". Thus, the expected architecture-professional concentration on physical factors is not apparent in it. Nevertheless, it should be cited that the main characteristic of her effort is the classification of physical factors of an environment in three categories of spatial features, functional spaces, and environmental affordances that are applied in the present research too.

3.Theoretical Framework

The present research theoretical framework summarized in the title "environmental psychology of creativity" describes as follows: The sensual perception of some environmental features and consequently affordances causes motivating any user's behaviors in terms of enhancing his creativity. The explanation that some determinative feelings such as comfort and liveliness, in the context of physical environment, are resulted from the spatial senses of openness and transition rooted in neurotics, some senses based on intellection and self-expression, and the sense of ego, which were classified and reported for the first time by Steiner (1916). All must be noted to have important impacts on the potential behaviors of environmental users affecting their creativity (Rezaei, 2018). In this regard, comfort is the proper provision of a set of environmental factors that leads to the satisfaction of users physically by affecting their motivations (Brill, Margulis, and Kona, 1984). According to the subject of creativity and also Maslow's hierarchy pyramid of needs, scarcity of comfort in an environment is noted as a restriction. Thus, the senses related to environmental comfort such as the common quintuplets are so important. Besides, the term "liveliness" was brought up by Alexander (1979) to describe the built environmental conditions that lead to the feeling of highly-quality being alive or in other words, users' satisfaction due to the presence in a place. This feeling engaged with the senses like speech and self-expression, intellection, and ego. As it is apparent, all these senses are pointed to the collectivism tendency of humans, which is repeatedly emphasized in the creativity literature (Brill, Weidermann, Alard, Olson, and Keable, 2001). It should be noted that in Steiner's view, even the sense of ego refers to the natural perception of oneself and others that by it a person decides about the proximity with and self-expression among them to determine his territory and adjust his privacy (Steiner, 1916). Here, it is obvious that these items are the most significant physical factors of creating a sense of place, which is increasingly effective on the motivations and abilities of one's creativity (Killeen, Evans, and Danko, 2003). two other significant senses in the commonly supporting above-mentioned feelings are openness and transition. The first refers to the situation that is perceived by users according to the level of openness in an enclosed space, which usually has neurotics, psychological, and emotional origins (Franz, 2004). From a neural-mental point of view, this sense is pertinent to the environmental features like transparency and visual connection, movement accessibility, legibility and solidarity, complexity and ambiguity in bordering

(Stamps, 2005; Franz and Wiener, 2008). About this, the positive influences of high-ceiling spaces on conceptual thought and low-ceiling on detail-concentrated thought (Meyers-Levy and Zhu, 2007), the considerable impacts of constructive disorder (intentional and controlled) versus disruptive disorder (non-organized environment) on the creative thinking (Stamps and Krishnan, 2006), and finally, the effects of complexity and ambiguity in environmental boundaries on creative performance (Brill et al., 1984) demonstrate the importance of this sense in the research context. The second is the transition or the sense of depth, which its major advent occurs during physical movement and has been one of the most rudimentary solutions of humans for encountering problems. The meaning that any problem can be resolved by stepping (Beatty and Ball, 2011). This sense was pointed about the motion for the first time by Steiner (1916) and dealt with the subject of keeping unconscious balance. Moreover, Csikszentmihalyi (1996) nominates the acts of walking, swimming, driving, surfing, and other similar ones, pertained to the sense of transition, as the facilitators of the creativity process. It is on this basis that the positive distraction resulted from the transition leads to a divergence of cognitive processing and consequently creative outputs (Osborn, 1953).

As is mentioned before, the possibility of occurring some simple behaviors in a particular environment can assist the realization, continuity, and enhancement of creativity. These behaviors are physical mobility, accidental or intentional communication, seclusion, distraction, daydreaming, and relaxation, which some of them happen to interact with people, conditions, problems, or specific routine context versus some others that take place for being far from them individually or socially. Thus, it seems that the preparation of spaces in terms of motivational features, as the occurrence pot of these behaviors, can have influences on the enhancement of environmental affordances for stimulating the users' creativity to respond to their demands better. Accordingly, it is logical to see a strong correlation between two concepts of creativity and sense of place that relates to the numerous items like the satisfaction of needs and demands in different levels, perception of meaning and its emergent sense of beauty, and excitement and the sensory richness resulted from controlling it. This is a witness to the existence of similar stimulant behaviors in the improvement of creativity from one side and the realization of a sense of place from another. This connection is specifically emphasized in the research of Pancholi et al. (2015). Then, a meaningful relevance could be conceived between the sense of place that occurred in the users' minds and the potential environmental motives of their creativity in a certain environment. For instance, a strategy like "facilitating users' participation in design to meet their personal needs" that can lead to realizing an appropriate level of sense of place for them plays a direct role in the enhancement of creativity by motivating and making their mind dynamic. Moreover, since there is a direct link between the cognitive processes of mind and people's personality features, especially mental openness, and the visual perception-based experience-ability about aesthetics, more stimulation of emotions based on environmental beauty can ensue to improve the creativity of users. Therefore, creativity as a cognitive process has a strong correlation to the subject of environmental meaning and the beauty brought forth from it (Casakina and Kreitler, 2011). Furthermore, the environmental excitement and the sensory richness resulting from controlling it regarding the subject of sense of place from one side, and creativity from the other side should be noted. With this explanation that one of the aspects of emotional intelligence is the ability to use emotions and excitations in facilitating the cognitive processes, including creativity (Mayer, Caruso, and Salovey, 2000). Respectively, Torrance (1974) assumes that not only the emotion-exciting factors facilitate the cognitive processes, but also they are essential for attaining the important achievements of thought such as creativity. On the other hand, the organizing aspect of excitement is the indicator of one's ability to a reduction of negative emotions, which leads to a positive mood that can increase creativity by the growth of flexibility and expansion of contemplation (Ivcevic, Brackett, and Mayer, 2007).

According to what was mentioned, some behaviors and activities by people play the role of stimulus or practice for being more creative and since it is possible to provide the happening ground of many of them by environmental incitements, it is important to pay enough attention to environmental features and affordances supporting these activities. Then, it can be said that the interaction of the environmental items and the psychological processes motivated by them results in a perceptional situation to be more creative. In this regard, Barrett and Barrett (2010) suggest a model for designing creativity-inducing spaces, which established on three main cores: 1) Naturalism that signifies the emotional reaction of people to the positive aspects of nature and causes the attention toward items like natural light, greenery, air quality, and acoustics. 2) Individualism, which refers to the subject of people's tendency to privacy in the context of the psychological environment. 3) Stimulation that alludes to proper levels of setting properties to generate motivations in various conditions and is largely achieved by the purposeful use of lighting and coloring. McCoy (2005) and Dull et al. (2011) also consider five features of the physical environment influencing social behavior and consequently creativity in teamwork, which are: 1) Spatial organizing; 2) Architectural details; 3) Resources and equipment; 4) Appropriate views; 5) Environmental conditions focused on convenience and comfort. In this regard, the remarkable opinions about physical stimuli of creativity have been presented in Table 1 from the viewpoints of different scholars. It should be noted that the environmental factors, similar to what was considered by Williams (2013), could be divided into three separate classes of spatial features, functional spaces, and environmental affordances, which are connected (Rezaei

et. al., 2018) and presented in Table 2 concerning the subject of the sense of place in terms of creativity.

Table 1
Remarkable statements about the environmental stimuli of creativity (Source: The Author)

Origin	Scholar	Date	Description
Naturalism	Kaplan	1977	Emphasizing the significant role of the natural environment in mental development
	McCoy	2002	Creating an appropriate view of the natural landscape
	Shibata	2004	Necessity of greenery in interior spaces
	Haner	2005	Applying natural elements in the built environment and making visual access to the natural environment
Diversity-seeking	Alexander	1979	Spatial diversity leads to comparison and comprehension of the similarities and distinctions, while spatial monotony causes a waste of information and debilitation of mind.
	Gruter	1985	Stimulating curiosity, movement, and discovery of space
	Rio	1993	Environmental responsibility for various needs of different people
Beauty-demand	Taylor	1975	Colors as stimuli of creativity
	Haner	2005	Generating beautiful context by using colors and light
Interactionism	Csikszentmihalyi	1996	Emphasizing on creative interactions
	Paulus	2000	Interacting ideas in collaborations
	Hornecker	2005	Adjusting kinds and amounts of collective communications according to the form and size of spaces
	Haner	2005	Being Proximate while having privacy

The effect mechanism of interaction between the physical environment and its users' creativity, as the theoretic framework of the research, is that some spatial features and functional spaces bring out some environmental affordances by which users get mentally stimulated. Thus, every one by the self-relative perception of them motivated for the satisfaction of his variable needs at different levels uniquely, which leads to the incidence of his behaviors in the environment. In this regard, the heed to the perception relativity is important, according to different persons' abilities. Since the environmental affordances are considered as potential capabilities, if the awareness about their existence is not attained, they will not come into the reality of the users' minds. Besides, the ability of perception in different people relates to other fundamental individual characteristics such as insight, knowledge, and belief system (acquisitive aspect) and nature, temperament, and aptitude (genetic aspect). Accordingly, the environmental affordances are understood with different rates and therefore, the mental stimulation eventuated from a specific environment is different in people. This causes the occurrence of various behaviors or intensity and weakness in a particular behavior among different people in a specified environment. Similarly, the mentioned environmental-behavioral influences determine people's interpretation of the meaning of an environment and consequently the realization of different levels of sense of place. Then, it could be claimed that the resultants of these influences are not the same in their power of creativity.

The meaning as it is attributed to an environment and especially in the spaces with particular functions is largely performance-driven (Amabile, 1983; Brill et al., 1984). That means, in this context, the environmental specific stimuli of the mind and the occurrence of particular physical and mental behaviors resulted from them lead to continuous activity of some special parts of the human brain that are responsible for creative thinking. Therefore, a constant-used physical context directly influences the level of users' identity (Karimifard and Tabatabaei Malazi, 2017) that indirectly affects their creative potentials. By this approach in the research, the concept of environmental meaning narrows to a range that a place would be significantly affecting users' individual and social creativity.

Table 2
Physical factors influencing the sense of place in terms of creativity (Source: The Author)

Class	Physical Factors			
Spatial Features	Visual accessibility	Transparency	Adjusted view axes and proper perspectives	Visual proportions
	Specific textures and colors	Light and halation	Natural light and ventilation	Natural materials and elements
	Interconnection of inside and outside	Openness	Stability and equivalence	Formal integrity and cohesion
	Formal diversity and composition	Formal discipline	Formal chaos	Formal fracture
	Formal curvature	Formal challenging and tenseness	Formal legibility and clarity	Formal complexity and ambiguity
	Contradiction, contrast, and deconstruction	Formal iconography and symbolism	Functional discipline	Functional legibility and clarity
	Functional mixture and diversity	Functional integrity and cohesion	Functional proportions	Functional complexity and ambiguity
	Functional challenging and tenseness	Flexibility and collaborative design	Proximity	Visibility
	Supervise-ability	Permeability and movement continuity	Appropriate zoning and hierarchy	Enclosure
	Privacy and territory	Functional crypto-type	Being Interaction-based	Safety
Functional Spaces	Spaces with proper natural views and sight	Mediate semi-open spaces	Lateral green spaces	External pedestrian routes
	Interior walking spaces	Halt spaces	Appropriate access spaces	Multipurpose spaces
	Welfare spaces	Unofficial spaces	Personal spaces	Collective spaces
Environmental Affordances	Presence-ability	Activity-ability	Collectability	Security
	Possibility of relaxation	Possibility of movement and walk	Possibility of playing	Possibility of personalization and being dominated
	Wonderfulness	Risk avidity and challenging	Dubiousness and skepticism	Interpretability and philosophic-ability
	Possibility of positive distraction	Changeability and adaptability	discoverability	Possibility of ostentation
	Being inspirational	Being energetic	Role-playability and role-playfulness	Memorability and memory-making
	Possibility of establishing a direct connection	Liveliness	Being Sanctimonious	-

Figure 1 as the conceptual model illustrates the general theoretic framework of this research, which based on it, the independent variables consist of all physical stimulant factors of creativity generating environmental affordances. The occurrence, continuity, and enhancement of creativity in users of any environment are considered as the dependent variables. The intervening variables are the environmental perception and its resulted sense of place, which are considered at two levels: 1. The mental dynamism effective on creativity that is under the influence of perceived environmental affordances and motivations in response to them, and 2. The stimulating and reinforcing creative behaviors that are under the influence of the perception as well.

Finally, it should be noted that the control variables of the research problem include individual characteristics, non-

physical environmental factors affecting creativity, and the conditions of users' learning, which must be neutralized by applying special methods in the research process. Hence, the main hypothesis of the research is as follows:

By considering the certain mechanism of effect, the physical factors of an environment bear notable importance to have impacts on the incidence, increment, and durability of creativity, from the viewpoint of being in line with the sense of place.

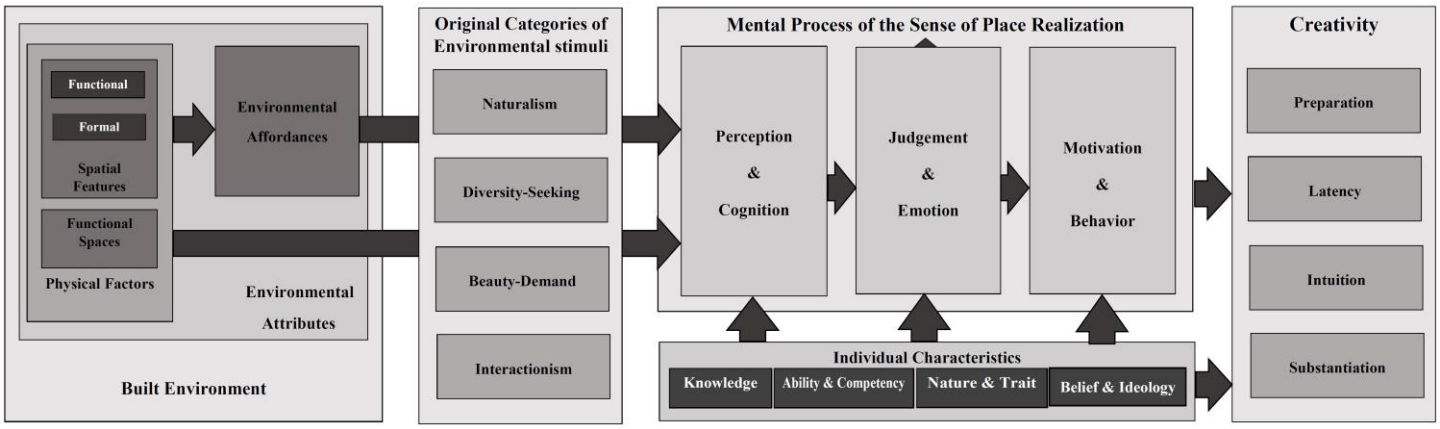

Fig. 1. The research conceptual model (Source: The Author)

4. Research Methodology

The present research consists of two major phases that respectively are: First, the review of the literature, the logical analysis of the opinions to produce the theoretical framework, and make the hypothesis precise, which were discussed formerly. Second, assessing the result validity of the previous phase due to statistical analytical methods in a case study. Therefore, at first, the codification and classification of the theoretical basics and consequently the formation of the theoretical framework were performed by a descriptive-analytical approach led to the determination of some aspects of the physical environment to be potential for enhancing people's creative capabilities in a specific environment. Afterward, by random sampling and use of a researcher-made questionnaire, a quantitative survey among the targeted people and the deductive statistical analysis of the obtained data were carried out. The queries of the questionnaire had been prepared to determine the importance of the physical factors, including spatial features, functional spaces, and environmental affordances concerning the realization of a high-level sense of place and separately, occurrence, enhancement, and continuity of the respondents' creativity in one of the stages of preparation, latency, intuition, and substantiation. To answer the questions, the Likert five-point scale was exerted, so the importance of each proposition would be assessed in people's view about the built environment. The explanation that a sentence of practical description followed by some depictive examples had been presented for every item of the physical factors come up in Table 2 and the respondents were asked to rank each item regarding their experiences to be effective on their mind in terms of the sense of place and creativity evolving, separately. For instance, about the spatial feature "Functional challenging and tenseness", the proposition was "Any physical-environmental thing that causes some stress in users of an environment during doing of physical activities in a space such as encountering an unusual physical element like high-altitude stair when moving" that every respondent must have given points from 1 to 5.

It should be noted that the respondent group in the targeted case was randomly selected from post-graduate architecture students of three high-education institutes, including Islamic Azad University of Kermanshah, Razi University, and Jahad-e-Daneshgahi Non-Profit Institute, all in Kermanshah. Since there were about 200 post-graduate students in these three institutes at the time of the survey, the cumulative volume of the sample was calculated using the Cochran formula (135) to provide reliability and generalizability in the level of 95 percent of meaningfulness (α=0.05). Subsequently, the questionnaire that the faculties of architecture departments of the mentioned universities had approved its validity, was electronically distributed among 150 students who were selected by the classified random method of sampling. Exactly 141 responses presented that four of them were not usable. The outcomes gathered from 137 cases were analyzed by SPSS version 24. Regarding the demographic information, the gender ratio consists of 43 men and 94 women with an educational combination of 126 master students and 11 Ph.D. candidates and age distribution range from 20 to 54 years old. Moreover, the categorizing of the sample was performed proportionally to the population of each university respectively 55, 45, and 37. After gathering the data, the amount of Cronbach's Alpha was calculated using SPSS for validating the questionnaire, which was 0.967 about the variable of sense of place and 0.921 about the variable of

creativity for the sum of all presented items and so demonstrates the high accuracy of measurements of the planned queries. Furthermore, the necessary condition of being random in all the data attained from the selected sample was confirmed by exerting the Run-Test in SPSS that led to the values larger than 0.05 for the indicator P. Besides, the normal distribution condition of the sample was investigated and affirmed by determination of skewness and kurtosis of resulted values of variables. Therefore, it was acceptable to apply parametric methods for statistical deductive analyses. To check the homology of variance dispersion between different groups of the sample and also to check the possibility of using the correlation analysis, Levene's test was applied and approved. Eventually, the one-sample T-test was used to investigate the meaningfulness of the differences between the data-achieved averages and anticipated values that validated the research hypothesis.

Then, an exploratory factor analysis based on Pearson's correlation matrix was applied for identifying and rating the major influential factors of the sense of place on the occurrence, enhancement, and continuity of users' creativity in the surveyed educational environments. In this regard, the correlativity and linearity of variables were approved in Bartlett's test and the proportion of variables for the execution of factor analysis was acknowledged by using the KMO test with results as 0.893 and 0.859 in two different modes. It should be noted that the multiplicity of respondents and the diversity in levels of their knowledge and abilities had a tremendous impact on limiting the control variables and preventing directional mistakes. Furthermore, the purposeful selection of the case among people with a high level of education in architecture was due to their familiarity with the environmental concepts especially the sense of place and their acceptable perception of the essence of their creativity, which is a reason for the validity and reliability of the research outcomes.

5. Findings

Considering that the research questionnaire focuses on the theoretical framework-extracted items as the sense of place factors in terms of promoting creativity, once it examines them in providing the conditions for realizing a high level of place sense and again in providing the facilities of emerging and strengthening creativity. As a result, in the first case, almost all items (except the spatial features "formal chaos", "formal challenging and tenseness", "functional complexity and ambiguity", and "functional challenging and tenseness" and also the environmental affordances "dubiousness and skepticism" and "risk avidity and challenging") were scored high and upper on average that the t-test confirmed their meaningfulness (the P-values less than 0.05), while in the latter case, different outputs were obtained that should be analyzed and are presented as follows: For all variables with a plus difference of average in comparison with the intermediate value of 3 except the spatial features "formal complexity and ambiguity" and the environmental affordance "risk avidity and challenging" the P-values less than 0.05 indicate their importance in the provision and formation of a suitable context for creativity. Moreover, the excess of averages compared to 3 in both above-cited variables was meaningless and caused by error, which demonstrates the equality of averages with the mediocre level illustrated the importance of these variables in the middle degree. For variables with a minus difference of average in comparison with 3, the equality of the averages with the supposed mediocre value has been approved about all variables except the spatial features "formal chaos", "formal fracture", "functional complexity and ambiguity", "functional challenging and tenseness", and "functional crypto-type" and also the environmental affordance "dubiousness and skepticism". Thus, nearly similar to the results of the previous step in terms of the sense of place, the importance of the mentioned variables, which have lots of similarities together, was less than the mediocre level in environmental users' opinion and about the other items, the importance is notable. In acknowledging the obtained results from reviewing the literature, it could be said about these less important variables that the environmental aspects of being challenging, ambiguous, and stressful can assist the occurrence and reinforcement of creativity in a controlled manner, especially in the functional field, but it would have negative effects in a more amount. A summary of these results is presented in Table 3.

Ultimately, by using exploratory factor analysis, the remarkable independent variables of the place sense concept were ranked in two separate categories of environmental attributes in terms of affecting the dependent variable of creativity, first based on spatial features and functional spaces, and second based on environmental affordances. The analysis outcomes are inset into Table 4 that shows the determined variance by the variables of environmental affordances for the dependent variables of respectively the sense of place and creativity. The same was done for the variables of spatial features and functional spaces in Table 5. As it is specified in these tables, 75.93% and 61.30% of the variances of the dependent variables of respectively the sense of place and creativity are explained due to 5 environmental attributes based on environmental affordances, and 89.61% and 66.99% of them (for respectively the sense of place and creativity) are signified by 11 environmental attributes based on spatial features and functional spaces, which are considered as significant numbers. It should be noted that these attributes can be presented in the form of a correlation matrix as it is shown in Table 6 in which the overlap of determined variances for the variables "sense of place" and especially "creativity" by two cited groups of attributes is emphasized.

Table 3
Ranking the Physical factors of the sense of place influencing creativity by Descriptive Statistics (Source: The Author)

Class	Rank	1	2	3	4	5	6	7	8	9
Spatial Features	**Item**	Natural light and ventilation	Controlled view axes and proper perspective	Formal beauty and attractiveness	Natural materials and elements	Lighting and penumbra	Formal legibility and clarity	Being spatial interaction-based	Interconnection of inside and outside	Functional flexibility and collaborative design
	Mean for sense of place	4.87	4.21	4.41	4.83	4.27	4.11	4.46	4.67	4.33
	Mean for creativity (In order of rank)	4.33	4.23	4.20	4.15	4.13	4.04	4	3.95	3.89
Functional Spaces	**Item**	Lateral green spaces	Welfare spaces	Mediate semi-open spaces	Halt spaces	Unofficial spaces	External pedestrian routes	Spaces with proper natural views and sight	Interior walking spaces	Multipurpose spaces
	Mean for sense of place	4.65	4.51	4.77	4.32	4.43	4.29	4.81	4.18	4.58
	Mean for creativity (In order of rank)	4.25	4.04	4.02	3.98	3.94	3.91	3.89	3.76	3.72
Environmental Affordances	**Item**	Being energetic	Liveliness	Memorability and memory-making	Possibility of rest and relaxation	Possibility of movement and gait	Presence-ability	Activity-ability	discoverability	Security
	Mean for sense of place	4.63	4.89	4.81	4.70	4.34	4.49	4.42	4.19	4.55
	Mean for creativity (In order of rank)	4.36	4.23	3.99	3.97	3.97	3.97	3.97	3.97	3.95

Table 4
Environmental attributes that are influential on creativity based on the environmental affordances (Source: The Author)

Item	Environmental attribute	Environmental affordances as subcategories (in importance order*)	Determined variance of the dependent variable of place sense	Determined variance of the dependent variable of creativity (in order of rank)
1	Dynamism	Possibility of movement and walk, Possibility of playing, Liveliness, Possibility of ostentation, Being energetic	15.31%	18.24%
2	Generativity	Possibility of positive distraction, Discoverability, Role-playability and role-playfulness, Being Sanctimonious, Memorability and memory-making, Changeability and adaptability	19.24%	13.37%
3	Justifiability	Activity-ability, Being inspirational, presence-ability	17.89%	12.72%
4	Enrichment and excitement	Risk avidity and challenging, dubiousness and skepticism, Wonderfulness	7.04%	9.17%
5	Durability and consistency	Possibility of relaxation, Security	16.45%	7.80%

*The order shows the importance of subcategory factors to form any attribute based on the statistical analysis.

Table 5
Environmental attributes that are influential on creativity based on the spatial features and functional spaces (Source: The Author)

Item	Environmental attribute	Spatial features and functional spaces as subcategories (in importance order*)	Determined variance of the dependent variable of place sense	Determined variance of the dependent variable of creativity (in order of rank)
1	Naturalism	Natural materials and elements, Lateral green spaces, Mediate semi-open spaces, Interconnection of inside and outside, Adjusted view axes and proper perspective, Transparency, Visual accessibility	13.12%	10.75%
2	Functional appropriateness	Supervise-ability, Appropriate zoning and hierarchy, Functional discipline, Functional legibility and clarity, Permeability and movement continuity	9.99%	9.56%
3	Diversity of usage	Interior walking spaces, Spaces with proper natural views and sight, External pedestrian routes, Halt spaces, Unofficial spaces, Mediate semi-open spaces	10.03%	9.20%
4	Formal proportionality	Formal integrity and cohesion, Visual proportions, Formal discipline	7.97%	7.72%
5	Functional balance	Functional mixture and diversity, Functional integrity and cohesion	6.71%	4.82%
6	Being formal multi-semantic	Formal chaos, Contradiction, contrast, and deconstruction, Formal complexity and ambiguity	3.57%	4.82%
7	Being Functional multi-semantic	Functional complexity and ambiguity, Functional challenging and tenseness, Functional crypto-type	2.91%	4.70%
8	Interactionism	Spatial openness, visibility, Proximity, Being Interaction-based	10.71%	4.48%
9	Individualism	Formal iconography and symbolism, Functional flexibility and collaborative design	8.22%	4.28%
10	Formal balance	Formal fracture, Formal curvature	5.21%	3.49%
11	Composure and calm	Privacy and territory, Safety, Stability and equivalence	11.17%	3.13%

*The order shows the importance of subcategory factors to form any attribute based on the statistical analysis.

Table 6
Correlation matrix of environmental attributes based on dual origins (Source: The Author)

		Attributes based on environmental affordances				
Attributes based on spatial features and functional spaces		Dynamism	Generativity	Justifiability	Enrichment	Durability
	Tendency to nature and interaction	●			●	
	Appropriateness and balance between form and function	●	●	●		●
	Diversity of usage and function	●				
	Being formal-functional multi-semantic		●	●	●	
	Individualism		●	●		
	Composure		●			●

6. Discussion

As mentioned before, the main question of this research has been considered in most of the similar previous researches, whereas limited conditions and particular scopes have been pursued in their approaches towards their answers. Furthermore, most of the related researches have just presented partial architectural solutions and approximately none of them concentrated on the suggestion of structured practical regulations in a systematic approach concerning the mechanism of the physical environment impacts on users' creativity, while the present research has sought to determine a generative pattern to be a road map avoided from the superficial consideration to this major problem and an anti-creativity prescription of temporary predefined solutions. Thus, it was attempted that the findings are profoundly presented in the form of an informative checklist so that the power of designers' creativity would be the ultimate solver of the design problem.

It is noteworthy that in the research by Williams (2013), the only study that has applied the systematic approach to analyze this subject, no linkage is considered between environmental affordances with spatial features and functional spaces. The explanation that this concept has been imperfectly limited to the presence of some adjunct equipment in the physical environment such as furniture. However, the concept of environmental affordance in a considerable correlation with other physical features is processed as the major environmental trigger of creativity in the present research. Besides, here for the first time, the theory of *the strong correlation of environmental creativity with the place sense of any built environment* and also its "why" and "how" has been proposed.

7. Conclusion

This research has been seeking to determine the physical attributes of a creativity-enhancer place and presenting the principles for designing such environments. For this purpose, spatial features, functional spaces, and subsequently their resulting environmental affordances

were introduced, as main factors of the sense of place, in a factor categorization format, which is acknowledged effective in the determination of creativity changes of environmental users meaningfully. These creativity-stimulant attributes are dynamism, generativity, justifiability, enrichment, and durability in the order of importance for the category of environmental affordances, and tendency to nature and interaction, formal-functional proportionality and balance, being formal-functional multi-semantic, diversity of usage, individualism, and finally, composure in the category of spatial features and functional spaces that each of them consists of its specific subcategories. According to their overlaps and correlations, the dynamism is related to naturalism and interactionism, formal-functional proportionality and balance, and diversity of usage and function. The generativity is deduced from formal-functional proportionality and balance, being formal-functional multi-semantic, individualism, and composure. The justifiability is concerned with formal-functional proportionality and balance, being formal-functional multi-semantic, and individualism. The enrichment is affected by naturalism and interactionism, and being formal-functional multi-semantic. Eventually, the durability is obtained from formal-functional proportionality and balance, and composure. Regarding the multiple repetitions of the above-mentioned factors, it is conceivable to say that the most important subjects that should be focused on to achieve the architectural design purposes concerning the improvement of users' mental activities and creativity are the formal-functional proportionality and balance, and especially multi-meaningfulness to provide various inferences for different users. As it turns out, all the research results affirm the hypothesis that the same physical factors causing the realization of a high level of the sense of place in a specific environment are probably affecting the occurrence and enhancement of potential creativity in users of that place. Therefore, it can be claimed that approximately most of the factors influencing the sense of place have been identified in this research about any built environment and among these, the items that are most effective on the creativity of environmental users have been ranked. The results indicate a notable overlap of these factors and so validate a strong correlation between The two concepts of environmental creativity and the sense of place.

According to all these interpretations, it is feasible to contend that the more creativity is applied in the architecture of an environment in the way to orient the physical factors influencing the realization of a high level of the sense of place, it would have more potential for stimulating the environmental users' creativity. Thus, it seems to accentuate an enhancing cycle of architectural creativity, especially in educational spaces of architecture that is illustrated in Figure 2.

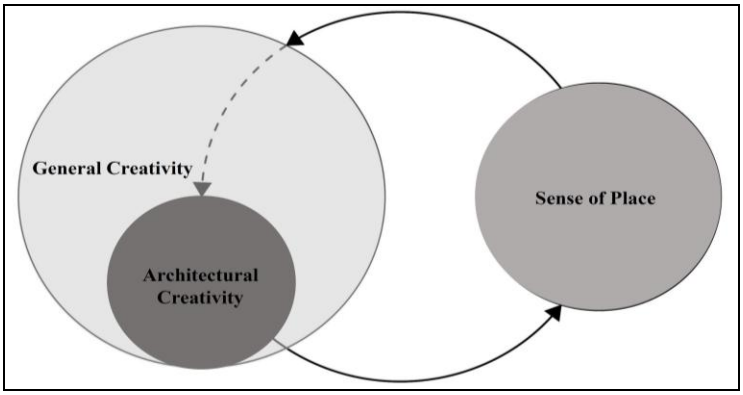

Fig. 2. The environmental cycle of creativity promotion in educational spaces of architecture (Source: The Author)

References

1) Alexander, C. (1979). Architecture and Secret of Immortality: Timeless Way of Building. (M. Ghayoumi Bidhendi, Trans.). Tehran: Shahid Beheshti University Press. (In Persian).
2) Amabile, T. M. (1983). The Social Psychology of Creativity. New York: Springer-Verlag.
3) Amabile, T.M. (1988). A Model of Creativity and Innovation in Organisations. Research in Organisational Behaviour, 10, 123-167.
4) Amabile, T.M. (1990). With You, without You, the Social Psychology of Creativity and Beyonal. In Theories of Creativity, R. Albert & M. Albert (Eds.). Sage Publication.
5) Amabile, T.M., Hill, K.G., Hennessey, B.A. & Thige, E.M. (1994). The Work Preference Inventory: Assessing Intrinsic and Extrinsic Motivational Orientations. Journal of Personality and Social Psychology, 66(5), 950-967.
6) Azemati, H., Parviz, R., Karimi Azari, A.R. & Aghaghi Kallaki, M. (2016). Design Effective Principles in Improving Students' Creativity in Teaching Spaces, Example Case: Maidenly High Schools in Lahijan, Quarterly Journal of Innovation and Creativity in Human Sciences, 6(2), 121-142. (In Persian).
7) Barrett, P., & Barrett L. (2010). The Potential of Positive Places: Senses, Brain, and Spaces. Intelligent Buildings International, 2(3), 218-228.
8) Beatty, E.L., & Ball, L.J. (2011). Investigating Exceptional Poets to Inform an Understanding of

the Relationship between Poetry and Design. DESIRE '11: Proceedings of the Second Conference on Creativity and Innovation in Design. 157-165.
9) Bisadi, M., Mozaffar, F., & Hosseini, S.B. (2013). Spatial Aspects of Public Areas Affecting the Researchers Creativity and Innovation in an Architecture and Urban Design Research Center. Technology of Education, 7(3), 239-249. (In Persian).
10) Brill, M., Margulis, S., & Konar, E. (1984). Using Office Design to Increase Productivity. Buffalo, NY: Workplace Design and Productivity, Inc.
11) Brill, M., Weidermann, S., Alard, L., Olson, J., & Keable, E. (2001). Disproving Widespread Myths about Workplace Design. Jasper. IN: Kimball International.
12) Boden, M. (1999). Computer Models of Creativity. In Handbook of Creativity, R. J. Sternberg (Ed.). New York: Cambridge University Press.
13) Casakina, H., & Kreitler, S. (2011). The Cognitive Profile of Creativity in Design. Thinking Skills and Creativity, 6(3), 159–168.
14) Castells, M., & Hall, P.G. (1994). Techno Poles of the World: The Making of Twenty-first Century Industrial Complexes. London, New York: Routledge.
15) Csikszentmihalyi, M. (1996). Creativity: Flow and the Psychology of Discovery and Invention. New York: HarperCollins.
16) Dul, J., Ceylan, C., & Jaspers, F. (2011). Knowledge Workers' Creativity and the Role of the Physical Work Environment. Human Resource Management, 50(6), 715-734.
17) Evans, R., & Russell, P. (1989). The Creative Manager. London: Unwin Hyman.
18) Franz, G. (2004). Physical and Affective Correlates to Perceived Order in Open-plan Architecture. Dresden International Symposium of Architecture, Dresden, Germany.
19) Franz, G., & Wiener, J.M. (2008). From Space Syntax to Space Semantics: A Behaviourally and Perceptually Oriented Methodology for the Efficient Description of the Geometry and Topology of Environments. Environment and Planning B: Planning and Design, 35(4), 574-592.
20) Gharebigloo, M. (2012). The Role of Environmental Effects on Developing Creativity in Children. Manzar, 4(19), 86-91.
21) Gibson, J.J. (1977). The Theory of Affordances. In Perceiving, Acting, and Knowing, R. Shaw & J. Bransford (Eds.). New Jersey: Lawrence Erlbaum Associates.
22) Golestan Hashemi, M. (2008). Sociology of Creativity and Innovation. Journal of Social Sciences Development, 11 (3).
23) Ivcevic, Z., Brackett, M.A., & Mayer, J. D. (2007). Emotional Intelligence and Emotional Creativity. Journal of Personality, 75(2), 199-236.
24) Kamrani, A., & Behzadfar, M. (2016). The Meaning of Place; A Constant or Changing Quality? Lynch, Rapoport and Semiotics View Points. Space Ontology International Journal, 5(2), 43-47.
25) Karimi Azari, A.R., Hosseini, S.B., Saleh Sedghpour, B., & Hosseini, A. (2016). Design Principles of Residential Space to Enhance Children's (3-7 Years Old) Creativity in Iran (Case Study: Tehran District 4). Bagh-e Nazar, 13(41), 19-34. (In Persian).
26) Karimifard, L., & Tabatabei Malazi, F. (2017). Physical Factors Influencing Place Identity in Higher Education Environments (Case Study: Islamic Azad University, South Tehran Branch). Space Ontology International Journal, 6(1), 55-68.
27) Killeen, J.P., Evans, G.W., & Danko, S. (2003). The Role of Permanent Student Artwork in Students' Sense of Ownership in an Elementary School. Environment and Behaviour, 35(2), 250-263.
28) Lang, J. (1980). The Built Environment and Social Behaviour: Architectural Determinism Re-Examined. Via, 4, 146-153.
29) Lang, J. (1987). Creating Architectural Theory: The Role of the Behavioural Sciences in Environmental Design. (A. R. Einifar, Trans.). Tehran: Tehran University Press. (In Persian).
30) MacKinnon, D.W. (1962). The Nature and Nurture of Creative Talent. American Psychologist, 17, 484-495.
31) Mayer, R.E. (1999). Fifty Years of Creativity Research. In Handbook of Creativity, R. J. Sternberg (Ed.). New York: Cambridge University Press.
32) Mayer, J., Caruso, D., & Salovey, P. (2000). Emotional Intelligence Meets Traditional Standards for an Intelligence. Intelligence, 27(4), 267-298.
33) McCoy, J.M. (2005). Linking the Physical Work Environment to Creative Context. Journal of Creative Behaviour, 39 (3), 167-189.
34) Meyers-Levy, J., & Zhu, R. (2007). The Influence of Ceiling Height: The Effect of Priming on the Type of Processing that People Use. Journal of Consumer Research, 34(2), 174–186.
35) Motalebi, G. (2001). Environmental Psychology: A New Knowledge Serving Architecture and Urban Planning. Honar-Ha-Ye-Ziba Memar-Va-Shahrsazi, 10. 52-67. (In Persian).
36) Nickerson, R.S. (1999). Enhancing Creativity. UK: Cambridge University Press.
37) Osborn, A.F. (1953). Applied Imagination. New

York: Charles Scribner's Sons.
38) Osborn, A., & Scribner, C. (1984). Your Creative Power: How to Use Imagination. New York: Charles Scribner's Sons.
39) Pancholi, S., Yigitcanlar, T., & Guaralda, M. (2015). Place Making Facilitators of Knowledge and Innovation Spaces: Insights from European Best Practices. International Journal of Knowledge-based Development, 6(3), 215-240.
40) Rezaei, H. (2018). Investigating the Psychological Impacts of Place on Built Environment Users' Creativity (Case Study: Spatial Impacts of Educational Environments on Architecture Students' Creativity). Ph.D. Dissertation, Islamic azad University Central Tehran Branch. (In Persian).
41) Rezaei, H., Keramati, G., Dehbashi Sharif, M., & Nasirsalami, M. R. (2018). A Meta-Analytical Attitude to the Form-Function Relation in Architecture Using the Concept of Creativity. Cogent Arts & Humanities, 5(1).
42) Rezaei, H., Keramati, G., Dehbashi Sharif, M., & Nasirsalami, M. (2018). A Schematic Explanatory Pattern for the Psychological Process of Achieving Environmental Meaning and Actualizing Sense of Place Focusing on the Intervening Role of the Perception. Bagh-e Nazar, 15(65). 49-66.
43) Rezaei, H. (2019). Human and the Environment (Environmental Psychology). Master of Architecture Course Notes, Islamic Azad University, Kermanshah Branch, Faculty of Engineering, Department of Architecture and Urbanism (In Persian).
44) Rezaei, H., Keramati, G., Dehbashi Sharif, M., & Shafai, M., & Madani, R. (2010). Principles of Designing Children's Educational Spaces Based on Creativity Model. Technology of Education, 4(3). 215-232. (In Persian).
45) Simonton, D.K. (2005). Creativity. In Handbook of Positive Psychology, C. R. Snyder, & S. J. Lopez (Eds.). US: Oxford University Press.
46) Stamps, III, A.E. (2005). Isovists, Enclosure and Permeability Theory. Environment and Planning B: Planning and Design, 32(5), 735-762.
47) Stamps, III, A.E., & Krishnan, V.V. (2006). Spaciousness and Boundary Roughness. Environment and Behaviour, 38(6), 841-872.
48) Steiner, R. (1916). The Twelve Human Senses. In Toward Imagination: Culture and the Individual. (1990). Hudson NY: Anthroposophic Press.
49) Strzalecki, A. (2000). Creativity in Design: General Model and its Verification. Technological Forecasting and Social Change, 64(2&3), 241–260.
50) Toker, U. (2003). Space for Innovation: Effects of Space on Innovation Processes in Basic Science and Research Settings. Ph.D. Dissertation, North Carolina State University.
51) Torrance, E. P. (1974). Torrance Tests of Creative Thinking: Norms-Technical Manual. Bensenville, IL: Scholastic Testing Service.
52) Wallas, G. (1926). The Art of Thought. New York: Harcourt, Brace, Jovanovich.
53) Williams, A. (2013). A Grammar of Creative Workplaces. Ph.D. Dissertation, University of East London