

Architectural Creativity as Architecture of Creativity; Analysis and Rating of the Physics-Based Psychological Effects of the Sense of Place on Environment Users' Creativity; Case Study: Higher Education Institutions of Kermanshah*

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ABSTRACT

Creativity is one of the certain traits of human beings and is especially valuable in human societies as the central theme of many scientific researches in various sciences such as environmental psychology. Accordingly, the present research tries to answer the question "How much important are the effects of physical factors of architectural place on the users' creativity and what is the role of architectural design in organizing and enhancing them?" Regarding this query and how it has been addressed in past researches, the present study aims to explain the main characteristics of creative places in a pattern form by identifying and categorizing the physical factors of any built environment that may influence the users' creativity actively. It should be noted that what distinguishes this study from other research is its systematic approach in problem-solving and consequently the kind of its results. In terms of methodology, the configuration of the present research is based on the Grounded Theory and a mixed research method (qualitative and quantitative survey) in which the findings resulted from a comprehensive documentary and field (interview and questionnaire) study and in other words, its theoretical framework, are completed and validated by applying statistical techniques (One-sample t-test and Pearson correlation analysis) on the data collected in a purposeful case study. The samples of this case study include three universities in Kermanshah, Iran, consists of educational environments of architecture in which convenience-selected teachers and random-selected post-graduate students identified and expressed their creativity-stimulant behaviours as well as the physical items of the environment that afford those activities. Finally, it is concluded some of the spatial features, functional spaces, and their associated environmental affordances as the main items affecting the users' creativity enhancement and continuity that ultimately have been classified and rated by an exploratory factor analysis as creativity-effective environmental attributes to be considered in designing the future environments in general and educational environments especially, as the main strategy.

Keywords: Environmental Affordances, Environmental Perception, Environmental Behaviour, Creativity, Educational Spaces of Architecture.

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1. INTRODUCTION

Creativity is a significant phenomenon that its relatively superior approach is a fundamental goal in any provident social system. Thus, the attempt for support and acceleration of its processes is considered an indispensable segment in the policies of societies (Castells & Hall, 1994). Since the aptitude for creativity is instinctively situated in humans and its realization is possible to be learned and nurtured, contextualization and growth ground are required in order to bolster it and this is achievable by providing condition, equipment, and requisite facilities. The notion of creativity has been emphasized in the arts more than other Humanities and meanwhile it has always been considered the most challenging need and important pedagogical and professional issue. In architecture, the meaning of creativity is any form of innovation in the concept, style, or body of a building (Sobhiyah, Bemanian, & Keshtiban, 2008).

Despite the age-long endeavor for the identification of creativity's essence and ways of enhancing it, this topic has still remained one of the most mysterious subjects in human's intellectual demeanor. Some scholars deem creativity as a social phenomenon and reckon that it is rooted in society's desiderata and circumstances and familial conditions. Some people assume it as a personal phenomenon that is under the influence of factors such as motivation, excitement, emotion, and individual learning. Others presume creativity like a cognitive concept that interacts with preeminent processes of mind such as contemplation, intelligence, imagination, and information processing. And last, some regard it as a multi-dimensional conception affected by social and cognitive factors (Golestan Hashemi, 2008). Therefore, the effective factors in the development of creativity might generally be divided into individual and environmental categories. The former category is related to personal characteristics and the latter to one's positions in relevancy with others (Amabile, 1990). Although the term "environment" could be used in phrases like social environment, cultural environment, economic environment, physical environment, and etcetera and it is conceivable to investigate and contemplate the efficacy of each on creativity, what is going to be heeded in the present study is certainly the physical environment through which an architectural work and its resulted place can be embodied. In accordance with the incontrovertible and unremitting impacts of the physical environment on humans in various mental and behavioural dimensions, it should be acknowledged that the field of environmental design and in fact, the architectural product, is one of the most substantial contexts for the realization and enhancement of creativity. Architecture is an instrument whereby the true meaning of place emerges and this place influences the human's body and mind by all its specific properties and capabilities. Hence, in order to determine the essence and causality of environmental occasions and affordances, the purposeful architectural

planning and actions substantially affect the humans and the formation and realization of their mental and behavioral characteristics including creativity. By reviewing about 7000 essays on creativity, Amabile perceived that only 138 of them were concentrated on contextual variables of creativity, whilst a few of those variables were related to the physical environment. Whereas she opined that the physical environment is cognitively and perceptively stimulant, then it can amplify creativity (Amabile, 1996). Woodman also considers the physical environment as an important contextual effect (Woodman, Sawyer, & Griffin, 1993), and Martens believes that the physical environment can have an impact on works, processes of creativity, and incentive alternation (Martens, 2011).

The major goal of this study, therefore, is to attain principles and regulations propelling the augmentation of physical environment effects on the emergence and enhancement of users' creativity. To this end, it is required to investigate the interrelation between place, in terms of environmental affordances and semantic levels, and creativity as a mentally motivational requirement and its environmental stimulants. In the other words, the main query of the present survey is as follows: How much important are the effects of physical factors of architectural place on the users' creativity and what is the role of architectural design in organizing and enhancing them. So as the basic hypothesis of the research, it can be stated that "the possibility of the emergence and enhancement of users' creativity in an environment is influenced by some of its features, affordances, and attributes that likely lead to a high degree of sense of place".

2. RESEARCH BACKGROUND

The first techniques for the development and enhancement of creativity were presented by Osborn in 1948 by emphasizing on team working and brainstorming (Osborn & Scribner, 1984). After that and during the 1960s and 1970s, tremendous efforts were made to regulate the models of creativity development and enhancement and at the end of the second millennium, they led to Nickerson's twelve processes based on obtained abilities, experiences, and knowledge of people (Nickerson, 1999). Likewise, some studies have been carried out on the environmental factors affecting creativity, which seems negligible compared to the importance of this topic. Despite the fact that the environment has a more prominent role than personality factors, interventions in environmental factors are much easier than changes in individual characteristics and aptitudes (Amabile, Hill, Hennessey, & Thige, 1994). Howsoever, most of the aforesaid researches regarded the issue narrowly and locally and often focused on the study of only one or more particular environmental factors to improve some aspects of creativity in a predetermined class of environment users and confined to small-scale solutions. One of the few existing apparent surveys

in this field, is Toker's research that investigated the issue of innovation in research centres (Toker, 2003). In his research, using the space syntax method, he was engrossed in studying the effects of spatial configurations of different research offices and laboratories on technical face-to-face consultations, and innovative outputs of researchers. In this regard, Bisadi et al. (2013) in their survey under the heading "Spatial Aspects of Public Areas Affecting the Researchers Creativity and Innovation in an Architecture and Urban Design Research Center Print" studied the quality of collective spaces in architectural and urbanism research centers. The purpose of forenamed research was the illustration of some guidelines for designing architectural and urbanism research centers based on increasing the creativity and innovation of scholars in which the impact of spatial features such as privacy, beauty, spatial diversity, flexibility, contiguity, and visibility were recognized as the spatial characteristics effective on the increment of creativity built upon factors like the motivation, physical lull and comfort, interactions and creative thought. Furthermore, Shafaei et al. (2010) proposed some tactics for stimulating the sense of curiosity and imagination of children in educational environments through a survey entitled "The Design Principles for Children's Educational Spaces Based on Creativity Model". Major findings obtained from their research are directed to the feasibility of free operation of open spaces and natural materials by children. Gharebigloo (2012) also considers the open urban space and environment in the paper entitled "The Role of Environmental Effects on Developing Creativity in Children" as a context for the education of children and realization of creativity in them. She describes that this substantial subject is fulfilled by increasing the social interaction capability and learning in children and the reason is the diversity of issues and their discrepancy with monotonous and predetermined upbringings of parents. In the same vein, Azemati et al. (2016) in a paper called "Design Effective Principles in Improving Students' Creativity in Teaching Spaces, Example Case: Maidenly High Schools in Lahijan" investigated and presented a solution for the relations of physical factors including variability of light and color, furniture variability, flexibility of forms, presence of green space, water, and natural materials, and application of semi-open spaces in inciting creativity factors. Moreover, Karimi Azari et al. (2016) in their research titled "Design Principles of Residential Space to Enhance Children's (3-7 Years Old) Creativity in Iran (Case Study: Tehran District 4)" concluded that the application of natural elements, provision of safe, complex, and flexible space can improve the creativity in residential environment through positive influence on child's motivation for play, innovation, curiosity, and mental peace. Therefore, it seems that among all the national and international studies carried out in this area, the survey of Williams (2013) entitled "A Grammar of Creative

Workplaces" studied the issue much more profoundly and endeavored to determine an updated systematic process capable of describing the emergence and enhancing the creativity under the influence of environmental factors. However, that survey has been performed in the field of organizational management and focused on the concept of environment in diverse physical and social dimensions. Thus, the expected professional concentration on physical factors is not apparent in it.

3. THEORETICAL FOUNDATIONS AND FRAMEWORK

The theoretical foundations of the present research are submitted in the fields of creativity and environmental psychology of creativity where the required constructs and concepts of its analytical section are presented and ultimately, the research theoretical framework is exhibited in the form of the conceptual model of the research.

3.1. The Concept of Creativity and Factors Affecting It

There are huge amounts of definitions for creativity and one of the most common of them is presented by Amabile; "The creativity is the process of generating novel ideas and innovation in the successful application of them", she describes (Amabile, 1983). In this regard, creativity encompasses two aspects; subjective and objective, both of which are noticed momentous in the evaluation of this ability. With the admission of this definition, 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 purposeful realism; and (3) A sequential nature based on the time. Therefore, this general concept might be defined and evaluated in the practical area of the issue by three individual indicators (Strzalecki, 2000):

(1) Cognitive system of mind and flexibility in its processes; (2) Personality system consists of freedom and liberty in self-declaration and expression; and (3) Value system and authority in validating and choice. In categorizing creativity, Boden (1999) introduces it in two types: (1) historical creativity which revolutionizes the history and culture; and (2) personal creativity which due to it, new ideas are harnessed for the person and it does not possess any historical or cultural importance. Parallel to these definitions, other classifications of creativity have been presented, among which the classification including instant creativity and everyday creativity is of the most important ones. The instant or interim creativity leads to alternations in the society depending on the person's capability just like Boden's historical creativity and the everyday creativity is a kind that because of it, people are dealing with solving their own issues and improving their work and life conditions (Amabile, 1983; Simonton, 2005; Runco, 2007).

The first model of creativity, that alludes to its sequential nature, was elucidated by Poincare in 1913 and formulated by Wallas in 1926 in four stages including introduction, latency, clarification, and final acknowledgment. Afterward, this model was modified by Evans and Russell (1989) and included four stages of “preparation, latency, intuition, and substantiation” with an additional conditional stage named “failure” that turned this model from linear into a cyclic mode (Rezaei, Keramati, & Dehbashi Sharif, 2018). Csikszentmihalyi (1996) also adjusted Wallas’s model with a cyclic model where the “substantiation” phase is divided into two stages of “assessment and codification of details”. Examination of this sequential essence reveals that creativity is not just a characteristic feature that could exist within the man without any alteration. By contrast, it is an item that gets completely reinforced by the effects of some specific factors and attenuates due to circumscriptions (Rezaei, Keramati, Dehbashi Sharif, & Nasirsalami, 2018). Therefore, studying the creativity as a perceptual-cognitive process resulted from mental activities in relation with the physical environment or in other words, the environmental psychology of creativity, is necessary more than ever.

3.2. Environmental Psychology of Creativity

One of the most important behavioural fields of the human mind is raised when encountering the surrounding environment and the importance of this issue has eventuated a branch in the science of psychology which is called environmental psychology. In this context, the living environment of human is assumed as a container for his behaviors and activities, and introduced and studied namely as the behavioural setting. Therefore, the main presumption is that the man’s behaviour and experiences cannot be observed separately without attention to environmental conditions. “It is not conceivable to disassemble the patterns of events dominating living in buildings and cities from the spaces where they occur”, Alexander (1979, p. 61) describes. Thus, it is acknowledged that the human-environment relation is an interrelated one happened through perception and this perception is not just a biologic process and varies from person to person. Hence, it is essential to pay special attention to motivation and its relevancy to the concept of demand. Human owns diverse material, psychic, and spiritual urges that are heeded as a directing and organizing force of deliberate perception, cognition, and behaviour. Since one’s behaviour emerges from satisfaction of his needs, it is assumed that specific features of an environment, which are perceived in a unique manner, are the stimulus of motivation for performing the behaviours that are in compatibility with the satisfaction of his needs and the level of creativity of these behaviours are mostly appertained to the aforesaid environmental properties. The concept of affordance must be noticed for an explanation of this process. The word “affordance” was first coined

by Gibson in 1977. He believes that the combination of materials and constitutional diverse levels of the universe reveals some of environmental affordances and the human mutates levels of physical environment in order to adjust the affordances of environment with his demands (Motallebi, 2001). In Fact, physical environment consists of a set of levels and the human alters the meaning of built environment by varying in these levels (Mortazavi, 2008). In accordance with Gibson's opinion, “A building proposes something by its existence” (Lang, 1987, p. 91). However, it should be noticed that the affordances of an object or environment are founded on properties, experiences, merit, and demands of the observer. “An environment might own particular affordances for a specific individual, whereas these affordances could be meaningless (more often due to paucity of the knowledge about their presence) for another person and the environment does not disclose them for him” (Motallebi, 2001, p. 62). In other words, themes like meaning, beauty, and liking form in users' mind and become de facto because of those potential and variable affordances and this is a prerequisite for realization of behaviour and determiner of its creativity level. Therefore, it can be cited that the human feelings and actions are restricted by affordances of man-made environment (Lang, 1980). In the context of this research, ergo, the meaning of an environment is commensurate with the elicited creativity of its environmental user which is the consequence of the interaction between affordances of the environment and his demands. Explaining that it can be claimed the environmental affordances considered in the research, which derive from the spatial features and functional spaces of the architectural work (Rezaei, Keramati, Dehbashi Sharif, & Nasirsalami, 2018), are one of the most important mediating variables of the problem, as input of perception process and in other words stimuli of creative behaviours.

3.2.1. Environmental Senses and Perception from the Creativity Point of View

Senses are the tools for transferring the environmental information to the processing center of a human mind and in other words, a requisite for the attainment of individual's perception from environment. Human owns many various senses, however, his five senses are studied and identified quite more. Yet the human senses are beyond these, and when it comes to the topic of the physical environment and the occurrence of a creative behavioural reaction, other items like the feelings resulted from spatial openness, transition or depth and pain that rooted in neurotics, and the feelings based on speech (expression), intellection or cerebration and individuality (ego) must be noted which were classified and reported for the first time by Steiner (1916). Several human effective conditions have been perceived because of those senses in relation to the subject of creativity and consequently the production of sufficient motivation for creative behaviours, which

are sometimes overlapped with each other, and in the following, some of the important ones are going to be considered.

A) Comfort

The comfort is the proper provision of a set of environmental factors that leads to the satisfaction of the user of that environment physically, and is effective in his stamina and motivation (Brill, Margulis, & Konar, 1984). Regarding the subject of creativity and according to Maslow's pyramid of hierarchy needs, the scarcity of comfort in an environment is definitely noted as a restricting factor of creativity both in the area of realization and its continuity. In this regard, the environmental comfort-related senses such as gustation, olfaction, audition, touch, and vision are important. The two firsts are mostly applicable to the air quality of environment by factors like temperature, smell and freshness, the two latter are relevant to the type and texture of materials especially in environmental comfort equipment, and the last one is often alluded to the field of aesthetics.

B) Openness

This notion refers to the feeling that is generated in the user according to the level of openness in an enclosed space in each spatial position which usually has neurotics, psychological, and emotional origins (Franz, 2004). From a neural-mental point of view, this feeling is pertinent to features like visual and movement accessibility, complexity and bordering and mostly gets processed and perceived by a special part in human's brain which is called Parahippocampal Gyrus (Stamps, 2005). In relation to this concept, the keywords such as "complexity with an emphasis on contrast, sensory richness, and visual connection" and also "the order with an emphasis on legibility, transparency, and solidarity" are discussed and surveyed (Franz & Wiener, 2008) and so, it has a special niche in theoretical foundations of the present research. Among the most significant achievements of this research area, one can mention the positive influence of high ceilings on conceptual thought and short ceilings on thinking concentrated on details (Meyers-Levy & Zhu, 2007), the positive influence of constructive disorder (intentional and controlled) versus the negative influence of disruptive disorder (environment without organizer) on spatial openness feeling and consequently the creative thinking (Stamps & Krishnan, 2006), and the positive influence of complexity and ambiguity in environmental boundaries on openness feeling and creative performance (Brill, Margulis, & Konar, 1984).

C) Transition

Transition or the feeling of depth, which its major manifestation is unveiled in movement, has been one of the most rudimentary solutions applied by humans for encountering issues and difficulties and has underscored from a long time ago: For instance, it is said that any problem can be obviated by ambulating (Beatty & Ball, 2011). This feeling was pointed in relation to

the motion for the first time by Steiner (1916) and it deals with the issue of keeping unconscious balance. Csikszentmihalyi (1996) nominates gait, swimming, driving, surfing, and similar activities as the facilitators of the creativity process that all somehow pertain to the sense of transition. Specifically, this feeling during walking and its effect on creativity are important due to channels of mental phenomena of arousal and self-assurance (Blanchette, Ramocki, O'del, & Casey, 2005) and cognitive phenomena (Beatty & Ball, 2011). In which the positive distraction resulted from walking leads to a divergent procedure of cognitive processing of inputs and consequently, creative outputs (Osborn, 1953) that by some means evokes the role of mentioned unconscious mediation in keeping balance during moving.

D) Liveliness

This term brought up by Alexander (1979) to describe the environmental conditions in a man-made space that lead to the user satisfaction due to the presence in a place. This classification consists of senses like speech and expression, intellection and contemplation, individuality and ego. As it is apparent, all those senses are somehow directed to the human's collectivism issue and his social connections and repeatedly emphasized in the creativity literature (Brill, Weidermann, Alard, Olson, & Keable, 2001). It should be cited that even in Steiner's view, even the sense of ego refers to the perception of oneself or others, so in this way, the person decides about the proximity with and self-expression among them, determination of territory and adjustment of his privacy (Steiner, 1916). In this regard, it can be claimed this condition is one of the most significant factors of creating a sense of place which is increasingly effective in the motivation and abilities of one's creativity (Killeen, Evans, & Danko, 2003).

3.2.2. Behaviours and Behavioural Characteristics Stimulating Creativity

As it arises from the literature of topic, in general, the possibility of occurring some simple behaviours in a particular functional environment can assist in the realization of creativity and its continuity. These behaviours with individual or collective nature can be located in a few categories such as distraction, physical mobility, seclusion, daydreaming, accidental or intentional communication (with an emphasis on synergy), rest and relaxation, empty-headedness, and etcetera, which some of them outcrop in order to interact with people, issues, information, and ideas and some others take place for being far from them or a specific quotidian context (environment). Thus, the preparation of spaces and special spatial features as the occurrence of those behaviours can have an influence on enhancement of environmental affordances for stimulating the creativity (Rezaei, 2018). Moreover, the findings of some recent research imply a potent

correlation between two concepts of creativity and the sense of place, which is related to the numerous factors like satisfaction of needs in different levels, perception of meaning and its emergent sense of beauty, excitement and the richness resulted from controlling it. This is a witness for the existence of similar stimulant behaviours in improvement of creativity from one side and realization of the sense of place from another. This connection is specifically emphasized in the research of Pancholi et al. (2015). Expressing that, a meaningful relation exists between the sense of place created for the user of environment and his potential stimulus of his creativity. For instance, a strategy like “facilitating the possibility of user's participation in design for the user in order to supply his personal needs” that can lead to realizing an appropriate level of sense of place for him, beside resolving the mentioned needs, plays a direct role in his enhancement of creativity by generating motivation and mental dynamism. Moreover, since there is a direct link between the cognitive processes of mind and people's personality features especially mental openness, and experience-ability of affairs specifically in accordance with aesthetic topics and the level of sensory perceptions from visual aesthetics, the more stimulating of emotions based on environmental beauty can ensue to improvement of creativity in users. Therefore, the creativity as a cognitive phenomenon has a strong correlation to the subject of meaning and the beauty brought forth from it (Casakina & Kreitler., 2011). Particularly, this relation is highly important when it comes to figurative creative thought (Myszkowski, Storme, Zenasni, & Lubart, 2014). Furthermore, the relation between environmental excitement and the sensory richness and sense of place should be noted from one side, and the creativity from the other side. Explaining that one of the aspects of emotional intelligence is the ability to use emotions and excitation in facilitating the cognitive processes, including creativity (Mayer, Caruso, & Salovey, 2000). Mayer opines that the emotions (due to excitations) affect one's cognitive system and change it. These changes compel the cognitive system to survey the issue from different point of views and just in one case, ponder in depth and more creatively. Torrance (1974) also deems that not only the emotion-exciting factors facilitate the cognitive processes, but they are also 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 in reduction of negative emotions and preservation of positive excitements,

which leads to positive mood and it can increase the creativity by growth of flexibility and the expansion of contemplation (Ivcevic, Brackett, & Mayer, 2007). In this regard, the influential environmental factors on controllable emotional behaviours are able to have an impact on the level of creativity and its realization in environmental users.

3.2.3. Underlying Features and Environmental Affordances of Creativity

According to what mentioned above, some of the demonstrated activities and behaviours by people play the role of stimulus or even exercise and practice for being more creative and since it is possible to provide the happening ground of many of those behaviours due to environmental incitements, it is important to pay enough attention to features and environmental affordances in encouraging to commit those activities. In this regard, Barrett (2010) suggests a model for designing creativity-induced spaces, that is established on three main cores: (1) Naturalism, which signifies the emotional reaction of people to the positive aspects of nature and its consequences are the attention toward items like natural lighting, benefitting from the greens, air quality, and acoustics; (2) Individualism, that implies the issue of people's tendency to private work and life spaces and refers to the topics such as privacy, spatial density, and movement routs; and (3) Stimulation, which alludes to proper levels of context properties in order to generate motivation in various conditions and largely is achieved by application of lighting and purposeful use of specific colors. McCoy (2005) and Dull et al. (2011) also consider five features of physical environment influential on social behaviour and consequently on 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 and theoreticians that the ideas' origins could be observed in four general categories of naturalism, diversity-seeking, beauty-demand, and interactionism. Moreover, in another classification of the present study systematic approach, the physical factors of environment could be divided into three separate classes of spatial features, functional spaces, and environmental affordances which they are connected to each other. Some of the most important ones are presented in regard to the creativity in table 2.

Table 1. Remarkable Opinions about the Environmental Stimuli of Creativity

Origin	Theoretician	Date	Description
Naturalism	Kaplan	1977	Emphasis on the significant role of natural environment in mental development and clarity process
	McCoy	2002	Creating appropriate view to natural landscape
	Shibata	2004	Necessity of greens existence in interior spaces
	Haner	2005	Visual accessibility to natural environment – application of natural elements in built environment - visibility

Origin	Theoretician	Date	Description
Diversity-seeking	Alexander	1979	Spatial diversity leads to comparison and understanding of similarities and distinctions. Spatial monotony causes waste of information and debilitation of mental strength.
	Gruter	1985	Stimulating the curiosity and encouragement of moving and discovery of space
	Rio	1993	Responsibility for various needs of different people
Beauty-demand	Taylor	1975	Color as a stimulus of creativity
	Haner	2005	Generating beautiful context by using the color and light
Interactionism	Csikszentmihalyi	1996	Emphasis on creative interaction
	Paulus	2000	Interplay of ideas in collaboration
	Hornecker	2005	Adjusting the amount and type of collective communications according to the form and size of space
	Haner	2005	Proximity of people while having the privacy

Table 2. Physical Factors Affecting Creativity

Class	Items			
Spatial Features	Visual accessibility	Transparency	Controlled view axes and proper perspective	Visual proportions
	Texture and specific coloring	Lighting and penumbra	Natural light and ventilation	Natural materials and elements
	Interconnection of inside and outside	Extent and openness	Stability and equivalence	Formal integrity and cohesion
	Formal diversity, change, and composition	Formal discipline and chaos	Formal fracture and curvature	Formal challenging and tenseness
	Formal legibility and clarity	Formal complexity and ambiguity	Formal Contrast and deconstruction	Iconography and symbolism
	Formal crypto-type	Formal beauty and attractiveness	Functional discipline	Functional legibility and clarity
	Functional diversity and mixture	Functional, integrity and cohesion	Spatial extent and functional proportions	Functional complexity and semantic ambiguity
	Functional challenging and tenseness	Functional flexibility and collaborative design	Proximity	Visibility
	Supervise-ability	Permeability and movement continuity	Appropriate zoning and hierarchy	Enclosure
	Privacy	Functional crypto-type	Being spatial interaction-based	Safety
Functional Spaces	Spaces with proper natural views and sight	In-between semi-open spaces	Lateral green spaces	External pedestrian routes
	Interior walking spaces	Halt spaces	Appropriate access spaces	Multipurpose spaces
	Welfare spaces	Unofficial spaces	Individual and personal spaces	Collective spaces
Environmental Affordances	Presence-ability	Activity-ability	collectability	Security
	Possibility of rest and relaxation	Possibility of movement and gait	Possibility of playing and motion	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-playing and playfulness	Memorability and memory-making
	Possibility of establishing a direct connection	Liveliness	Being Sanctimonious	-

3.3. The Conceptual Model of Research

According to the proposed model of research, the effect mechanism of the physical environment on users' creativity, as the theoretic framework of research, is in a way that some of spatial features and functional spaces bring about some affordances for the environment. Thus, the user gets mentally stimulated when encountering those affordances and perceiving them and a particular motivation is generated for satisfaction of his needs in different levels, which leads to the incidence of behaviour in the environment by him. In fact, it can be stated that the environmental specific stimuli of mind and the occurrence of particular physical and mental behaviours resulted from them leads to continuous activity of some special parts of the human's brain that are responsible for creative thinking and in this way, the enhancement of user's creativity betides. In this regard, the heed to the mediatory role of perception is essential and its relativity in different people is also important, according to their abilities and competencies in percipience of environmental affordances. As it was cited formerly, since the environmental affordances are considered as potential capabilities, if the awareness of their existence is not attained and they are not perceived properly then they will not come into reality.

Besides the abilities and competencies, the mentioned relative perception in different people appertains to other fundamental individual characteristics such as knowledge, awareness, and belief system (with acquisitive aspect) and nature, temperament, and aptitude (with genetic aspect). Accordingly, the environmental affordances are understood with different rates and therefore, the mental stimulations eventuated from a specific environment are different in people. This issue ensues to the occurrence of various behaviours or intense and weak in a particular behaviour among different people in a specified environment. Similarly, the mentioned environmental-behavioural influences determine people's personal interpretation toward the meaning of environment and consequently the realization of different levels of sense of place, and the resultants of those influences are not identical in their power of creativity. In fact, the meaning as it is attributed to environment and especially in the spaces with particular functions, is

largely performance-driven (Amabile, 1983; 1996; Brill, Margulis, & Konar, 1984; Hameed & Amjad, 2009). By presumption of this approach in the present research, the concept of environmental meaning narrows to a span that a place would be significantly influential on users' individual and collective creativity. Figure 1 illustrates the general theoretic framework of this research as a conceptual model and based on it, the independent variables of the survey consist of all physical stimulant factors of creativity which forms the mediating variables of environmental affordances and stabilize the environmental attributes. Other intervening or mediator variables are also in two levels: 1. The mental dynamism effective on creativity which is under the influence of environmental affordances perceived and generating motivation in response to them, 2. The stimulating and reinforcing behaviours of creativity that are under the influence of environmental perception as well. Finally, it should be noted that the nuisance variables of research include individual characteristics and nonphysical environmental factors influential on creativity which must be neutralized by applying special methods in the research process. Hence, after determination of theoretical framework and the extraction of influential variables on creativity of environmental users, the main hypothesis of research is as follows: By considering a specific mechanism of effect and from the preparation of proper environmental conditions point-of-view, the physical factors of environment bear a significant importance in order to have the incidence, increment, and durability of creativity. Therefore, the architectural creativity used in the design of an environment is considered as one of the main factors determining its future users' creativity capacity. In other words, architectural creativity can be considered as architecture of creativity, which is achieved through the architecture of senses and, as a result, the realization of a high degree sense of place. Developing the hypothesis, it should be noted that, first, the possibility of emerging user's creativity in an environment is affected by some of the features, affordances and attributes of that environment, and second, there is a direct relation between the environmental meaning perceived by the user (and consequently the sense of place degree realized for him) and his capacity of emerging creativity in that environment.

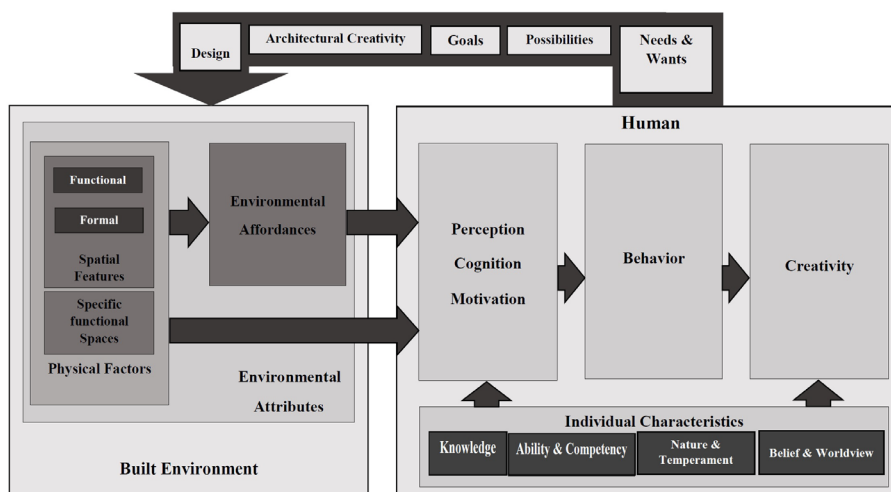


Fig. 1. The Conceptual Model of Research

4. RESEARCH METHODOLOGY

The present research consists of two major phases which respectively are: First, the review of literature and logical analysis of opinions in order to produce the theoretical framework and make the hypothesis precise, which were cited formerly and second, the validation of results from the previous stage due to statistical analytical methods in a case study. Therefore, at first, the codification and clarification of the theoretical foundations and framework were performed by applying descriptive-analytical method which resulted in the determination of some aspects of physical environment being potential for enhancing people's creative capabilities in a certain built environment. In the next phase, due to the survey-based nature of the case study strategy considered in the research, which somehow focuses on the context of the problem (educational spaces of architecture), the grounded theory was used as a traditional method to confirm or reject the hypothesis based on the contextual data collection and analysis (Glaser & Strauss, 1967). It should be noted that the selection of this method was due to its appropriateness to the exploratory nature of the problem, accurate structuredness and comparison of the data obtained, the emergence of basic findings and concepts under theoretical and subsequently exploratory development processes, approaching the optimal result of the research process at the right time, repeated accurate findings, and as a result ultimate maturity and high citation capability (Rezaei, Keramati, Dehbashi Sharif, & Nasirsalami, 2018). Based on this, semi-structured interviews were designed and conducted with some experts in the field of architecture and environmental design in order to investigate the subject matter. The main purpose of these interviews was to clarify the aspects of physical environment perceived as factors enhancing their creativity by individuals. The data obtained in the form of a sentence, phrase or even a word expressing a significant sense of the interviewee was collected and classified as information units. This data collection was followed until the information saturation was obtained. The result of this phase was to accurate and complete the theoretical framework of the research in the form of a researcher-made questionnaire, which was used to survey the sample. Then quantitative analysis of the data exerted using descriptive and inferential statistics. It should be noted that the wrote-in queries in questionnaire of the research were prepared in order to determine the importance of spatial features, functional spaces, and environmental affordances (presented in Table 2) each from the respondents' point of view in regard with occurrence, reinforcement, and continuity of their creativity in one of the stages of preparation, latency, intuition, and substantiation from creativity process. In order to answer the questions, the Likert five-point scale was exerted so the importance of each hypothesis would be assessed in environmental

users' view. It should be noted that the respondent group in the targeted case was randomly selected from architecture post-graduation students of three high-education institutes in Kermanshah. The cumulative volume of investigated cases in research was calculated using Cochran's formula in order to provide the result's reliability and generalizability in a meaningful level of 95 percent ($\alpha=0.05$) and 135 people were assigned and the resulted outcomes were analyzed by SPSS software version 24. It should be cited that after the distribution of the questionnaire and gathering the field data, the amount of Cronbach's Alpha was calculated for redetermination of validity and the admissibility of the questionnaire by using SPSS software which its amount was 0.967 for the sum of all presented items in the questionnaire and so it demonstrates the validity of the questionnaire and the high accuracy of measurements in the intended purpose of the research through the planned queries. Furthermore, the necessary condition of being random and normal distribution in all of the data attained from the selected samples of the research was confirmed by exercising the Run-Test in SPSS and the obtained values for indicator P (larger than type 1 error 0.05) and thus, parametric methods are accepted for deductive analysis. Eventually, the one-sample T-test was used in order to investigate the meaningfulness of the differences between the achieved averages from the selected sample and anticipated values and in other words, the validation of the research hypothesis. Then, an exploratory factor analysis method (with Pearson's correlation matrix) was applied for identification and rating the main influential factors on the occurrence, enhancement, and continuity of users' creativity in the surveyed educational environments. It should be noted that the correlativity and linearity of variables were approved in Bartlett's test and the proportion of variables for execution of exploratory factor analysis was acknowledged by using KMO test. It should be noted that multiplicity of respondents, diversity in levels of knowledge and abilities of people in understanding the issue, and the locative and cultural multiplicity of the surveyed educational environments have had a tremendous impact on limiting the existing nuisance variables in the research process and preventing from directional mistakes. Besides this, the purposeful selection of the surveyed sample amongst the environmental users with high level of education in architecture was due to their familiarity with understudy concepts in the questionnaire and also their acceptable perception of the essence of their personal creativity, is a reason for validity and reliability of the research outcomes.

5. RESEARCH FINDINGS

Based on the answers to the questions of the questionnaire and the pointing process to each of the independent and mediating variables of the research from the respondents' point of view, using descriptive

statistical analysis (calculation of means), rating all physical factors listed in Table 2 was done to provide appropriate environmental conditions of enhancing the dependent variable of creativity (the summary is presented in Tables 3). Furthermore, in order to study of the meaningfulness of each intended physical factor importance on the users' creativity of the selected educational environments due to their self-declaration, the single-sample T-test was subsequently applied. Hence, the meaningfulness of the difference between the gained average importance of each variable and the abovementioned value was measured in which the comparison between the resulted value of P in calculations with the amount of error type one 0.05 indicated that P-value is less than 0.05 for all variables with plus average difference except the spatial feature of "formal complexity and semantic ambiguity" and the environmental affordance of "risk avidity and challenging". Therefore, the meaningfulness of the plus difference of mentioned averages and their significant importance for approximately all variables were approved by users for the provision and formation of creativity context. Moreover, the excesses of average in both above-cited variables compared to the fixed mediocre value were meaningless and caused by error, which demonstrates the equality of

averages with the mediocre level and according to the assumption, they illustrate the significant importance of those variables in the middle degree. Though, the relation might be meaningless for variables with the minus average difference compared to the mediocre value so the equality of the averages with the supposed mediocre value and the hypothesis of the research would have been proved. This issue was acknowledged about all variables except the spatial features of "formal chaos and disorder", "fractured and sharp-angled forms", "functional complexity and ambiguity", "challenging function", and "functional crypto-type" and also the environmental affordance of "dubiousness and skepticism". Thus, the importance of the mentioned variables which have lots of similarities together, was less than the mediocre level in environmental users' opinion and in the other cases, the importance is notable. According to the nature of those abovementioned variables in acknowledging the obtained results from reviewing the literature, it could be said about this outcome that the aspects of challenging, ambiguous, and stressful can assist the occurrence and reinforcement of creativity in a controlled manner especially in the functional field of environment and in an amount beyond that, it would have negative effects.

Table 3. Rating of the Physical Factors Affecting Creativity Using Descriptive Statistics

Class	Rate	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	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	In-between semi-open spaces	Halt spaces	Unofficial spaces	External pedestrian routes	Spaces with proper natural views and sight	Interior walking spaces	Multipurpose spaces
	Mean	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	4.36	4.23	3.99	3.97	3.97	3.97	3.97	3.97	3.95

Ultimately, the remarkable and effective independent and intervening variables on the dependent variable of the creativity were ranked in two separate categories of factors which were titled as "environmental attributes based on spatial features and functional spaces" and "environmental attributes based on environmental affordances" by using an exploratory factor analysis method. The resultant outcomes from the above analysis are listed in Table 4 (the variables of environmental affordances and the variance of the dependent variable of creativity explained by them), and also in Table 5 (the variables of spatial features and functional spaces). Based on the findings presented in the above-mentioned tables, it is possible to guide the attributes of a built environment and how to approach them by preparing some spatial features, functional

spaces and environmental affordances in the process of architectural design. For example, the most important affordance-based environmental attribute in this regard is dynamism, which is derived from the possibility of movement and gait, the possibility of playing and motion, liveliness, the possibility of ostentation, being energetic, with a total of 18.24% covering of the variable dependent changes explanation. Also, among the spatial-based environmental attributes, naturalism with 10.75% of explaining the changes of the creativity is in the first place, respectively, by the factors including natural materials and elements, lateral green spaces, in-between semi-open spaces, the interconnection of inside and outside, controlled view axes and proper perspective, transparency, and Visual accessibility. As it is specified in these tables,

61.30 percent of the variance of the dependent variable is explained due to five environmental attributes based on environmental affordances and 66.99 percent of its variance is signified by 11 environmental attributes based on spatial features and functional spaces (with overlapping) which are considered as significant values. However, it should be noted that the formation of environmental affordances is based on the spatial

features and functional spaces, and therefore these two categories of environmental attributes are overlapping. Thus, the mentioned environmental attributes can be presented in the form of a relative correlation matrix as it is shown in table 6 in which it justifies the overlapping of the variances of the dependent variable of creativity explained by the two cited factor groups.

Table 4. Environmental Attributes Affecting Creativity Based on the Environmental Affordances

Rate	Factor (Environmental Attribute)	Sub-Factors (Environmental Affordances) by Importance Priority	Variance of the Dependent Variable of Creativity Explained by the Factor
1	Dynamism	Possibility of movement and gait, Possibility of playing and motion, Liveliness, Possibility of ostentation, Being energetic	18.24%
2	Generativity	Possibility of positive distraction, Discoverability, Role-playability and role-playfulness, Being Sanctimonious, Memorability and memory-making, Changeability and adaptability	13.37%
3	Justifiability	Activity-ability, Being inspirational, Presence-ability	12.72%
4	Enrichment and excitement	Risk avidity and challenging, Dubiousness and skepticism, Wonderfulness	9.17%
5	Durability and consistency	Possibility of rest and relaxation, Security	7.80%

Table 5. Environmental Attributes Affecting Creativity Based on the Spatial Features and Functional Spaces

Rate	Factor (Environmental Attribute)	Sub-Factors (Spatial Features and Functional Spaces) by Importance Priority	Variance of the Dependent Variable of Creativity Explained by the Factor
1	Naturalism	Natural materials and elements, Lateral green spaces, In-between semi-open spaces, Interconnection of inside and outside, Controlled view axes and proper perspective, Transparency, Visual accessibility	10.75%
2	Functional appropriateness	Supervise-ability, Appropriate zoning and hierarchy, Functional discipline, Functional legibility and clarity, Permeability and movement continuity	9.56%
3	Diversity of usage and function	Interior walking spaces, Spaces with proper natural views and sight, External pedestrian routes, Halt spaces, Unofficial spaces, In-between semi-open spaces	9.20%
4	Formal proportionality	Formal integrity and cohesion, Visual proportions, Formal discipline and arrangement	7.72%
5	Functional balance	Functional diversity and mixture, Functional integrity and cohesion	4.82%
6	Formal multi-semantic	Formal chaos and disorder, Formal contrast and deconstruction, Formal complexity and semantic ambiguity	4.82%
7	Functional Multi-semantic	Functional complexity and ambiguity, Functional challenging and tenseness, Functional crypto-type	4.70%
8	Interactionism	Spatial extent and openness, Visibility, Proximity of spaces, Spatial interaction-basedness	4.48%
9	Individualism	Formal iconography and symbolism, Functional flexibility and collaborative design	4.28%

Rate	Factor (Environmental Attribute)	Sub-Factors (Spatial Features and Functional Spaces) by Importance Priority	Variance of the Dependent Variable of Creativity Explained by the Factor
10	Formal balance	Fractured and sharp-angled forms, Curved and fluid forms	3.49%
11	Composure and repose	Privacy and territory, Safety equipment - Stability and equivalence	3.13%

Table 6. Correlation and Overlap Matrix of Environmental Attributes Based on Dual Origins

Factors Based on Spatial Features and Functional Spaces	Environmental Affordances- based Factors				
	Dynamism	Generativity	Justifiability	Enrichment	Durability
Naturalism and interactionism	•			•	
Appropriateness and balance between form and function	•	•	•		•
Diversity of usage and function	•				
Being multi-semantic in form and function		•	•	•	
Individualism		•	•		
Composure		•			•

6. DISCUSSION

The spatial features, functional spaces, and consequently environmental affordances, which have been introduced in the form of a factor classification, are significantly effective in explaining the changes of the environmental users' creativity and in fact, are the shapers and stabilizers of environmental attributes that stimulate creativity including the affordance-based items of dynamism, generativity, justifiability, enrichment, durability, and the spatial-based items of naturalism and interactionism, appropriateness and balance between form and function, diversity of usage, multi-semantic in form and function, individualism, and composure, each of which contains its own subsets and can be exploited in the design process ideation phase with an up-down approach. Accordingly, and considering the overlap of these items from the perspective of the origins, the achievement of creativity in a built environment respectively depends in importance order on the environmental factors of "the dynamism derived from naturalism and interactionism, formal and functional proportionality and balance, and diversity of usage", "the generativity deduced from formal and functional proportionality and balance, multi-semantic in form and function, individualism, composure and repose", "the justifiability resulted from formal and functional proportionality and balance, multi-semantic in form and function, individualism", "the enrichment and excitement adapted from naturalism and interactionism, multi-semantic in form and function", and eventually, "the durability obtained from formal and functional proportionality and balance, composure and repose". It must be cited that there is no inconsistency between the

abovementioned paradoxical concepts in architectural literature, but they are deemed to be contrasted that it is possible to use them simultaneously as the features and attributes of a specific environment. Namely, complexity and crypto-type might exist in a space at the same time with formal and functional legibility and the combination of curved and fractured forms is also entirely possible in an architectural form by employing the architect's creativity and art. Regarding this argument, the adduced attributes must be provided simultaneously or in the form of a continuum should have a tolerance in the environment. In a sense, an environment can encompass a span of spaces from complex and ambiguous to simple and legible or relaxing and challenging spaces can be experienced in it simultaneously.

Finally, as it was cited formerly, it should be said that the main moot point of the present research has been propounded in most of the similar previous surveys, whereas a particular scope and conditions have been largely pursued in their dominant approaches towards its answer. Furthermore, most of the researches related to this question have just presented architectural small-scale resolutions and somehow none of them concentrated on proposing structured principles and regulations and describing the impact mechanism of the physical environment on user's creativity in a systematic approach. With knowledge of this issue, the present study has sought to determine and adjust a generative and reproductive prototype as a road map where it was avoided from the perfunctory glance to the problem and a disparate function (determining temporary predefined solutions) with the essence of architectural creativity. Thus, it was attempted that

the principles and regulations are clearly determined by a processional template so by that the power of the designer's creativity would be the ultimate solver in any period of time and geographical location in accordance with the ever-changing requirements of context and social and physical background of the project. It is noteworthy that the only study that has applied the systematic approach in order to analyze this issue is Williams's research (2013) which the idea of the present survey is somehow adapted from it. The manifest discrepancy of that research and the present survey is in the professional focus on the physical environment, and consequently in the determination of accurate relations between its factors in order to describe their effects on the creativity, in the theoretic framework of the research and also the use of the studied environments. Considering that in Williams's research no linkage is established between environmental affordances with spatial features and functional spaces and this concept is imperfectly limited to the presence of some adjunct equipment in the physical environment of organizations such as furniture. Nonetheless, the concept of environmental affordances is processed as the major environmental trigger of creativity and in a considerable correlation with other physical characteristics of the environment in this research.

7. CONCLUSION

This research has been seeking to determine attributes of creativity enhancer environments and presenting principles and regulations for designing such environments, particularly pedagogical spaces used by students of architecture (the case study) due to the identification and classification of some factors of the physical environment which are proactively affecting the stimulation and continuity of creativity in man-made environments. For this purpose, after an extensive study of the literature and initial development of the theoretical framework, the grounded theory was used to accurate that and the resulted hypothesis, in two forms of a qualitative survey (interview with academic experts) and a quantitative survey (completion of the questionnaire by architecture graduate students) to validate the results of the previous section and confirm the hypothesis. Based on the results of the research scientific aspect, it should be acknowledged that spatial features and functional spaces in any built environment significantly affect the occurrence of users' behaviours including creativity by shaping and defining some environmental affordances. Therefore, the research theory emphasizes that many physical factors affecting the actualization of environmental meaning and the realization of a sense of place, affect the environmental user's creativity capacity in that place. Thus a strong correlation between the sense of place and creativity can be proved. In other words, the architectural creativity used in the design of architectural work is

able to purposefully stimulate the environmental users' senses (sensual architecture) to enhance their creative behaviours. This matter can be justified by considering the instrumental role of the sense of place in the process and according to the validation done by appropriate scientific methods in this research it can be claimed in the theme of "architectural creativity as the architecture of creativity". Another momentous point, which was emphasized in this survey, is the intermediation of perception and human mind mechanism in relation to the occurrence and reinforcement of creativity. The majority of the identified factors, which passed through the perceptual filter of the user (influenced by personal characteristics), prepare the ground for shaping and the occurrence of a particular creativity-motivated behaviour in him. These are exactly the stimuli that cause the environmental affordances inciting, occurring, and continuing the creativity as well, and lead to the emergence of creativity in accordance with one's perceptual power and subsequently, the utilization of and reaction to them in order to satisfy his needs. Therefore, the intermediate role of individual perception, cognition, and motivation in the process of occurring progressive behaviours of creativity, is the most important factor of hierarchy and grades plurality in happening of emotions, positions, and subsequently creative behaviours in a wide spectrum.

From the practical point of view, the research can direct architectural ideas in a purposeful framework and improve the ideation phase of the architectural design process to focus on the naturalism and interaction, appropriateness and balance between form and function, diversity of usage, being multi-semantic in form and function, individualism, and composure and hereby achieving the environmental attributes of dynamism, generativity, justifiability, enrichment, and durability in order to achieve high degrees of the sense of place and the emergence of creative behaviours by users. Regarding the multiple repetition and presence of some of the above-mentioned factors, it is conceivable to cite that the most important subjects that should be focused to achieve design purposes in the architecture, including the improvement of users' mental activities and creativity, are the formal and functional proportionality and balance and multi-meaningfulness in them in order to provide different inferences. Therefore, special attention to this subject, especially with a naturalistic approach and in a natural context, will lead to the effectiveness of the architectural product to promote the creativity of environmental users. According to all these exegeses, it is feasible to contend that the more creativity is applied in the architecture of an environment in a way to orient the physical factors influential on creativity and also owns higher comprehensibility, it would have more potential for stimulating the users' creativity and its continuity in which this leads to an enhancing cycle of architectural creativity especially in educational spaces of architecture.

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