Comparison of Design Process in Student and Instructor

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ABSTRACT: In this paper the designing products of B.A. Sophomore students of architecture in Tehran University who were divided into two kinds of learning namely technical and skill-based learning. In technical learning the subjective steps of creativity process i.e. "insight", "preparation", "incubation", "intuition", and "verification" were discussed and it was suggested that these steps cannot be taught but in skill-based learning the objective steps of creativity process i.e. "combination", "mutation", "analogy", "first principle" and "emergence" in a form of an instructional and designing practice were studied. In skill-based learning, three kinds of learning namely "passive", "active" and "reflective are utilized. Passive learning is used by the student to discover the knowledge and skill of the instructor. The active learning which is based on the idea is utilized for helping the novice learners. The result of the case study indicated that the perception through creativity in the designing process is like building a bridge on the knowledge gap between teacher and student through studying the samples of architecture as an active learning and student's implicit knowledge as a reflective learning. In this paper the emphasis is on the values of education and the very important point about learning designing is the access to the creativity as a product of an educational process. To this end the instructors' concern on the quality of improving the novice learners' designing ability and considering the suggested model in order to evaluate the designing improvement is quite necessary and indispensible.

Keywords: *Creative Education, Interactive Education, Implicit Knowledge, Gap Knowledge, Reflective Learning, Passive learning, Active Learning.*

INTRODUCTION

Innovations and new concepts in designing are often reported as sudden illuminations. In this idea creative mutation is considered as the axis of designing process (Archer, 1984). Some theoreticians believe that all the steps and processes in designing are creative although there are some documents that indicate that the degree of creativity can be faithfully evaluated (Amabile, 1982, 1013). Creativity in such cases is related to the product rather than process (Christians, 1992). Regarding other theoreticians' view, creative mutation as a "sudden insight" is defined as a completely new feature in a previously perceived situation. This model (Koestler, 1967) is proposed for the explanation of creative insight. Sudden change is not necessary to recognize mutation in creative designing. An unexpected displacement within solution space may suffice. This slight change in solution space with an appropriate concept for it presents creative design as a "Research" rather than a "search".

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Creative design does not mean bringing on a conflict but rather it is an answer to the designing problem and a working method between the background (Current situation) and the potential construct of design product (Ideal situation).

Knowledge on the current condition (problem) and the desirable condition (solution) leads to building a creative bridge and moving along the gap in between. This gap is the source of creative energy that removes the obstacles (March, 1975). The movement between the gaps starts when one's past experiences and future ideals combine. In this way he can create realities and connect "realities" to the "facts". This creation emerges from contemplation which can be observed and utilized by the architecture student's past experiences (Islami, 2011).

In this study the subjective model of creation based on Wallace Model was proposed after defining creation; then it was put into action by suggesting some designing practice in order to turn the subjective model into objective one and finally some effective components as creative bridge were introduced. Through the whole paper, problem solving area is considered more significant in which the student is mostly discovering

than innovating.

Recognition the steps to be taken in forming a creative idea in architecture are among the questions that so many architecture instructors and art teachers always have in their mind. Some experts believe that creative design process is so complicated a phenomenon that its components are inseparable and their introduction seems impossible (Harrison & Cough, 1962).

Wallace's model is the basis for the other models. In the other models different terms are used. However, other models are in fact the extension of Wallace's model and have been improved in his (Wallace's) framework. The utilized processes in all models indicate that the creativity procedure includes both unconscious mind (intuitive thought) and conscious mind (analytic thought). These two mental procedures are inseparable meanwhile they are present in all steps of creativity, however the significance of the roles of each in any step is different (Wallas, 1926). According to Amabile, it is wrongly believed that only unconscious mind (Incubation, illumination, Intuition) indicates creativity. As we move away from the old models of creativity process and get closer to the new ones, the role of the unconscious becomes less significant while that of the conscious becomes more significant (Amabile, 1982). That is to say the creativity process especially creating new ideas can be controlled and directed as to Plesk (1996) model which was introduced under the title of directional creativity (Plesk, 1996). Based on his thorough investigation, Weisberg (1999) concluded that there is no convincing evidence to prove that the unconscious processes have a critical and significant role in creativity (Weisberg, 1999). Moreover, there is less evidence indicating that the sudden mutations (inspiration and intuition) are extremely important. Therefore, creativity can be encouraged through necessary preparation.

Some experts differentiate between creativity and innovation at theoretical level. To them creativity is creating new and valuable ideas while innovation means the application of such ideas. However, most of the models and especially the new ones present creativity as both creating and applying new ideas. So the value of the ideas depends to a large extent on their practicality.

With regard to the first steps of the models in creativity process there is a problem whose origin is the feeling made through the interaction of the senses with the environment. Then the mind acts on such information and creates new concepts which are finally put into practice. This was in fact an emphasis on the ideas given by Aristotle, Weisberg and Drucker on the origin of creativity and feeling input resulting from the interaction with the environment (Weisberg, 1999).

In the old models of creativity, creativity process is introduced as a linear and cause- effect phenomenon, while in the new models (Koberg & Bagnall, Fritz, and especially Amabile and Plesk), the creativity process is presented as circular and nonlinear phenomenon (Amabile, 1982). In other words creativity process is like an infinite circle. Although the models presenting creativity as a circle are very helpful in the formation of creativity and its role in our life, the drawback is that such models are limited to one circle in which the cause-effect relationship is one-sided.

MATERIAL AND METHODS
Subjective Steps of Design Process

Preparation is the first step in the creativity process which comes just after the emergence of the first insight in the artist's mind. In this step the architect who has a general image of his construct in his mind tries to prepare himself for the application of his first insight using any method and instrument. The creator in this step is busy studying, note taking, discussing, asking questions, collecting information and doing research (Kneller, 1965). In fact this step is a thorough investigation of the facilities and capabilities of the first ideas. An architect may ponder smoothly all day long and take notes out of his thoughts in order to create a design at a proper time.

Incubation period: Based on the findings in psychology, the unconscious mind follows conscious mind. The incubation period at this process is a step in which the unconscious mind comes to sit in lieu of the conscious mind and the achievements are continued from the previous stages. Preparation and incubation period are logically different and are originated from various sources. However, no one can imagine a physical distance between them. In this step the architect directs his design process, implicit beliefs and mental precedent of the design process before moving through the design formation. The mind of a designer in the incubation period is the helmsman of his mind which if accompanied by teacher's appropriate guidance, can complete the conscious part of designing process (Eigbeonan, 2013).

Illumination: This step is the apex of the designing process in which the designer considering the facilities and limitations of designing comes to an appropriate conclusion in which all the existing realities and designing ideals have been considered. In other words in the designing process, the time when the designer finds a new solution to the questions in his mind can be called the moment of enlightenment provided that the solution is a abstract one. There are two completely different approaches on intuition. Some experts call it a voluntary step and some others call it involuntary step. Many designers like Housman (1937) consider their works as a result of an ambiguity intuition believe in involuntary nature of intuition and also there is another group in contrary who introduce intuition as a conscious act.

A complete understanding of this theory (consciousness of intuition) needs special attention which in often cases has been disregarded due to inappropriate judgments. This theory claims that humans are capable of being intuition in artistic procedures through some strategies. Schiller (1805) for instance had some rotten apples on his desk, Mozart (1791) was taking exercise before writing his notes and Hartcrane (1932) was just playing jazz loudly. These are all the strategies used by contemporary artists for making the ground for intuition in creating an art work. The strategies can be effective only when the previous stages are

passed successfully (Kneller, 1965).

Verification and review is the final step in creative design. Successful passage through intuition step is a must for creativity which is completed in "Verification" step. What have been prepared at previous stages are in fact raw materials which are completed based on the related science and technical knowledge in order to be able to answer the concerned questions in designing (Kneller, 1965). As an example, an architect may find an answer to a question in designing but if he doesn't examine it carefully he cannot make sure whether it's right or wrong. Many important and effective events in designing happen when the architect tries to put his ideas into practice. At the verification stage, modeling the designing idea is an effective step in connecting the objective work of art and an architect's mental procedures.

been added to the list: emergence, which is widely accepted, is a useful objective model of creative design (Cross, 1997).

(Fig.2) Indicates subjective processes of creativity which includes "preparation", "incubation", "intuition" and "verification" that turn into objective at verification step and it can be used to lead us to objective steps i.e. "combination", "mutation", "analogy" and design from "first principle". These steps can be taught and observed. Fig. 3 shows a practical exercise of designing a chair in Gero & Rosenman (1993) studies which reflects objective steps of creativity (Rosenman & Gero, 1993).

Fig.1: Wallace's model in the process of creativity

Objective Steps of Design Process

Attempts to understanding and promote creative thinking in design generally focus on a number of techniques and procedures. Rosenman & Gero (1993) suggested four objective methods by which creative design might occur: combination, mutation, analogy and first principle (Fig.2) (Rosenman & Gero, 1993). Another creative design method with similar potential has since
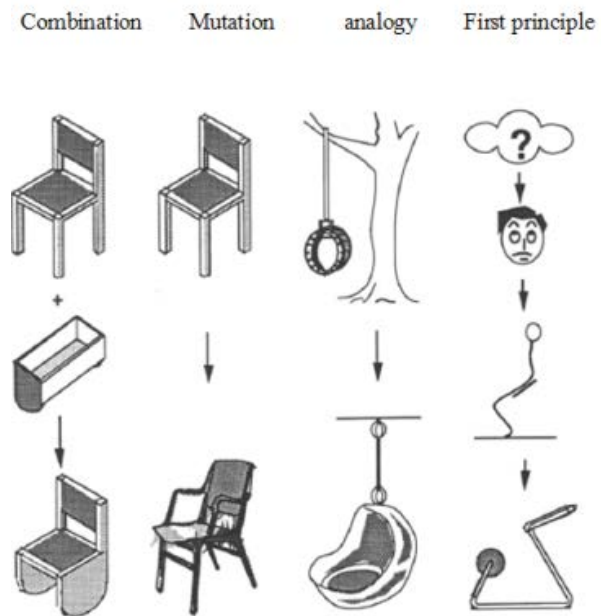

Fig. 3 : Demonstration of the procedures of designing a chair (Rosenman & Gero)
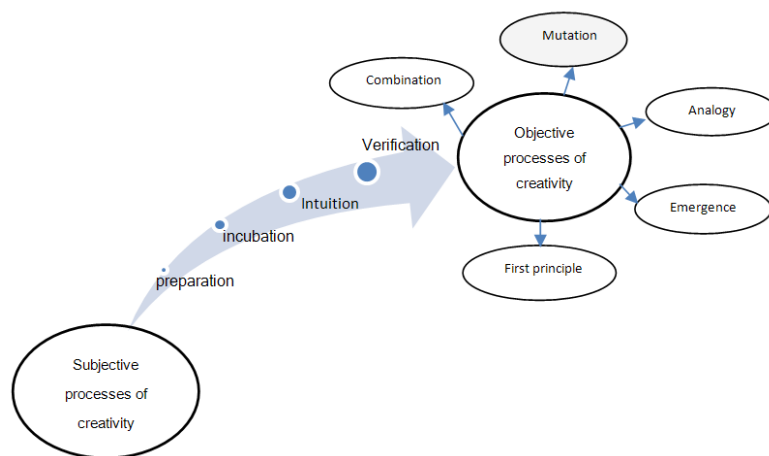

Fig.2: Subjective and objective models of creativity

One of the main challenges of precedents in teaching the novice architecture students is the probability of stabilization on a specific solution from among the precedents. Although using the precedents as the reference design by the designers is justified through various studies and researches, its effect on designing process has been questioned (Fig.4). Therefore the effective components in forming objective designs can be studied as two educational approaches (Westfall, 2012).
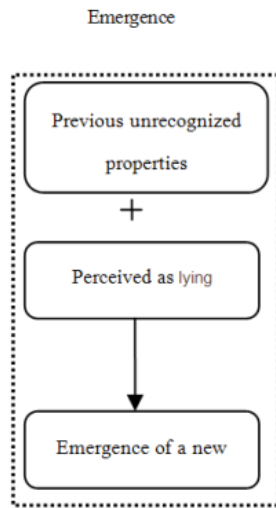

Fig. 4: Demonstration the procedure of designing "Emergence"

Creative instruction tries to increase the students' questions. In this kind of instruction the role of the students is very important and instruction is not led only by the instructor. In this method the instructor should ask some thoughtful and stimulating questions in order to make the students motivated and encourage them to think about finding the answer. The creative instruction group has the following characteristics:

Dynamic instruction, planning for the movement, paying attention to the role of the students;

Progressive, constant, restless and theory making instruction,

Vigilant and opportunist instruction,

Permanent and unceasing instruction, and

Interdependent instruction, companionship rather than competition (Hojat, 2010, 32-39).

In designing, the overall problem should be decomposed into sub problems, even though; the sub solution should be combined with an overall solution.

Creative designing seems to proceed by oscillating between sub solution and sub problems areas, as well as decomposing the problem and combining sub solution (Fig.5). This corresponds to the explanatory model of the design process proposed by cross (1994) (Cross, 1994). Interactive instruction (logic and creativity): In this method the novice using the features of the two hemispheres (analytic information in one hemisphere and accessing the ideas in the other) of the brain and activating various capabilities keeps going with designing.

This model presents the relationship between cognition through left hemisphere which is responsible for logical and critical thought and introducing ideas through right hemisphere that is responsible for creative thinking and finally presentation through the interaction between the two hemispheres that deals with the content. One of the important features of interactive model in various areas of designing is thought which makes designing procedure a cyclic one (from whole to the part and vice versa) in which there is no obstacle on the blossoming of the designer's talent (Fig.6).
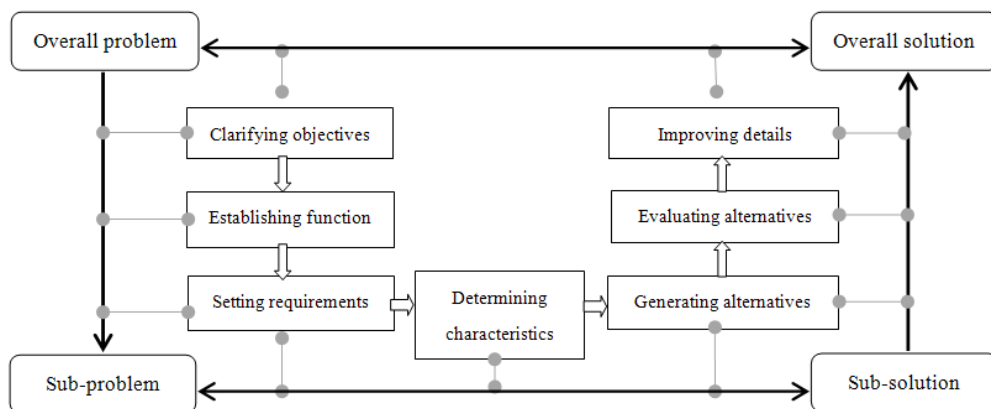

Fig.5: Model of the symmetrical relationship between design problem and design solution (Cross, 1994)
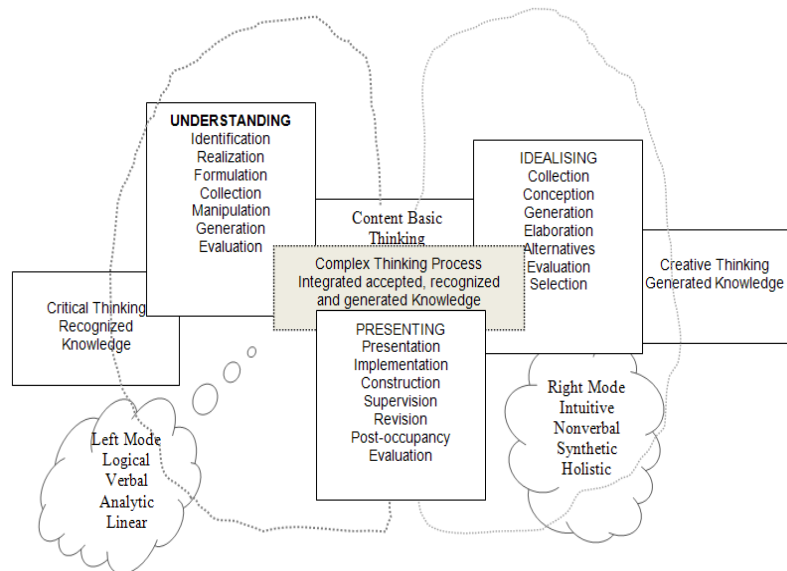
Fig.6: Introducing the interactive model in designing process (Mahmoodi, 1998)

Knowledge Gap between Student and Instructor

A great part of the designers' knowledge is implicit (Plesk, 1996). The implicit knowledge which is advantageous to the designers is accompanied by a decrease in recognition load to make the mind more commodious. This act leads the designer to the other delicate layers of designing and makes the designer reach a perfect understanding. While modeling, the designer finds the appropriate materials and perceives knowledge as implicit.

Polanyi explains the explicit knowledge in its deeper levels in two terms: the proximate (that lies at a closer distance to the source) and the distant (that lies far from the source). He described the functional relationship between these terms as knowing the proximate only through what it tells us about the distal. Hence practitioners only know the tacit principles

that govern their practice through their effects in the act of undertaking that practice. Polanyi further described the phenomenal structure of tacit knowledge as moving from the proximate to the distant. The designer attends to the distal, the result that they are working for. They do this from their tacit principles and those principles can only be learned through practicing their use, a process he called "internalization."

Polanyi also considered the reverse of this process, where the focus of the designer's attention was returned to the principle of architecture. The immediate result of this is often a complete loss of meaning;" By concentrating attention on his fingers, a pianist can temporarily paralyze his movement". However, Polanyi believed the long-term effect need not be negative; destructive analysis of such knowledge followed by re internalization could result in a better developed basis for practice (Fig.7).
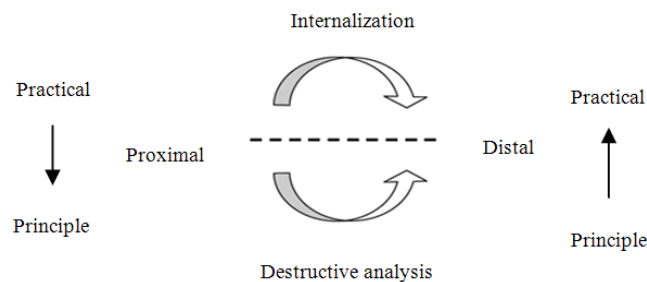

Fig.7: Interpretation of Polanyi's theory

Polanyi's work implies that such knowledge is gained experientially, through undertaking the actions and absorbing the principles. This project aims to enable new practitioners to tap into the tacit knowledge of teacher and expert student. Polanyi (1983) described the means by which such knowledge was learned as a process of indwelling: the novice seeks to dwell in the actions of the expert through observing them and taking action to imitate them (Polanyi, 1983).

In her study of Susan Peterson(1974) described the relationship between student and master:" To learn as a student means to submit oneself to the master: This surrender to the master does not mean just blind imitation, but gives a spiritual discipline and the opportunity to absorb a skill into one's bones,, (Peterson, 1974).

However, Wood observed that, at an early stage of learning, it was very difficult for a novice just to observe and imitate successfully. According to Polanyi, the difference between the skill of a novice and that of an expert is "a gap to be bridged by an intelligent effort" (Wood, 2006).

The diagram in Fig.8 is not intended to be a measurable graph, but more a visual aid, which represents a specific concept. It shows the potential skill of a novice in relation to that of an expert over time and the initial "knowledge gap" that exists between the two:
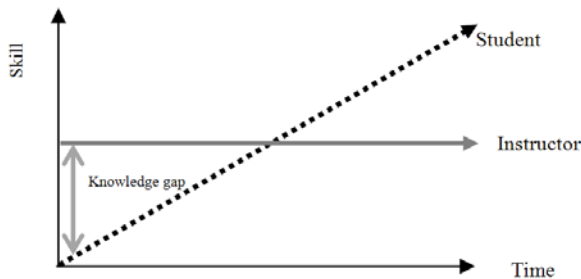
Schon (1987) suggested the solution is in "reciprocal reflection in action", implying that the expert needed to make as much effort as the novice in the process of bridging the gap between the problem and the solution. The novice should get engaged in imitation in order to reflect the behavioral feedback of the instructor. The instructors should also observe the reflective behavior of the novice (Fig.9). They must observe reflectively and improve or add to their instruction until they make sure that the novice's behavior is convergent (Schon, 1987).

Fig.10: finding a solution by the novice after accessing the knowledge gap.
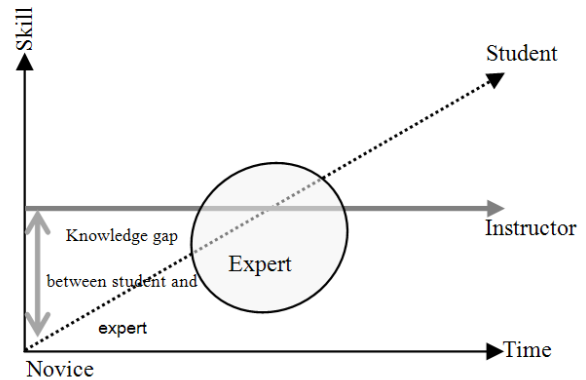

Fig.8: The knowledge gap between the novice and expert
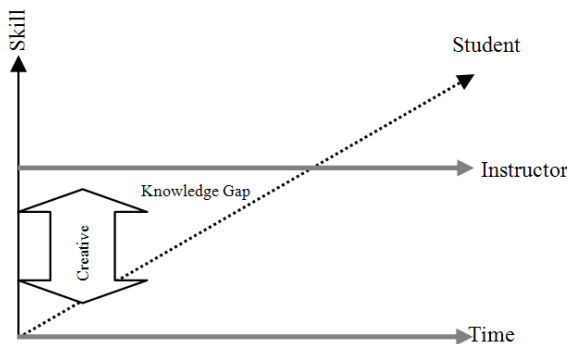
Fig.9: Building a creative bridge in knowledge gap between the student and the instructor.

In this situation the novice and expert could be seen to be working together to bridge the gap between them (Fig.10).

The implicit knowledge can potentially build a bridge between the student and the instructor and it can help the student to imitate the behavior of the instructor. Step by step instructions by the professional instructors can reflect and improve the novice learners' techniques at specific stages of designing. According to the conceptual model (Fig. 11) the relation between the subjective and the objective is made through interactive and creative instructional procedures. The studies indicate that the gap between the subjective and the objective is just a creative bridge in which some components are effective in turning the subjective into the objective. The degree of the significance of each of the components was identified through a questionnaire by the students. The number of the participants in doing the research was 13 from each of the instructional groups. They were sophomore BA students of the educational year 2009 who were selected from among the students at Tehran University according to four criteria:

The students should be provided with the same instructional condition from the very beginning;

The instructors should have passed their Ph.D. in the field of education and under various instructional procedures;

They should have an experience of more than 8 years in teaching in the field;

The designing ateliers should be close together; and
The sessions should be held at a common time.
In order to designate the effective components at subjective and objective models of creativity, a reliable and valid questionnaire was used. Its reliability was proved to be acceptable by 11 instructors and its validity was calculated through Gronbach

alpha coefficient and based on the results of alpha some questions were deleted and some others were improved to meet the content validity of the questionnaire.
In the following tables the effective components in turning the subjective into the objective by thirteen
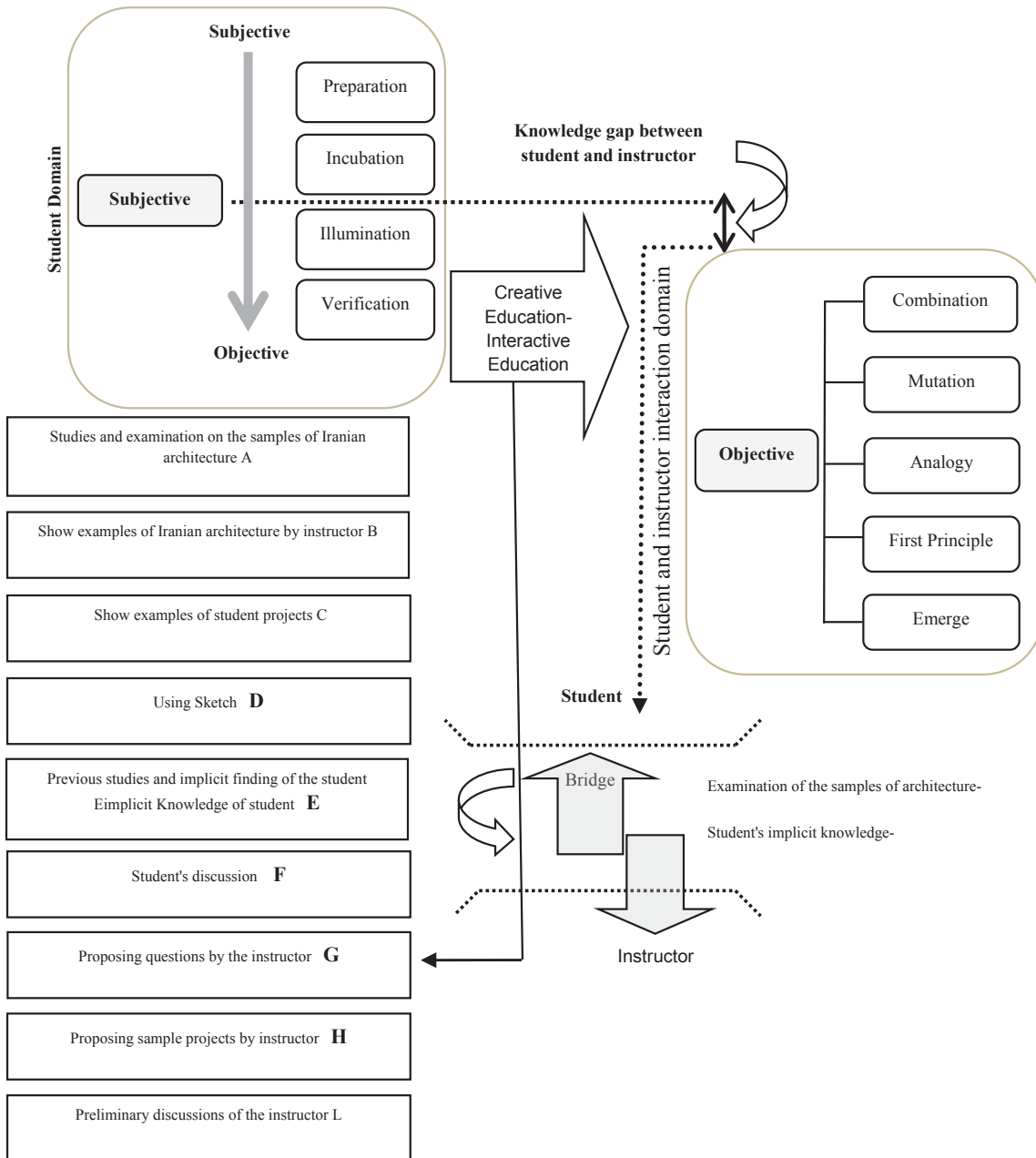Students of both groups are shown.
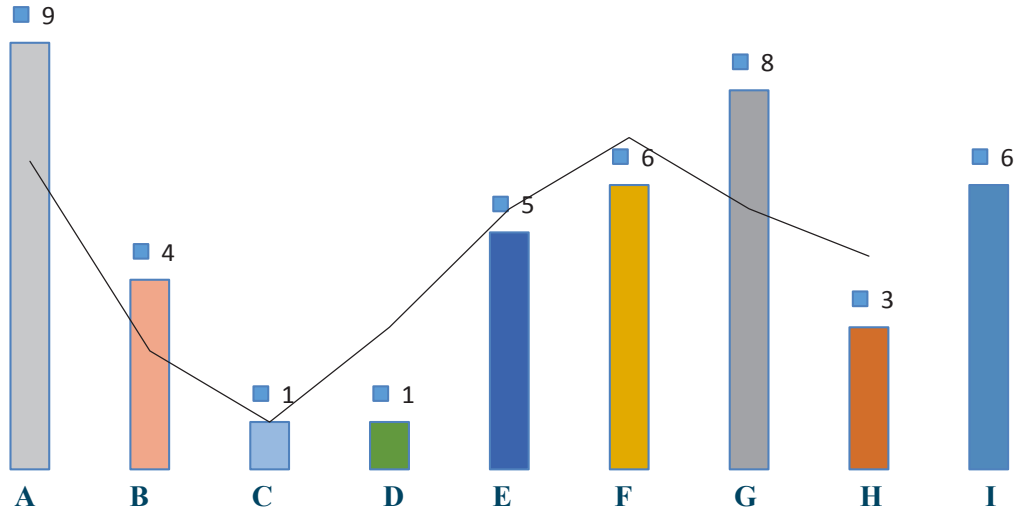

Fig.11: Conceptual model of design process

Fig.12: The frequency of the effective components in turning the subjective into the objective- creative instruction studio- No. of student: 13
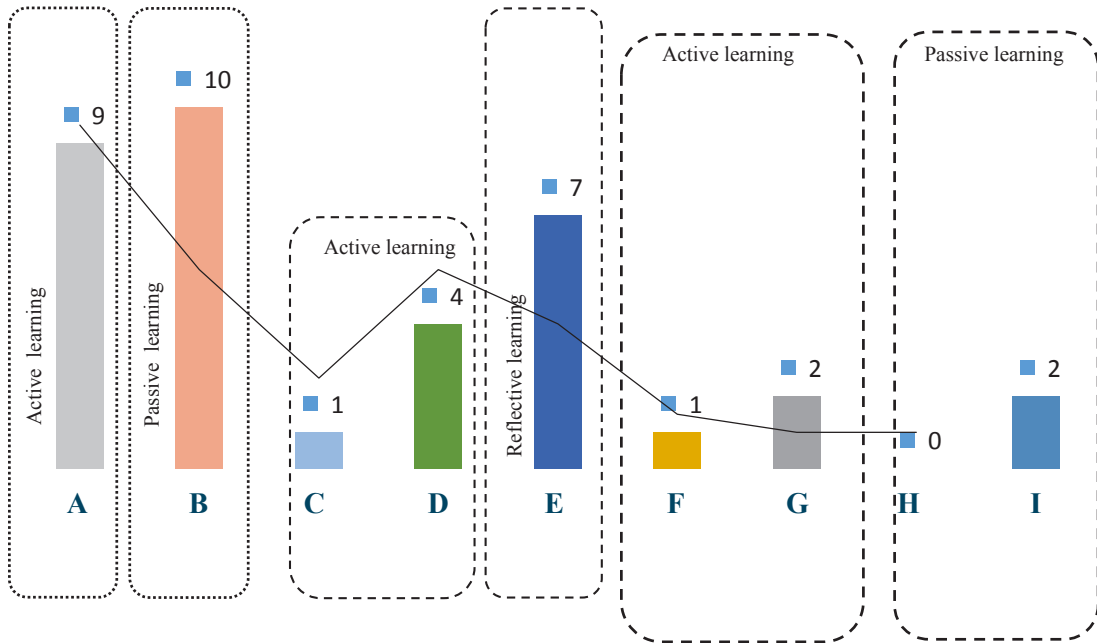

Fig.13: The frequency of the effective components in turning the subjective into the objective- interactive instruction studio
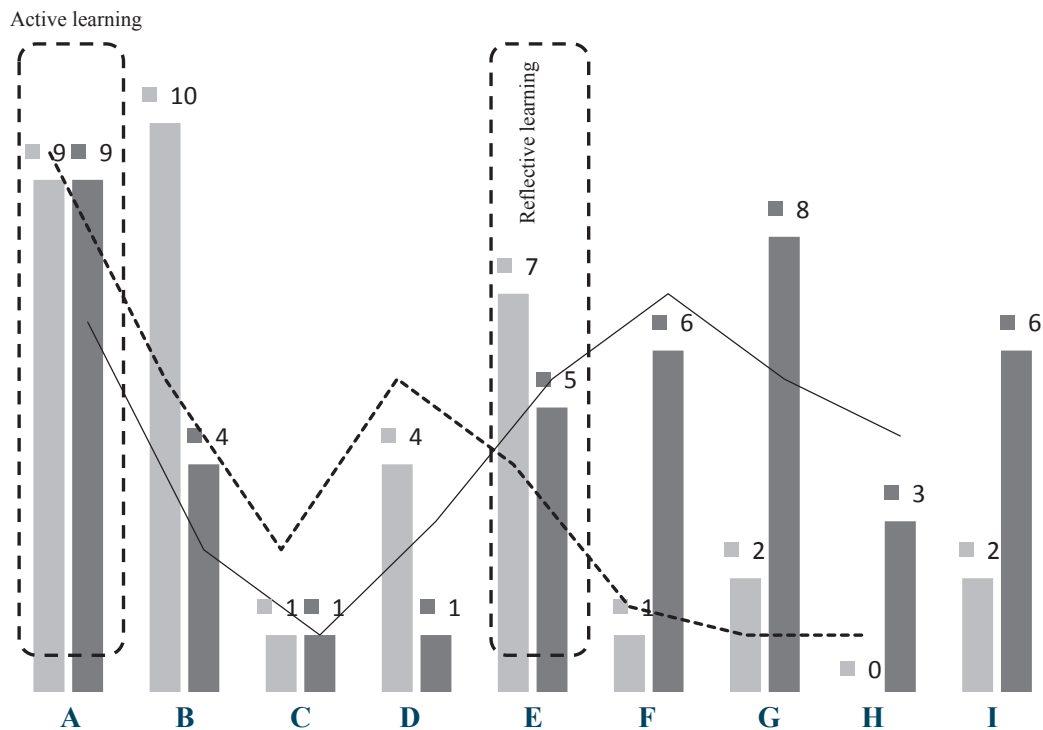
No. of students: 13

Fig.14: The frequency of the effective components in turning the subjective into the objective-comparison between inter-active and creative studios.

CONCLUSION

As shown in the Fig.12, the creative group in designating the frequency of the effective components in turning the subjective into the objective; show examples of Iranian architecture by the instructor; studies and examination of the samples by the student and the instructor; previous studies and implicit findings of the student; using sketch and the professors' introductory discussion in explaining the designing program and making questions in the students' mind have the most frequency. In the interactive group the examination on the samples, making questions in the students' mind; students' discussion; the instructor's introductory discussion in explaining the designing program (Fig.13); and the previous studies and implicit findings of the students have the most frequency while in comparison with Fig.14 the studies and researches on the samples of architecture in Iran; previous studies and implicit findings of the student; demonstrating samples of the architecture in Iran; making questions by the professor; professor's introductory questions, and students' discussions had the most frequency and demonstrating the sample projects of the students and proposing them by the professors had the least frequency. Also the balance line drawn at the above tables connects the average frequencies which can be utilized for drawing the general picture of the table. As the lines indicate both of the educational

procedures have nearly the same results.

In this practice, learning is examined at three steps: active learning is the first which is a quick glance at the obligations that are mainly acquired through examination of the samples of Iranian architecture and demonstration of photos. The second is passive in which the student progresses through making Knowledge Bridge with the professor and is often guided through discussion and asking questions. The third step is reflective in which the student offers his mental recognitions and implicit findings for the evaluation of the results of his work and improvement of his skills.

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