The Knowledge Gap Between Novice and Instructor in Architectural Education

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Abstract: This research provides 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. In active learning the focus is on the progress in the skills of the novice while in passive learning which is achieved through discussion and using sketch, the focus is on the expansion of their skills. The findings and the implicit knowledge of the student which are the result of passive and active learning, appear in the novice learners' reflective knowledge and skills. The results indicate that in transference of the subjective into the objective, the active and reflective learning are the most frequent ones among the students of both groups. The instructor and students through studying and doing some researches on the samples of architecture in Iran on the one hand and the student through his implicit findings on the other hand can turn the subjective into the objective.

Keywords: Creative education • Interactive education • Implicit knowledge • Gap Knowledge • Reflective learning • Passive learning • Active learning

INTRODUCTION

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 [1].

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 [2]. 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 [3]. That is to say the creativity process especially creating new ideas can be controlled and directed as to Plesk [4] model which was introduced under the title of directional creativity [4]. Based on his thorough investigation, Weisberg [5] concluded that there is no convincing evidence to prove that the unconscious processes have a critical and significant role in creativity [5]. 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 [5].

In the old models of creativity, creativity process is introduced as a linear and cause-effect phenomenon, while in the new models (Kobreg & Bagnall, Fritz and especially Amabile and Plesk), the creativity process is presented as circular and nonlinear phenomenon [3]. 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 AS 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 [6]. 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.

**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 [7] consider their works as an 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 [8] for instance had some rotten apples on his desk, Mozart [9] was taking exercise before writing his notes and Hartcrane [10] 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 [6].

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 [6]. 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.
Objective Steps of Design Process: Attempts to understanding and promote creative thinking in design generally focus on a number of techniques and procedures. Rosenman and Gero [11] suggested four objective methods by which creative design might occur: combination, mutation, analogy and first principle (Fig. 2). Another creative design method with similar potential has since been added to the list: emergence, which is widely accepted, is a useful objective model of creative design [12] (Fig. 2). Indicates subjective processes of creativity which includes "preparation", "combination", "mutation", "analogy", and "first principle".
"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. Figure 3 shows a practical exercise of designing a chair in Gero and Rosenman [11] studies which reflects objective steps of creativity [11].

Methods of Education: One of the main challenges of the 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. Therefore the effective components in forming objective designs can be studied as two educational approaches.

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 [13].

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. This corresponds to the explanatory model of the design process proposed by cross [14]. 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.

Knowledge Gap Between Student and Instructor: A great part of the designers' knowledge is implicit [4]. 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.

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 [16] 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 [15].

In her study of Susan Peterson [17] 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, [17].

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" [18].

The diagram below (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 [19] 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. They must observe reflectively...
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

and improve or add to their instruction until they make sure that the novice's behavior is convergent [19].

In this situation the novice and expert could be seen to be working together to bridge the gap between them (Figure 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 (Figure 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 the field;
- The designing ateliers should be close together; and
- The sessions should be held at a common time.
Fig. 14: The frequency of the effective components in turning the subjective into the objective-comparison between interactive and creative studies.

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 Cronbach 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.

**CONCLUSION**

As shown in the figure 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 and the previous studies and implicit findings of the students have the most frequency while in comparison with figure 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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