

## THREE DESIGN PRINCIPLES FOR HIGHER ORDER THINKING - ASCENDING ORDER OF COMPLEXITY AND DESCENDING ORDER OF RESPONSE

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### Abstract:

The paper aims at identification of methodical process to bridge disparities between the learning and teaching process of architectural design at architectural schools. This disparity was observed during the surveys undertaken for the Doctoral research. The performance of the second year students as compared to the first year students seems to be low in terms of originality and creativity. The further work was undertaken to assess the reasons for this and analyzing the parameters governing low output. Surveys exercises were designed to evaluate initially nine parameters through a set of assignments/tasks on the three design principles of higher order thinking. The surveys were undertaken at five Architectural Schools & institutes with over 600 students of first, second & third year. The increasing complexity in the inputs of the designed exercises resulted in the decrease in response in terms of quality and quantity.

**Keywords:** *Three design principles, Higher Order Thinking, Architecture design education.*

### 1. Introduction

Architectural design education today has to face many challenges due to globalization, technological inputs, futuristic perspective etc. where the process of design education span a longer bridge of disparities between the contents taught and the knowledge assimilated. Students mostly depend on the inputs easily available on internet which is fragmented and in most cases unreliable, incomplete and misleading. The other major source of input is individual's cognitive skills which have its limitations. Hence there is a need for new inputs methodically worked out to bridge the gap and the disparities

### 2. Literature survey of Architecture Design Education

The architectural education was incepted as early as 1671 at Royal Academy of Architecture and subsequently was restructured several times. However in the year 1919-1933 the entire architectural education system was restructured for contemporary social conditions at Bauhaus. The following citations clearly describe the necessary elementary requirements of the architectural education:-

- 1) Architecture education is about observing and grasping. It's about interpersonal interactions where one is influencing and other is an absorber and the struggle lies between the two individual (Salama 1995) in his book new trends in Architecture.
- 2) The problems framed and solution derived is another issue. The process between the two ends becomes most crucial than the output, Peter Levin, Barry Poyner and Melvin Webber with Horst Rittel (1984) have discussed the structure of design problem.
- 3) The educational is through building experience. The experience is built in a hypothetical situation to be applied for a practical application. (Salama 1995)
- 4) The architecture design education process is fragmented and need support. The process has a lot of tangible and intangible parameters. (Christopher Alexander (1960) and Christopher Jones talks on design process and the goals of process.)
- 5) The design fixations is elaborated by Steven M. Smith, Julie S. Linsey and Andruid Kerne (2010) in their paper 'Using Evolved Analogies to Overcome Creative Design Fixation'.
- 6) The existence of mental blocks in process of creative thinking ,and there is need to overcome it ( Khandwalla 2004).

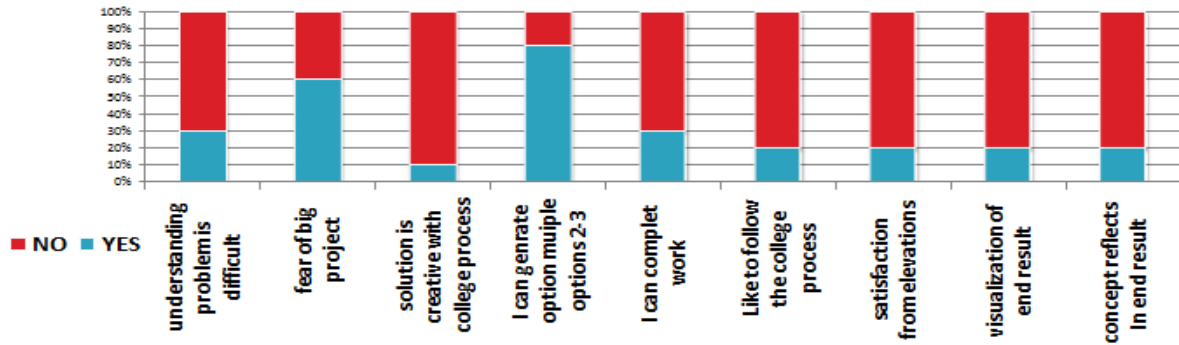
However it was observed that there are no techniques recommended for the Architectural pedagogy to ensure the higher quality creativity and originality. Observations during the doctoral research and subsequent dedicated survey to assess 'creativity and originality' being the core issues, concluded that the most of the elementary requirements are not achieved or satisfactorily received at the student's end as essential objective of architectural education for various reasons. The hypothesis thus arrived is the introduction of higher order thinking to change the low creative and original outputs in a straight line design process.

### **3. Methodology**

The methodology to understand the core issue and to evaluate the observation from the analysis was worked out in this research paper. First stage dealing to collect the student's feedback for the pedagogical design process adapted in the colleges and institutes is further detailed and described in the paper. The second stage dealing with experimentation and feedback on exercises designed to improve creativity and originality is described in further in the paper.

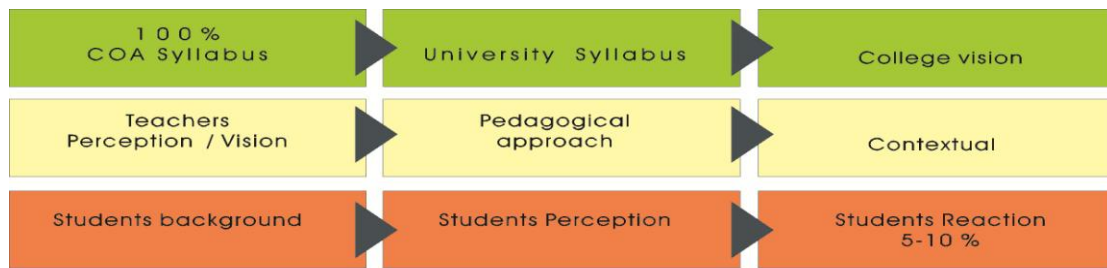
#### **3.1 Methodology part 1 – Survey Parameters**

The dedicated surveys based on the observations during the doctoral research were designed to receive the student's feedback on the process of architectural design. The student's feedback can be measured on a variety of parameters however it was limited to nine parameters to focus only on creativity and originality aspects, such as – understanding the design problem, complex projects, college pedagogy, multiple concept generation, completion of work, options to college pedagogy, satisfaction with end stages of design process, visualization of the process and the inputs necessary for the end results, developing the generated concepts into the final designs. The feedback received from the over 600 students are tabulated as under:-



**Figure-1.** Graphical representation of Student’s survey on nine parameters

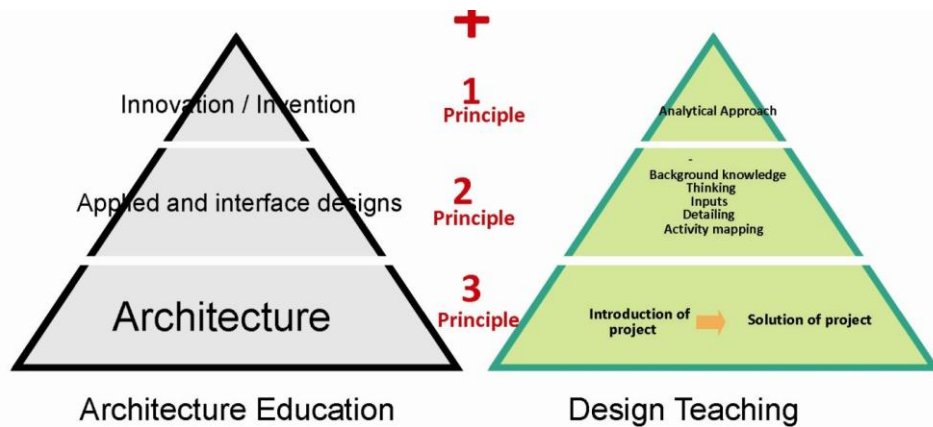
The observations from the surveys conclude that disparities start right form syllabus to student’s response. The gist of the process is that only 5-10 % of the educational objectives get materialized due to factors varying such as college vision, teacher’s teaching and perception, student’s academic and personal reactions to teachers, student’s background and perception etc.



**Figure-2.** Diffusion of knowledge content from syllabus and factors affecting diffusion.

The above observations conclude that there exist numerous drawbacks and loopholes in the architectural education process there by generating the wide range of opportunities for new methods and techniques to bridge the gap in design teaching and students assimilation of the knowledge for higher creative and original outputs, within the existing circumstances, infrastructure and guidelines of the Council of Architecture.

The Architectural education is based on the thinking patterns of human mind flavoured with creativity and originality for better solutions. The thinking is not only lateral or verticals but also analytical and logical. In the architectural design learning triangle the base is wider and maximum students belong to the wider portion of the Triangle, this being the most convenient approach, to follow teachers or reproduce from cognitive skills without a deeper analysis of its contextual references, situational relation, acceptability, functionality and utility etc., resulting in student’s assimilation of knowledge at around 5-10% [Figure – 2].



**Figure 3.** – Level of thinking

The major issues resulting in the qualitatively unsatisfactory academic solutions to design problems are – lack of skill to frame the concept, to progress with the concepts, to overcome the hurdles in the progress, to overcome the inability to proceed, to draw inspiration from other sources, to think and to think beyond, to maintain the continuity of the thought throughout the design process and many others which are defined as Mental Blocks as an existing common dominating factor for the low outcome in terms of creativity and originality.

### 3.1.1. Observations/Mental Blocks

In design process students face a difficulties which can be described as are inability to think, decide and proceed with design exercise resulting in mental blocks, which may be categorised as -

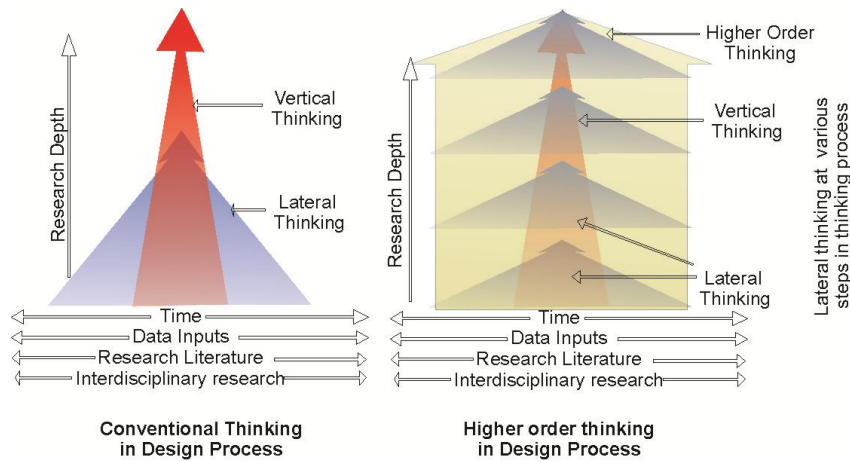
- 1) When an individual lacks resources is trapped and cannot think further (thinking stops)
- 2) Thinking in same domain (repetitive thinking without innovation resulting in alterations)

The detailed analysis of dedicated surveys conclude that the stages of design process in which students faced the mental blocks are - concept generation, deciding on options, documentation of thoughts. The maximum mental blockages lie in concept generation and decision making. Concept generation is in divergent thinking and decision making as convergent thinking. It is also observed that the guidelines for the design teaching pedagogy lack the necessary thinking inputs required for the design process.

## 4. Inputs in design

An academic design exercise is a channelized straight line process with the inputs in terms of thinking i.e. observation, experience, conceptualisation, visualisation, interpretation and extrapolation of data base. The methodology and inputs to overcome the mental blocks by way of thinking – lateral and vertical is missing in the pedagogy and the Council of Architecture Guidelines hence is the cause for the low creative and original design outputs.

The literature survey and the experts in the field of design education recommend a host of techniques and methods for teaching design. However most of the techniques are focused and conditional hence cannot be generalised and adapted for academic application, most of the techniques are not tested for their adaptability and acceptability, and some techniques are only theories with no methodology for teaching. None of the techniques so identified and discussed by scholars have found inroads in the guidelines laid out by Council of Architecture.



**Figure-4.** Higher Order Thinking

Higher Order Thinking (HOT) - is a concept of architectural educational reform based on learning taxonomies. HOT have complex judgmental skills such as critical thinking and problem solving. Both are difficult to achieve but the results are expected with exposure and rigorous practice. According to Bloom's taxonomy (1956), skills involving analysis, evolution and synthesis (essential for creation of knowledge) are thoughts of higher order. There is the remarkable difference in vertical and lateral thinking but the higher order thinking need to have best combination of the two, wider base of lateral thinking and focused approach of vertical thinking.

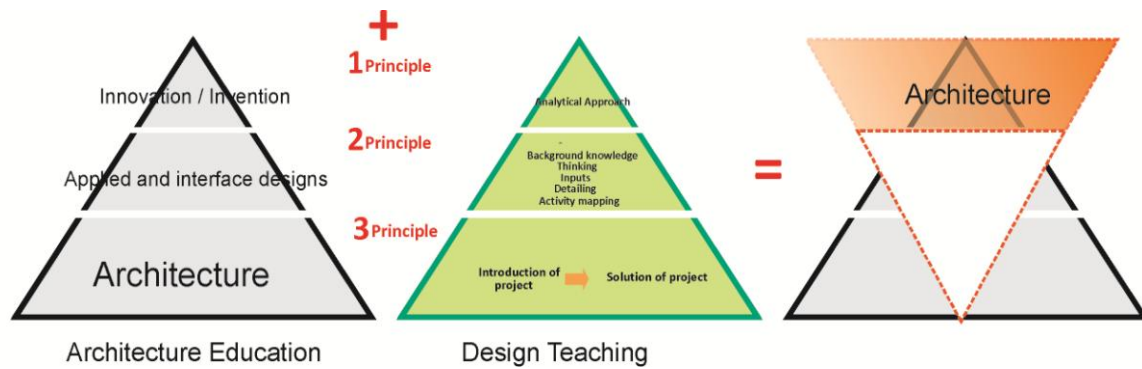
The principles of learning and practicing design are broadly classified in three categories based on these inputs and essential element of design process-

**Table-1.** Three Design Principles

<b>First (1<sup>st</sup>) Principle</b>	<b>Second (2<sup>nd</sup>) Principle</b>	<b>Third (3<sup>rd</sup>) Principle</b>
Minimum basic inputs and use of elementary principles of designing to achieve any outstanding results of highest level of creativity and originality.	Unlimited inputs and drawing inspirations from other sources, bio mimicry etc., results in the increased visualization, creativity depending on the originality of the inspiration.	Unlimited inputs from an available data base and examples. Lowest level of creativity and originality as data base is in common use.

The pedagogy adapted by the Council of Architecture is silent on the suitability and adaptability of the principles for creative education, which is the focus of this research and it's necessity is justified by reviewing the student's score of creativity and originality through variety of feedbacks designed specifically for the same objective.

The Figure – 5 describes the process of academic design studio and the various skills required in the order of design thinking normally adapted in the schools and institutes of design. It is also observed that this deals with the basics like attendance, conduct and quantity and basic skills essential for the general awareness without any focus and depth of the subject and thinking. It is also evident that the aim and the objectives also deviate due to lack of focus and rigidity in the structure.



**Figure-5.** Need for 1<sup>st</sup> principle thinking in architecture

The inversion of the Triangle as proposed would result in the reversion of the existing system where by taking the large number of students to the higher thinking level resulting in more responsive professional than mere creative applicators. This would also generate a range of professionals required for the design which is lacking and the expertise in allied subjects is left to non designers and technicians. The basic skills though necessary are now getting redundant due to gadgets specialised to do the necessary task more precisely and take it further in the process. The depth of the thinking which is lacking in the existing system is the prime focus of development leading to a paradigm shift in the professionals and thinkers essential and required for the decision making concerning the vital global issues, local issues of architecture and human habitation. Lack of interdisciplinary approach and extreme thinking has resulted in the chaotic development vulnerable to natural calamities and becoming the cause for it.

#### **4.1 Stage 2-Experimentation.**

The exercises for identification of the drawbacks in the existing academic design process were designed to cater to three design principles as follows-

##### **Exercise - 1 for Design Principal - 3**

The objective was to evaluate the cognitive skills of the students and students were asked to do a task accordingly.

##### **Exercise - 2 for Design Principle - 2**

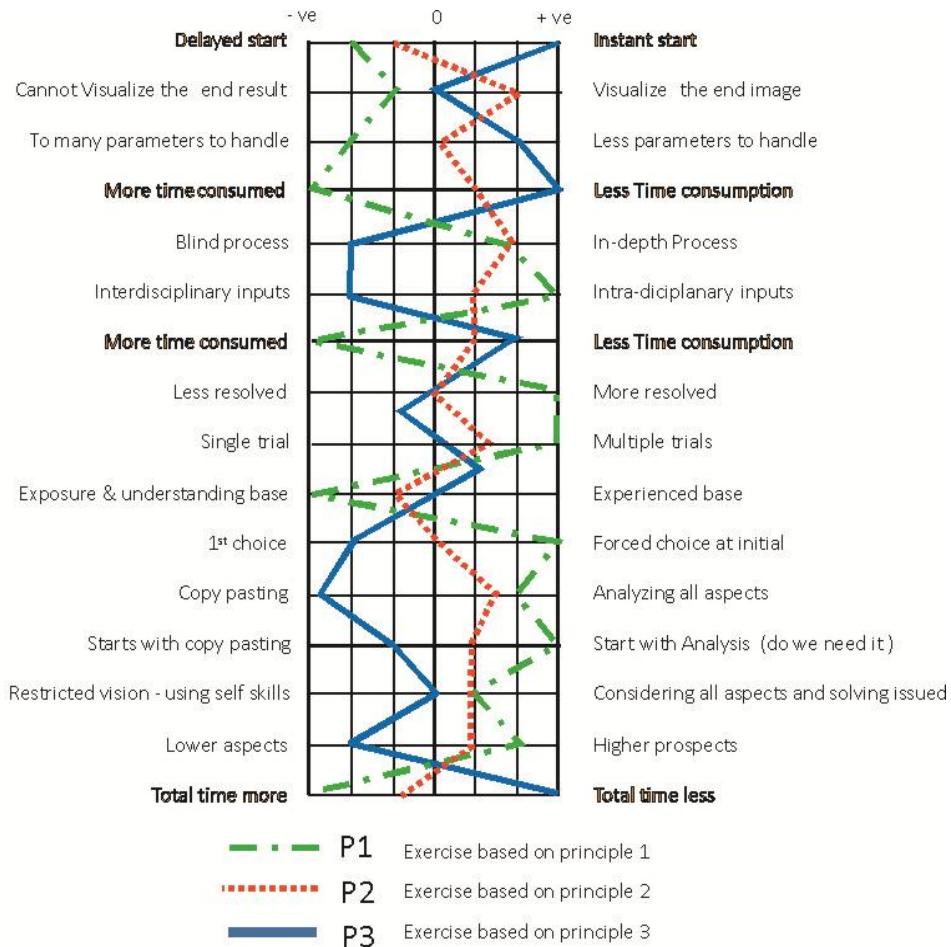
The objective was to evaluate visualization skills based on inspirations drawn or identified images or objects.

##### **Exercise - 3 for Design Principle - 1**

The objective was to evaluate analytical thinking and high order thinking by giving suitable task.

#### **4.2 Data Interpretations**

The experiments were conducted amongst 600 students and the results were mapped on the identified indicators. Exercise one (continuous blue line) was more of fun to start and end based on cognitive skills. The student's response was on the positive side of the identified indicators. Exercise two (dotted red line) was the visualisation exercise to externalise the thinking process beyond cognition. Exercise three (dash and dot green line) was analytical and high order thinking. The student's response was on the negative side of the indentified indicators.

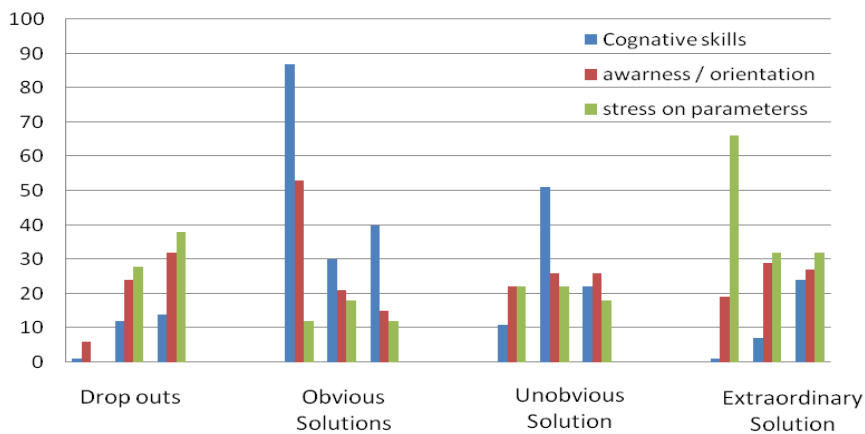


**Mapping of three processes based on 3 orders of design principles**

**Figure-6.** Path followed by the three processes on identified indicators

### 5. Inferences

The analysis of results from the three principle design exercise increasing the complexity in the design thinking is represented graphically in figure 8. The inference that can be drawn is as the complexity in the exercise increases the response level is decreases which is obvious in First Principle.



**Figure 7.** – The graph shows the ascending order of complexities and descending order of response.

## 6. Conclusion

Design teaching is a process of orienting the direction and giving inputs from variety of knowledge sources. The process of teaching widely adapted have a number of disparities and needs adaptive means to overcome them at all levels Institute [seat of knowledge], teacher [transmitter] and students [receivers]. Diffusion of knowledge is a constant where as assimilation of the same by the receiver is varying and cumulatively as low as 5-10% [Figure–2] of the desired objective. These receiving capabilities needs to be enhanced methodically and needs the structure and pedagogy for the same. One factor that needs more focus in the process of design education is exposure to thinking abilities as compared to application skills such as presentation etc.. The in-depth study revealed that the maximum students are more comfortable in thinking on cognitive skills, but few move the steps above. The Architectural Design learning with high order thinking as a continuous process shall thus result in higher level creative and original solutions.

## 7. Recommendations

1. Higher order thinking skills and ability should be developed and used in architectural design teaching.
2. The architectural education should develop the attitude and aptitude for experimentation and exploration.
3. There is a need to inverse the Triangle of education [Figure – 4] and incorporate the deeper and higher order thinking at the foundation level. This will help in long run to develop better analytical understanding to go to the depth of problem.
4. Also the need to incorporate the deeper thinking triangles to the lower level.
5. To achieve this at first stage awareness is required first at the facilitators end and then percolating to students end.

*If teaching has any purpose, it is to implant true insight and responsibility. Education must lead us from irresponsible opinion to true responsible judgement. It must lead us from chance and arbitrariness to rational clarity and intellectual order. Mies Van Der Rohe quotes*

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