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# Innovation and Practicality Architecture Design Studio at a Crossroads

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**Abstract—** Architectural Design studio, no doubt, lays at the core of any Architectural education program and developing the methods and techniques of teaching in the design studio plays an essential role in enhancing the educational program. The rapid need of practicality joined with the evolution of four consecutive industrial revolution puts questions the established vision of Architecture as a field of artistic innovation. This paper is concerned with introducing a restructured comprehensive framework for Architecture design studios to bridge the gap between the two visions. It starts by exploring the pedagogical value of Architecture between art and science and the challenges facing Architectural education in the new IR4 era. Followed by introducing the main characteristics and features of the proposed comprehensive structure of Design Studios (CDS) supported by illustrative examples. The research ends by concluding remarks and some recommendations to the studio instructors.

**Index Terms—** Architectural Education, Design Studio, IR4, Comprehensive Design Studio.

## I. INTRODUCTION

Architecture design is crucially affected by all developments in surrounding fields and disciplines. The world witnessed a rapid and revolutionary developments in the last two centuries, starting by entering the first industrial revolution era (I.R. 1.0) introducing the industrialization concepts with the emergence of the steam age. This was followed by the second industrial revolution era (I.R. 2.0) with standardization and mass production. Then came the third industrial revolution era (I.R. 3.0) with concepts of automation and the increased role of computers and electronics. And finally, the fourth industrial revolution era (I.R. 4.0) marked the term from 20th to 21st centuries by entering the age of cyber-physical space systems and the digital communication and internet of things (I.O.T) and the revolutionary knowledge exploration. [7]

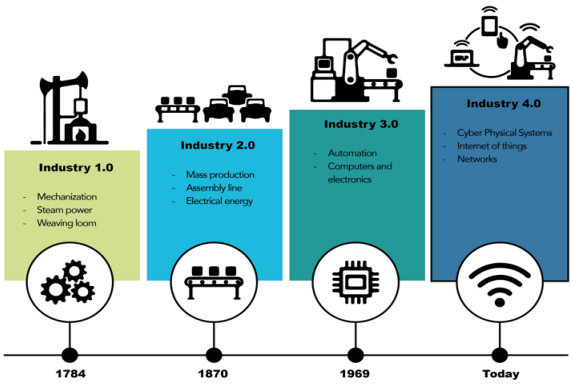


Fig. 1: Industrial Revolution Development, [7]

By entering the fourth industrial revolution era, we witnessed a lot of rapid developments in the construction industry which led to the fourth development in construction named by “Construction 4.0”. The aforementioned led to the rise of research and studies concerned with how to achieve a successful adaptation between the design process and the revolutionary development in communication and emergence of the virtual space that we started moving towards. A call for establishing what could be called “Design 4.0” required an adaptation of the architecture education with this development as well as finding tools and techniques for achieving it. New development horizons and opportunities for architecture education were emerged as well as difficulties and challenges. [7]

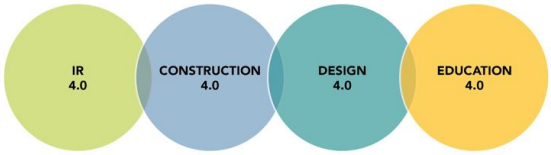


Fig. 2: Education 4.0 as a reflection for IR 4.0, [7]

By exploring some of these horizons and challenges, we can find rapid variation of new objectives, discovery of new tools and technologies in design and construction, expansion of human communication, stressful environmental challenges, ...

This added an extra load on the educational process where the students must be aware of the developments and should be trained to deal with them efficiently. Additionally, the role of the designer had to be redefined in a world full of intersecting disciplines and a lot of conflicting thoughts about the role of machine in the design process. Living in parallel to the virtual world added a lot of advantages of communication opportunities and imagination and simulation of virtual environments that could ease the evaluation of alternative and designs while adding some constraints and challenges on the shoulders of the designers. [6]

This paper focus on exploring how to develop the Architecture Education with more focus on the Architecture Design Studio, as the main core of the architecture education process, to face the previously mentioned challenges and benefit from the opportunities.

## II. ARCHITECTURE DESIGN BETWEEN SCIENCE AND ART

### A. Science or Art?

Science or art, the default question we face whenever we talk or discuss the hue of architecture. Does Architecture belong to the field of science, art, human and behavioral sciences? It is a lifelong debate. Are we required to considered feelings, human desire and interests, aesthetics? or we are talking about functionality, rational thinking, logical calculations leading to enhancing efficiency and functionality?

We cannot look at architecture as a pure art where the architect produces an artistic product for his own desire and preferences, and at the same time it could not be considered as an item produced in the lab. We can argue that this dilemma could be solved by considering the main function of architecture to create an appropriate environment to accommodate human activates. When we look to this definition deeply, we can realize that the main keyword here is about considering the human being. The dual nature of the human being, the emotional psychological side along with the physical practical side, where man can balance between these two sides to achieve his needs and desires. Architecture should consider the balance between these two directions and accordingly, it merges between these different disciplines. So, we have two contradicting directions that should be coordinated if we need to create a successful architectural product. We need to eliminate the competing sense and enhance and support the concept of internal integration in architectural work.

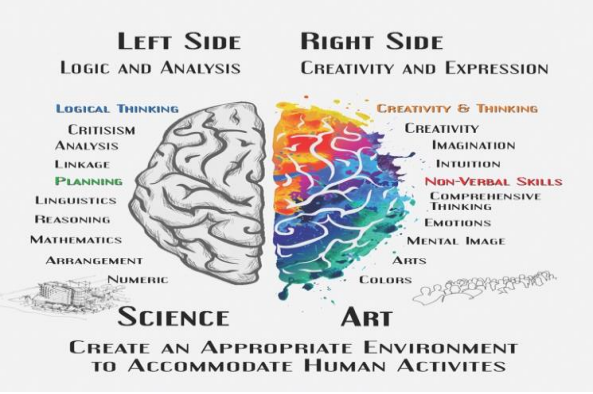


Fig. 3: Brain Function, [3]

When we look to the main developments in the last two centuries, we can notice three main cognitive fields of development which added new rules to architecture. Starting by the group of disciplines related to the human behavior and environmental behavioral sciences (EBS), studies of physical environment, and cultural studies. This made architecture education concerned with cognitive studies for pre-design and the trials of understanding the human behaviors and activates either for the pre-design phase or post-occupancy studies. Dimensions of users' participation and understanding human needs, culture and references emerged as important concerns of architectural design. Community design, as well, added new rule to the architect responsibilities to understand and deal with different communities. Accordingly, the architecture education became concerned with integrating these dimensions into its structure. [6]

Sustainability, environmental studies, ecosystem planning and development, and environmental awareness emerged as one of the main human concerns. The environmental dimension became one of the most important aspects in architecture design where the architect was required to take care of this dimension and accordingly should be aware of new intellectual and cognitive fields, seems for the first moment away from the architect's concerns like physics, mathematics, thermodynamics, but they are very crucial to act responsibly with his environment.

The third cognitive development is the increasing role of digital technology and virtual practice which added new dimensions to the architectural fields either in the direction of tools and techniques like visualization modeling and parametric techniques or the expansion of space of architectural practice through the virtual world techniques.[6]

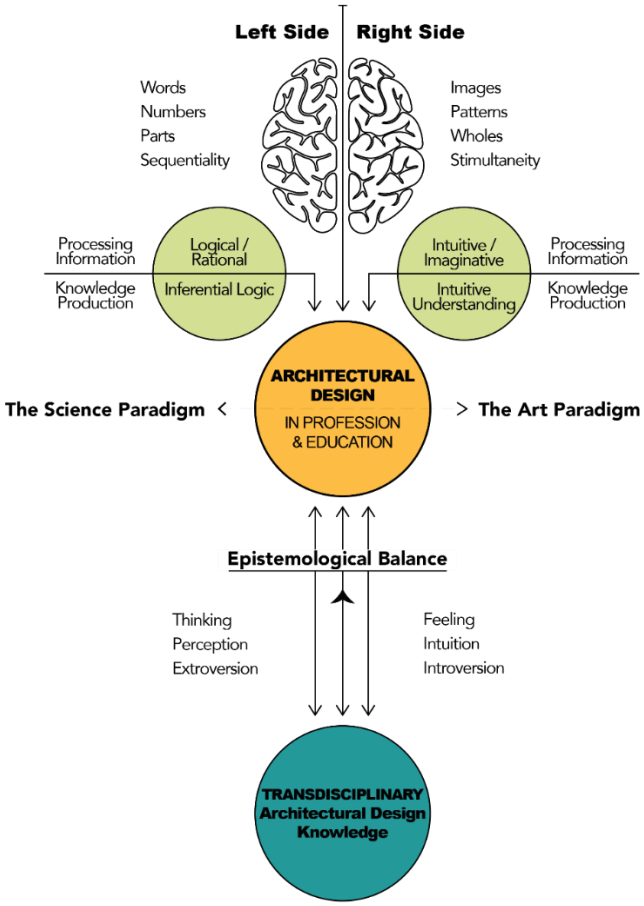


Fig. 4: Transdisciplinary Architectural Design Knowledge, Authors after [6]

These developments added several challenges for the Architectural Education that could be concluded in four main challenges, as follows:

1- The rapid "volatility" in the cognitive domain where the student is subject to a lot of developing and changing concepts and ideas all the time.

2- The “uncertainty” resulted by rapid changes of demands, goals, tools, and techniques.

3- The “complexity” resulted due to the endless changing and complicated variables affecting the architectural product and decisions.

4- The “ambiguity” facing the architect in front of the complex relation(s) between different variables.

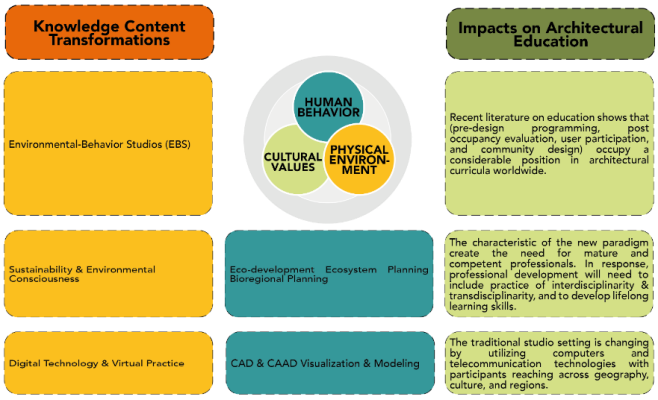


Fig. 5: Knowledge and Impact of Architecture Education, [5].

Ronald Barnett claimed that Architecture students will be facing a world that exhibits global characteristics of challenges, turbulence, contestability and unpredictability [8].

B. Problem or Challenge

Here we are facing a question about defining the situation as a problem or a challenge? Or in another format, how to convert the problem into a challenge and then how to overcome this challenge? As we argued that the main aim in the architectural process is to achieve that epistemological balance the tangible and intangible dimensions. The first dimension, Practicality, is concerned in how to produce what could fulfill the different market requirements. It should consider structural and construction dimensions, safety requirements, thermal performance, and all other practical consideration the student should abide with. At the same time, the architecture student should consider several human, psychological, aesthetical and innovative dimensions. The student is required to face the forementioned challenges. He should think in an innovative way trying to find untraditional solutions for new and changing design problems.

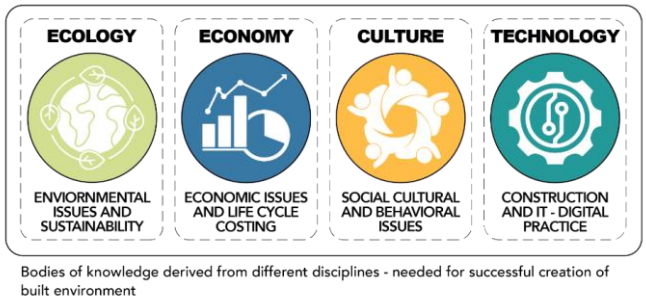


Fig. 6: Bodies of Knowledge and Disciplines, Authors after [1]

The student here should be equipped with integrated group of skills including creative thinking, social smartness, and environmental adaptation. He should be trained to deal with cultural diversity as he won’t be required only to consider the local context but to interact with international or multi-national firms. How to deal with the requirements and tools of the digital era. How to deal effectively with different disciplines. He needs to be trained to respond fast and effectively with this huge cognitive revolution. He to think and design in and for the growing parallel virtual world, and how to benefit from the advantages and to avoid or overcome the disadvantages. This problem is the main challenge facing the Architecture instructor to know how to help the

student to overcome these challenges. How to prepare him mentally and technically to face this cognitive revolution effectively and efficiently. We are here only focusing on the role of the design studio as medium where the instructor can guide the student to achieve this epistemological balance between technical and artistic entries, i.e. between practicality and innovation.

## III. COMPREHENSIVE STRUCTURE OF DESIGN STUDIOS

A proposed model for the structure of the design studios within Architecture educational program is suggested under the name of the "Comprehensive Structure of Design Studios CDS". We can recognize this model through four main characteristics, as follows:

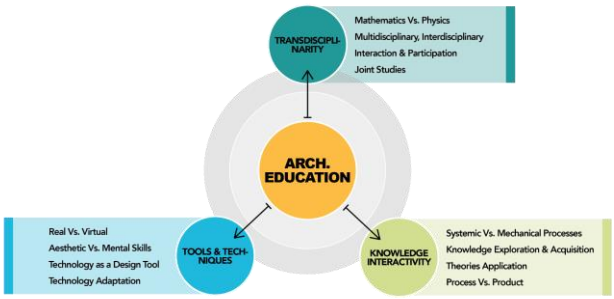


Fig. 7: Model for the Structure of the Design Studios, Authors.

### A. Main Structure of Design Studios

We need here to look at the group of design studios, this proposal suggests the whole group of studios (8/10studios) to act as one unified system composed of integrated units working in harmony as different parts of the same body. This system built on three main axes:

1) Integrated Disciplines:

As the rail practice of Architecture requires the integration between different disciplines; the proposed system should consider this by considering the concept of "transdisciplinary" among different courses integrating and intersecting with the Design studio. The students should be trained to practice the integration of different disciplines, such as mathematics, physics …, with their design work.

2) Knowledge Interactivity:

We should avoid, completely, the concepts of knowledge delivery. The student who is taught by receiving information will remain trapped with the validity of this information. In this rapid changing world, we cannot count on the given information which could be developed or even obsolete in the following few minutes. Instead, the student should be trained acquire, search, deal, and interact with knowledge. The student should feel and believe in the importance of knowledge seeking at first, and how to deal and benefit from this knowledge second. We need here to focus on the systematic process instead of the mechanical process.

3) Tools and Techniques: How to change the use of these tools and techniques positively from just being as aid means to be part of the design process.

### B. Characteristics of the proposed CDS

1) The process-based studios

Through design studios, the student should be trained to focus on the process not the final product, A problem-based not a product-based, because the product is varied and changeable. If the student learned how to design a school, as an example, the concept of the school itself is changing and getting developed rapidly. The student should learn how to be able to analyze the requirements and conditions of the new concepts of learning and teaching and act accordingly to provide a design solution responding to these changes. It's not necessary, as in the traditional approaches, to ask the student, every time and at each level, to provide a set of completed drawings for certain project. Alternatively, he/she should be trained to focus on specific detailed design problems. Problem-based tasks and assignments should be the main method to train the student on dealing with design

problems. He/she should be able to focus on solving one or two small partial problems and to understand and solve the interrelation between different problems. By accumulating these steps, he/she, by the end, can reach a comprehensive design. In each problem, the student should focus on answering three main questions, what, why, and how. To understand the requirements and define the design objectives. To understand different relationships (geometrically, spatially, functionally …) to be able to generate different alternative. And then, he/she could move to the analysis and synthesis phase.

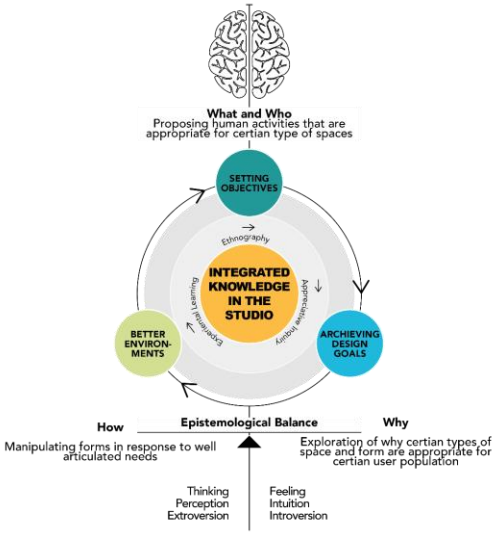


Fig. 8: Human Activities, Authors after [6].

2) Progressive Structure of Design Studios

We need to see design studios in a harmonious structural progression. The following table includes just an example to show a proposed hierarchy for the group of design studios:

Table 1: Proposed Studios' Hierarchy, Authors

| Level | Studio Direction |
|---|---|
| **Freshman** | Fundamental Principles & Architecture Language |
| | Design Process Studio |
| **Junior** | Contextual Design Studio |
| | Construction-aware Studio |
| **Senior** | Experimental Design Studio |
| | Integrated Design Studio |

In the early beginning stages, the fundamental design principles should be introduced to the student to allow him/her to recognize and get familiar with the Architectural language. Traditionally, we focus on the building types while assigning studios' projects. Instead, we need to focus on the main goal and objectives of these studios among the comprehensive system. In the following phase, the student should move to practice dealing with simple design problems through the design-process studio. He/she should learn how to move through the design process methodologically. After that, the student moves to a group of studios focusing on the contextual design. Not only the surrounding physical environment but considering all aspects and dimension of the whole physical, cultural, and socio-economic context. The following stage focuses on the structural and technical considerations through the construction-aware studio. After mastering dealing with the technical and functional requirements in design, in other words: mastering the language and tools, the student can move to do some experimentations. He/she should be allowed to get out of the box and try different innovative and creative ideas and thoughts with less constraints and limitations. Not necessarily to produce complete comprehensive projects in this phase, it's enough to produce

innovative ideas and thoughts. Then finally, we can have the integrated-design studio where students focus on the integration between different disciplines and dimensions.

3) Transdisciplinary Design Studio

The integrative design studio, suggested in III.B.2, is proposed to be introduced in late stages through a real-life studio. But before applying this approach, the student should be trained on moving from the group-work concept, as a reflection of the interdisciplinary knowledge era, to the team-work concept, as a reflection of the transdisciplinary knowledge era, where the different members of the design firm act in harmony as one body. When students deal with a real project, with a real client, real requirements, real constraints, the must start forming comprehensive integrated teams (including architects, structural engineers, electro-mechanical …). We also get help from professional experts to play different roles of local institutions and the instructor here plays a facilitating role to help the students to act in harmony until producing a realistic comprehensive project.

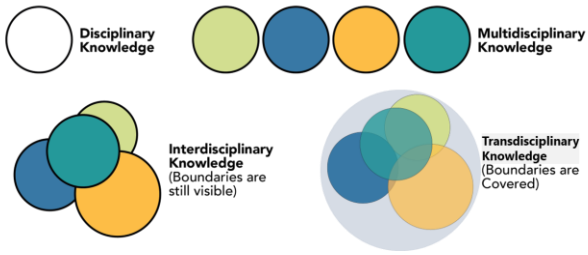


Fig. 9: Knowledge Types, Authors after [6]

4) Technology as a Design Tool

When the students learn Computer Aided Design Programs traditionally, they usually focus on developing their representation skills and how they communicate their ideas and designs. In the proposed structure we recommend adding more weight to focus on using technology advancements as design tools through the design process, and to help the students to develop their digital design skills. This could be used, for example, to improve how the students use digital model to improve their imagination and help them taking better design decisions. They can also benefit from using the advanced environmental analysis tools to study the impact of every design decision. They should be trained, as well, on using the parametric design tools to enhance the design process [2].

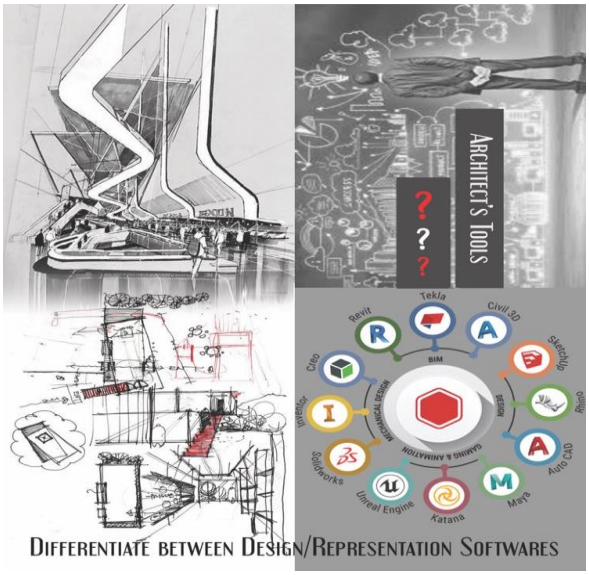


Fig. 10: Difference between Design/Representation Software, [3].

## IV. CONCLUSION

This research aspires to establish a base for addressing the challenges faced by the Architecture Education process in the Era of I.R. 4.0. This contribution aims to provide a fully integrated structure to introduce the Architecture Design Studio as an integrated constitutional module around which the educational process takes place. The proposed structure is conceived as a broad conceptual vision with a holistic view that can take into account the different visions and goals of each educational program in line with the vision of the institutions that follow it, and is highly flexible to accommodate continuous change and development, both at the architecture level and in the educational process. At this point, it is important to note the need for follow-up research to understand the mechanisms of applying the proposed structure given the growing demand for distance learning opportunities and design challenges in virtual environments.

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