Judicious Integration of Research and Professional Practice with Architectural Education: The Two Primary Parental Forces in the Nurturing of a Budding Architect’s Soul
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ABSTRACT
Architecture is a creative and extremely challenging profession. An architect needs to possess the talents and prodigy of an artist as well as the stead-fastness and accurate decision-making abilities of a true professional. The study of architecture comprises of a unique blend of art and science. Thus the role of architectural education is highly significant in honing the skills and thus shaping the future of the students. This paper presents the meaning and necessity that research in the field of architecture carries both for the professionals as well as for the academicians. Moreover, the students when exposed to actual industrial conditions under the monitoring of their professors display remarkable interests and outputs. This paper throws light on how dedicating time and resources on architectural research has helped in the growth and development of the profession and why does it become so beneficial to align research, industry exposure and academics together as a single unifying unit.

INTRODUCTION
The concept and meaning of the word education has held multiple and dynamic forms and dimensions over the history of mankind. Consequently, it has evolved from a more strict and systematic pattern to the present day liberal and changeful structure. Education can be defined as the systematic process undergoing which the pupil learns to understand the self and the world around. It fosters a deeper value system and enables him/her to respond more prudently to external stimuli.

Depending upon the cardinal points, the aim and road-map of education can be developed. In the words of Friedrich William Froebel "Education is unfoldment of what is already enfolded in the germ" [1]. The very same philosophy has also been advocated by numerous other dignitaries from across various eras. It is deemed that human beings are born with a host of capabilities and education is tool to help them truly realize their potential. According to the great Indian learned, Sri Aurobindo : "Education which will offer the tools whereby one can live for the divine, for the country, for oneself and for others and this must be the ideal of every school which calls itself national".

UNDERSTANDING EDUCATION IN THE CONTEXT OF ARCHITECTURE
In a nut-shell, architectural education is aimed at imparting the skills and knowledge required for building structures with greater efficiency and that stands in harmony with the surroundings as well as carries a captivating feel and appearance. Therefore, the student has to assimilate ideas on aesthetics apart from developing a high degree of technical skill and expertise.

The fabric of the building can be compared to a living being that needs adequate nourishment for a sound and healthy condition, thus requiring the knowledge of science and technology.
Beauty is such a free flowing intangible gift of nature that can only be felt, appreciated and enjoyed without being owned or dictated. It follows the two essential qualities of goodness and honesty [2]. Architectural education has the very meticulous task of converting the pupil into a prodigious craftsman, who has to blend the delicate laws of beauty with the universal scientific principles governing nature, the Architect (Figure 1)!

Figure 1. Amba Vilas Maharaja’s Palace, Mysore: A beautiful example of man’s supreme artistic abilities and technical perfection.

The Hypothesis

If the architecture pupil is considered as a young sapling, education takes the form of the nutritious soil into which the very roots of the plant spread out and grow while the external stimulus of sunlight is the hope and excitement that the industrial exposure that got to offer. The traditional system of education imparted at academic institutions today teach a particular set of subjects comprising of certain pre-determined topics which is followed year after year with little or no change at all. Moreover, not much guidance is provided to the undergraduate students about the kind of industrial atmosphere that lies outside the four walls of their classrooms. This distressing plight can be compared to that of a plant that is made to grow in the restricted area of a flower pot and is kept inside the house (Figure 2).

Figure 2. A symbolic representation of the present architectural education system (top) and the proposed one (bottom).

Research, academic skills and theoretical know-how of an advanced level cultivate the mind of the learners. It helps foster self-confidence in them while cultivating in them the thirst and desire to expand their horizons of understanding and thought-processes. It will prepare them to question, challenge the limits and emerge with triumphant solutions. Academic institutions, being already equipped with the various infrastructural facilities like well-developed library, advanced computational techniques and numerous trained guides can offer an excellent assisting background for generating ideas, experimenting possibilities and adequate dissemination of the results.
Opening the windows to the outside world will enable the students to understand the nuances of architectural practice with greater depth and detail. It will bring about a more holistic full-fledged growth. Association with the professional practice will inculcate in the students a sense of appreciation for the profession.

The R & D cells of these organizations in collaboration with the research-bodies of the educational institutions can produce the most practical, efficient and time-tested technologies with high-level conceptual backing.

Like everything else, even the very beneficiary sunlight comes with a host of harmful radiations. The internal mechanism of a plant’s functioning is so programmed that it will take in the useful rays only for its processes and discard the rest. Similarly a student who gets exposed to the industry need to be taught to assimilate the useful skills only while rejecting the dishonest or malpractices. It is the responsibility of the trainers to help him understand not only the theoretical aspects of architecture but also the on-site hard-facts.

The continuously growing knowledge owing to the research activities undertaken is comparable to the moving sea. Students must be taught the right approach towards research and the ability to distinguish between the authentic information and misleading data. The student with the aid of research equips himself/herself to face the ever-changing and challenging practical world. Furthermore, when the students get the chance to work under real-life situations, they would get a true understanding of the site conditions, its limitations as well as scope. Thus the metaphorical example of a hydrophyte that freely moves around the water body while receiving ample direct sunlight stands as a perfect example of this case.

**Role of Research in Architectural Domain**

Architecture is the branch of study that integrates aesthetics into structural efficiency. It combines the science and engineering philosophies with art and design. Research refers to original investigation undertaken in order to gain knowledge and understanding. In architecture, research is needed to identify new concepts and requirements of customers and align them with new discoveries by architects all over the world. If there are beautiful buildings, it does not mean more such structures cannot be designed.

“It is not the answer that enlightens but the question”[3].

Architecture has its own knowledge base and procedures. First stage in architectural research refers to processes involved in the design and construction of buildings and includes issues of representation, theories of design and environmental modeling. Building construction dealing with the study of engineering materials, structural analysis, foundations etc. form an integral section of architectural research.

Architectural products refer to research into buildings as projected systems and include issues of aesthetics, materials, and constructional techniques. With the help of progressive researches, new and advanced engineering materials are identified for buildings. Enhanced illumination by the presence of glass walls reflecting the green exterior is a significant application of the aesthetic mindset of an architect. New constructional techniques keep evolving with the identification of new resources and identification of the limitations of older resources.

Architectural performance refers to research into buildings once completed and includes issues of social occupation, environmental performance, cultural assimilation etc. Buildings that serve welfare for general public are hence given more significance than individualist structures.

Research has led to the incorporation of new concepts into building construction like designing earthquake resistant buildings, Rainwater harvesting systems, energy tapping and saving mechanisms etc. Such developments have led to the inception of a new form of architecture i.e. green architecture. Green buildings enable maximized flow of natural light inside the rooms adding to the beauty of the building besides reducing the number of electrical appliances and consumption. Residents will definitely live a healthier life.

According to the tripartite view, research in architecture is an iterative process. So development in any one element of architecture whether process, product or performance initiates development in the others (Figure 3).

![Figure 3. Symbolic image exemplifying the iterative nature of architectural research.](image)

Research can be pure or applied. If an entirely new concept is being researched that type of research is pure in nature. However if one tries to research on a topic upon which considerable research has been done already that type of research is applied one. For instance, when the concept of colors to create a vibrant and sophisticated outlook was studied for the first time,
it was pure research. But now with so many investigations and developments, any further research upon application of colours will be treated as applied research.

Both pure and applied research is important, but the identification of a purely new concept differentiates an innovator from a researcher. Architectural research brings innovation and business on one common platform. Research helps in developing new theories as sculptors of national development, we must know that the full potential of our cities cannot be realized without the aspect of research.

Being a very prominent and developing subject, the domain of architecture continues to increase over the decades. Prominent architects have always given new dimensions and direction to the subject. Architectural education has the responsibility of inculcating in the students the abilities of conducting research for developing advanced processes, materials, techniques and being grounded at sound conceptual theories simultaneously.

CONJUGATION OF RESEARCH AND EDUCATION IN ARCHITECTURE

With the rapidly changing times, our built-environment has seen immense variations ranging from the pre-historic caves, huts, mud-houses, concrete, steel and pneumatic structures to the modern bionic buildings. The novel and beneficial fruits of research when incorporated into education will enable both in the rapid transmission of technology as well as improvement in the quality of budding professionals. Architectural pedagogy must absorb the advanced visualization techniques offered by the modern times and must continuously provide new and evolved learning methodologies.

In the classic Beaux-Arts Architecture, architectural pedagogy involved a practice of evaluating aesthetics on the basis of certain self-determined criteria and procedures.

Imprints of this traditional academic legacy still continue to raise hiccups among the undergraduate architectural pedagogy in North America [4]. However, the fact that this conventional practice has been a significant contributor of urban analysis, form generation and special organization is undeniable. At the same time, this methodology results in the top-down teaching approach as pointed out by Gregory Marinic in his paper, Bubble Up [4]. The top-down approach gives rise to a few emerging talents while the majority of the pupils with a little less of artistic skills found themselves losing the battle.

In opposition to the conventional practices, the ‘Modernist’ approach was introduced by the German Bauhaus movement. The Bauhaus incorporated an interdisciplinary approach towards design instead of the merely abiding by the conventional classical determinants of aesthetics. The advent of modern technology and mass production techniques triggered by the emergence of various digital tools propagated the belief established by Bauhaus [4].

Logical and an open-ended investigation approach when followed helps raise the building’s overall performance. It is the need of the hour to adopt a broader perspective in terms of the holistic building design development. The vast domain of building technology enables the student to loop deeper into the enormous ocean of scientific principles and putting meticulous efforts to develop amazing output. This gives a chance to everyone even the one with average abilities to effort-fully elevate the standard of his works. “The total output of a studio led by the bottom-up philosophy tends to result in a greater percentage of successful works than those forums guided by traditional top-down methodologies” [4]. Thus through this process the purpose of education to develop skills in students gets served adequately.

The philosophy of conducting research-dependent academics is a developing area holding ample practical relevance.

RESEARCH-INTENSIVE-EDUCATION EXEMPLAR: THE BUSHWICK PROJECT

An alternative pedagogy of a research-intensive undergraduate program can be found in the semester-long collaborative studio of examining the Bushwick neighbourhood of North Brooklyn taken up by Gregory Marinic [4].

The aim here was to synthesize notions of place and culture architectonically apart from establishing the post-industrial Bushwick, Brooklyn as a laboratory of urban, social and demographic data in the neighbourhood context. The attempt intended to incorporate a multi-disciplinary approach and digital conceptualization techniques toward producing a malleable architectural organism [4].

Since the Brooklyn neighbourhood is undergoing major gentrification, the identification and study of its anthropometric relationship, change and morphologies helped students develop the context for collection of site-specific data samples. Students conducted the study of the several material conditions and operations in connection to the neighbourhood. This collected data was then tested with the help of advanced processes of mapping and digital fabrication [4].

“Students were introduced to the complexities and compromises inherent in contemporary architectural practice, whereby they designed, managed, procured, and ultimately deployed built form” [4]. The design process was brought in shape by the team that comprised of the students, studio critics, advisory groups, the hypothetical abstract of the client and the jury members. Being a collective effort, it enabled the students to conduct brain-storming, evolve ideas and weigh their works against their peer groups. Among several dimensions under review were those of sustainability, materials, patterns, texture, effective demonstration of works etc. [4].
Sustainability issues pertaining to the critical social and ecological imperatives were approached to mitigate waste stream and establish zero carbon footprint. Another objective was to make use of the local materials especially for the interior environments, which was the focus of the design process. Consequently, with the help of pre-used inventory provided by Materials for the Arts and those collected through self-initiated reclamation efforts, 95% of the resultant product was an example of ultra-weight built environment. The environment-friendly inputs were identified and documented followed by testing through computational transformations and generation of mapped sequence of activities [4].

One of the most significant aspects here was the introduction of the concept of the client that came along with a host of constraints, work schedules and economic factors. The “client” here is the personification of a 400 square foot small gallery space acting as an installation space and design directive at Bushwick, Brooklyn [4].

Manipulation with materials employing the process of making offered the classic and ageless tool for testing spatial notions of contextual and figural conditions. It enhanced the understanding giving rise to newer and unexpected results before the students which may not have been otherwise possible with hand-drawn or computerized methods. The cross-disciplinary approaches of Art, fashion design, interior design and photography involving the topics of local form, materials, structure, colour and texture were addressed. A total of five sequenced charrettes were developed that threw light on the process of making in various fields of art and design, researching with materials, creating multi-dimensional spaces and their implications on generation of newer ideas and problem-solving [4].

The human relationships between structure and skin help address the scales of space making. Several experiments were conducted using the series of intricate drawings of human dissections referencing allegorical poses, Leonardo’s Vitruvian Man and Le Corbusier’s Modular that acted as classic examples. The approach has previously also been employed by Diller+Scofidio in their investigation of the Bad Press: Dissident Ironing to explore the architectonic potential of Oxford shirts [5].

Everyday tasks of ironing, buttoning, folding etc. when carried out on the shirt presented unexpected prospects for the resultant wearable objects as well as the material. This approach helped investigate the joinery connections at actual scale, performance of materials under varying circumstances and the relationship of the skin (shirt) that acts as a secondary layer with the mobile structure (body) in space. Finally, using story-telling methodology, the students graphically depicted their ideas and linked it to the activities of gathering, analyzing, modifying and framing information [4] (Figure 4).

Furthermore, the students were trained with the task of connecting and conveying in order to familiarize them with the identification, investigation, testing and ultimately examining the inter-connected relationship of different objects in space. Given with a list of materials to exploit, students investigated the various primary and secondary forces acting on them.

The processes of patterning and postulating enabled the students to establish a relationship between the interiors with the overall urban context taking references from the data collected on site i.e. Bushwick. The place opened a plethora of opportunities for researching the spheres of historical, industrial and demographic parameters (Figures 5 and 6).
Several tools and techniques were employed to collect data from the site, testing and putting them into the context of designing process. Eventually, this careful probing lead to the potential of an environment completely built up of light elements such as coloured paper, plastic, metal wire and repurposed masonite. The experimentations, testing and analysis provided the students with a virtual library of the potential building materials and their inter-connections for future reference as well. “Here, we intended to apply a rigorous research investigation that translated circumstances into an event fixed in space” [4].

FUTURE OF ARCHITECTURAL RESEARCH

Architecture has much more to offer to the world. While intellectuals are trying to manifest it in many new areas and forms, entrepreneurs have been trying to spread its importance. It is more varied and diverse than a systematic field of study. It embraces innovation and technological reforms on a daily basis, while maintaining its pure essence. So definitely, architectural research shall reveal more unfounded magical excellence in the future. Domains of architectural research are likely to increase in the coming days with the onset of novel architectural forms and integrating global architectural expertise.

Furthermore, the outside world engaged in execution of construction projects will look up to the educational institutions for the solutions to some of the most testing hurdles that they are faced with in their everyday lives.

CONVERSION OF THE THEORITICAL WISDOM INTO PRACTICAL REALITY

The ultimate aim of any research or academic effort is to enhance the understanding and better equip the people for the professional sphere. It is therefore highly essential to conduct research activities with a focused sense of mind. The output should be tried and tested in real-time conditions to enable error-free results that can be implemented on site with ease and precision.

An architecture school comprises of skilled mentors and young talents, it can thus be an appropriate ground for conducting research activities. They can serve as a medium for constant learning and experimentation.

HOSPITAL DESIGN: A REAL-WORLD DESIGN PROBLEM

The project was undertaken with the aim to introduce a real-time construction problem in the pedagogy for the students of architecture. The project of a 150-bed general design of a hospital building was conducted with the efforts of 40 students and 4 project executives during the Spring Semester Studio-7 of the academic year 2007-2008 at the Selcuk University, Turkey-Konya. The design of a hospital building calls for a extensive range of information extraction and collaborative efforts [6].

The central area of the Konya city covering an area size of 10041 square meters is the proposed site. Residential and commercial units surround the site with the main vehicular axis for mass transport and circulation lying on the north-eastern axis of the site [7,8]. All the dimensions of the site such as the pedestrian and vehicular movement for accessing the building, site’s orientation, dominant wind direction, zoning status, functional requirements as well as the inter-connections established between the exterior spaces were analyzed in terms of movement and circulation. The exterior spaces included the emergency entrance, main entrance to the hospital, service entrance and morgue exit [6].

The project got completed in 14 weeks time. Information pertaining to the project was gathered through site visits, interviews and visual tools such as site examination and presentations. The elements designed on the site included operation room, intensive care unit patient care units, polyclinics, emergency ward, managerial section and service areas such as those used for laundry, kitchen and medical gas storage as well as technical service areas. The students were encouraged to conduct research and discussion to form concrete special programming outcome [9-10]. A host of decisions were taken to carry out effective area analysis [6].

The achievements of the studio experience based on actual design project lies in the fact that post-design process, the students had elevated awareness about: a) the various legal and professional problems posed in real life, b) conducting comprehensive analysis in response to users and functions, c) developing thought-processes about the spatial and functional design methodologies, d) generating solutions to space requirements through information extraction, e) realization the use and potential of related disciplines about the design, f) achieving complete command over the systematic process and experience of designing [6,11,12].
For the evaluation, care was taken to select the most beneficial design alternative from amongst the rest [6].

“In the studio process, information exchange supported communication, which led the students to trust the instructor and created self-motivation in students with the feeling “I can do it” [6]. The fear of the new and unknown in the students was successfully overcome with the right help and guidance (Figures 7 and 8).

Figure 7. The entire structure of the methodology followed in the execution of the project and the generation of design [6].

CONCLUSION

As it has been quoted in the Upanishads, “Education is for Liberation”, more of such initiatives need to be undertaken that can generate a sense of self-belief in the students. “It is a fundamental requirement for undergraduate students to be trained on how to use more complex research and investigative skills”. The problem-solving skills and decision making abilities can be best taught with the help of puzzles and problem-based exercises such as that of paper-bridge design taken up by Professor Hatem in his design studio class. Besides, artistic attributes of building architecture which is an indispensable aspect can also be developed in a new light only when adequate time and investigation of the factors is carried out. Whatever is the focus of building construction, the examination, evaluation, questioning and re-framing of notions will always help develop newer dimensions to the already existing knowledge domain.

With the changing times, there is an ever-increasing demand on the education system to not only keep itself abreast with the professional front but also to proceed a step forward in developing new and advanced techniques and materials for the growth and betterment of the profession.

A typical example of students’ active participation in actual construction activities is that of the construction of the geodesic dome and demonstration house by the students studying at the Yale University under the guidance of R. Buckminster Fuller and those of the Architectural Centre, New Zealand respectively.

The creative talents of the budding professionals honed by deeply researching the key areas of building construction and as the mature professional arena when brought into a symbiotic relationship acquire immense potential for the betterment of the society.
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REFERENCES