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EVOLUTION OF DESIGN STUDIO: PAST, PRESENT AND FUTURE

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ABSTRACT

Architectural education has a long history, starting with the transmission of knowledge through masters and apprentices. The *Académie Royale d'Architecture* was established in Paris in the late 17th century but closed in 1793 due to a revolt against the monarchy. The school was re-established in 1816 under the name "*École des Beaux Arts*" after the monarchy was restored. Industrial design emerged after the Industrial Revolution and peaked with the Bauhaus school in Weimar, Germany in 1919. Modern design education has evolved from the design studio or atelier of the Beaux-Arts and the Bauhaus philosophy in Germany. Post-1968, "theoretical practice" became institutionalised. Technological developments and environmental concerns have driven major changes in higher education since 1995, moving from traditional physical campuses to virtual classrooms. Design education is most influenced by the Internet, which disrupted global design education during the COVID-19 pandemic. The integration of technology and a more collaborative, globalised approach to education will continue to reshape architectural training, equipping future architects to address the complex challenges of the 21st century.

Keywords: Architectural Education, Design Education, Design Studio, Studio, Technology

1. INTRODUCTION

Since the beginning of human history, the knowledge of art, architecture and construction has been transmitted from one generation to another through a succession of masters and disciples to replicate itself Harry and Kumar (2022). Various texts on art and architecture have existed since ancient times but the earliest text to survive from antiquity on the subject of architectural theory is *De architectura* (On Architecture) treatise written by Marcus Vitruvius Pollio, a Roman architect, engineer and author, during the first century BC (circa 27 BC) Britannica (2022), Millon et al. (2022).

During the Medieval period (5th to 15th century AD), the architect's role was mostly that of an artisan-cum-designer or master mason, i.e., carpenters and builders famously known as *Magister Cementarius* or *Magister Lathomorum* in Latin language Cooley (2008). Basically, till the Medieval period, the knowledge of art, architecture and construction was passed on to the next generation through treatises, word of mouth and apprenticeship under master artisans and builders.

During the Renaissance period, the role of an architect was not restricted to carpenters and builders but was more of an individual in society recognised by their works as there was no differentiation between the vocations of art, architecture, engineering or any of the related professions. For example, Alberti, Brunelleschi, Giorgio, Michelangelo, Palladio and Leonardo da Vinci among many others.

During the Industrial period, the introduction of new materials and technology led to a separation of architecture and engineering fields. But art still remained with architecture. So, while artists and architects concentrated on aesthetics and human aspects, engineers looked at the technical aspects of building design. In 1671, with the establishment of *Académie Royale d'architecure* at Paris, France, formal architectural training was started but was shut down in 1793. Next came, *École Polytechnique* in 1794 at Paris, France for the formal training of engineers. With the closure of *Académie Royale d'architecure* in 1793, formal training of architects was revived with the opening of *École des Beaux-Arts* in 1816 at Paris, France. From there, it spread to different parts of Europe, then the United States and finally, to the rest of the world by 20th century Chakraborty (2015).

During the Modern period, i.e., from late 19th century to early 20th century, with the Industrial Revolution creating opportunity for mass manufacturing and utilisation, new building materials like iron and glass, new building types like office buildings and new methods of construction like concrete were introduced Millon et al. (2022). This resulted in architecture becoming alienated from art and giving rise to the profession of industrial design.

Academic viewpoints and the beliefs of architects were also shaped by this change in the domains of art, architecture, engineering, and building. New architectural ideas and several dominant schools of thought that served as forerunners to Modern architecture appeared in the early 20th century. Especially noteworthy are the Prairie School in the United States and the Deutscher Werkbund in Germany. Founded in 1907 to improve the quality of machine-manufactured items, the Deutscher Werkbund was instrumental in the development of the Bauhaus design school, which was started in Weimar, Germany in 1919. The Bauhaus school overcame the limits that have traditionally bound the architectural field. Aiming to combine art, craft, and technology, their design approach sought to blend mass production with personal artistic vision, therefore producing a synthesis of aesthetics and utility. Leaving a lasting impact on modern design and architectural education, the Bauhaus movement greatly shaped future developments in art, architecture, and interior design. During this time, the Design Studio became a crucial component of architectural and design education Bender and Vredevoogd (2006), Crowther (2013), Krupinska (2014), Chakraborty (2015).

Like elsewhere in the world, throughout the history of architectural education in India until 19th century, the knowledge of art and architecture has been passed on through the Gurukul system wherein one master trains a group of pupils who later become masters and train the next generation of pupils. In ancient India, texts on art, architecture and construction have existed since the first millennium AD Panda (2011). *Manasara* is one of the few manuscripts in India on building design that has lasted till date Klostermaier (1998). It is an ancient text written in Sanskrit

sometime during the first millennium AD Panda (2011). It consists of 70 chapters (*adhyayas*) and 10,000 verses (*shlokas*) providing complete guide on how to construct temples, houses and structures like water tanks, etc. It also provides detailed guidelines on the laying out of towns, gardens and sculptures. The initial 8 chapters are introductory, the next 42 deal with architectural matters, and the last 20 are devoted to sculpture Acharya (1946). In *Manasara*, architects are divided into four categories in their hierarchical order – the chief architect (*Sthapati*), the designer or draftsman (*Sutragrahin*), the painter (*Vardhaki*), and the carpenter or joiner (*Sutradhara*) – together they form the guild of architects. Similarly, there are four classes of architecture – earth or the land (*dhara*), the edifice and buildings (*harmya*), vehicle(s) (*yana*), and bedstead or couches (*paryanka*) and six categories of the edifice – the palace (*prasada*), the pavilion (*mandapa*), the council-chamber (*sabha*), the hall (*sala*), the water-shed (*prapa*), and the theatre (*aranga*) Acharya (1934), Acharya (1946).

Till the 19th century, architectural education in India existed as it used to be in other parts of the world whereby master craftsmen trained their proteges and thus passed on the knowledge from one generation to another Mehta (2006). To officially train draughtsmen, the British government created the contemporary framework for technical and architectural education in India in the 1850s. They established art and technical schools taught draughtsmen to assist British engineers in the building of structures for civil and military administration. These schools provided only basic education so as to produce junior engineers, surveyors and store keepers. At the time of Independence in 1947, the number of architectural institutions were just 2, by 1991 there were 45, by 1996 there were 96 Menon (1998), and by 2021, the numbers increased to more than 400 approved colleges in India. To govern the training of architects in the schools of architecture across India and practice of the profession of architecture throughout India, the Parliament of India passed the Architects Act of 1972 on September 1, 1972; the Government of India created the Council of Architecture under the Ministry of Education following the Act's terms. Council of Architecture (2021).

2. THE PAST: APPRENTICESHIP AND EARLY EDUCATION

2.1. ACADEMIE ROYALE D'ARCHITECTURE

The Royal Academies of Europe initiated formal education in architecture, initially in France (*Academie Royale d'Architecture*, 1671-1793) and subsequently in other locations. The academy's main goal was to train young architects to produce a suitably grand, French style of architecture and propagate a unified aesthetic philosophy. It aimed to transform the training of architects in a prestigious fine arts school moving away from the old 'guild' system of Medieval period Armstrong (2017), Chakraborty (2015).

The main characteristics of the academic system at *Academie Royale d'Architecture* were:

- Lectures formed the basic educational function of the Academy Chakraborty (2015).
- Public lectures, which could be attended by any "man of taste" (*homme de goût*), were given by a professor two days a week Chakraborty (2015), Armstrong (2017).
- Students were taught abstract design principles in the subject of architecture, and other subjects included history and theory, mathematics,

stereotomy (descriptive geometry), and hydrodynamics (fluid dynamics) Chakraborty (2015), Armstrong (2017).

- Basic knowledge of math and architectural drawing was a prerequisite in addition to being a literate. The Academy did not provide instruction in drafting, instead, the student was supposed to learn drafting at the office of one of the academicians as an apprentice Armstrong (2017).
- Training in an academy gave more social status than training under a master craftsman, which reflected not a trade but a creative art, intellectual and genteel Chakraborty (2015).
- An annual grand prix competition, *Grand Prix de Rome*, was conducted by the French Royal Academies and the winners were sent to the French Academy in Rome as pensionaries of the French monarch to study Italian art and ancient architecture Armstrong (2017).

2.2. ÉCOLE ROYALE DES BEAUX-ARTS

The French royal academies were completely destroyed during the French Revolution (1789 – 1799). But after the French monarchy was restored in 1814, the prestigious fine arts schools were merged into the *"École Royale des Beaux-Arts"* in 1819 on the royal order of French monarch Louis XVIII Chafee (1977), O'Connell (2020).

Operating six days a week, *École Royale des Beaux-Arts* offered full-time education with mornings dedicated to discussions with the professors and afternoons set aside for lectures on theory subjects like geometry, mathematics, fluid mechanics, perspective drawings, and, water supply and drainage. Design studio formed a distinctive part of the architectural education at *École*. Also, coexisting with the institution's curriculum was part-time learning of specific subjects, augmented by work, reflecting the classic atelier system of apprenticeships Green and Bonollo (2003).

The subjects taught at *École des Beaux-Arts* included architectural drawing, architectural history, architectural theory, Greco-Roman art and architecture, mathematics, perspective drawing and structural engineering. Around the year 1900, the programme was extended with building law, chemistry, and stereotomy. There were examinations for the subjects that required scientific knowledge Krupinska (2014). The educational framework of Beaux-Arts programme emphasised drawing as the principal method of visualising architectural form Drexler (1984).

The *Beaux-Arts* School's curriculum was divided into two sections: formal and practical. The design studio was lateral rather than central. Students learnt how to work with a variety of building materials like clay, glass, metal, stone, and wood, in a hands-on learning experience that was similar to craft training. In addition to introducing theories of colour, design, and space, the academic training focused on issues of architectural form through perception, illustration and formation. Particular skills, like learning the properties of materials through creative forms and comprehending geometry, colour, space, and structure through sketching, painting, and modelling, were made easier by this dual structure Pasin (2017).

The teaching-learning methodology that was followed in *Beaux-Arts* was introducing the 'design problem' at the beginning of the term and the students are then asked to develop their design sketches and ideas under the guidance of the design instructor or "Patron" Sultan (2018) through regular discussions and

critiques, either one-to-one or in groups. The term closes with the design project being judged by a jury of professors and guest architects Lackney (1999).

Exceptional teachers and experiential learning mostly shaped the *Beaux Arts* educational system. The rivalry was strong and led to aesthetically pleasing designs in traditional styles that could often be justified only by ideas of 'good taste' and intuition. Predominantly neoclassical, the preferred architectural form was monuments. Usually without the students present, a panel of professors and guest architects assessed projects. The jurors used the same standards as the students in their design – "good taste" Lackney (1999).

By mid-1800s, the pedagogical methods of *École des Beaux Arts* which was marked by a strong emphasis on drawing and classical legacy, became so influential that the institution was made into a university in 1863. While architectural design subject was imparted in a separate classroom provided with drafting tables called the 'studio' by professors, theory subjects were instructed in lecture rooms by lecturers. Beginning with studies of proportion and classical orders, students moved on to plan drawings Krupinska (2014).

2.3. BAUHAUS SCHOOL

Post the period of industrial revolution (1760 – 1840), the early part of 20th century saw the swift ascent of bulk production which caused art and architecture to separate from engineering and building, and the industrial design profession to be founded Green and Bonollo (2003), Krupinska (2014).

The Bauhaus School was an educational institution established in 1919 at Weimar, Germany by consolidating the schools of art and craft under the leadership of Walter Gropius. The initial years of the Bauhaus School emphasised on the integration of art and craftsmanship. The school acted as a laboratory of training the students to become a new sort of collaborator for industry and the crafts with equal mastery of both technology and form Green and Bonollo (2003).

According to Walter Gropius, the studio should reflect professional practice where projects are executed and theory subjects like manufacturing, material sciences, and mechanics support the studio project rather than teaching them in isolation Green and Bonollo (2003).

In 1925, the Bauhaus School relocated to its new campus at Dessau, Germany. Designed by Walter Gropius himself, the new building housed studios within the student accommodation, a gym, and a pool. As a result, design education turned into a whole universe of life, labour, and pleasure. Bauhaus education was founded on the same ideas of "learning by doing". In the foundational period of the Bauhaus School in Germany, from 1919 to 1933, there existed concepts of an ideal society in which art served societal benefit rather than individual satisfaction. During the Nazi regime, the school's directors, Walter Gropius and Ludwig Mies van der Rohe, emigrated to the United States, effectively concluding the institution's operations. By that time, the Bauhaus movement had profoundly influenced architectural institutions worldwide, especially in the USA Krupinska (2014).

Three stages made up the Bauhaus School's curriculum: the Basic Course, which presented ideas of various geometric forms and their composition; the General Course, which addressed spatial planning, aesthetics, and building construction; and the Architectural Course, which focused on RCC and steel structures. As the student advanced to a higher grade level, the necessary knowledge and abilities changed. Analytic drawing, bodily performance, observation, and painting in the Basic Course taught the fundamental ideas of colour, composition, and form; advanced theoretical

knowledge about aesthetics, economy, function, material, and space was communicated through the design studio as well as various technical and theoretical courses in the Architectural Course Pasin (2017).

Architectural education at Bauhaus School was centred on design studio where theory and practice of architecture were fused into an interdisciplinary setting. Unlike the two-tiered approach of École des Beaux-Arts, practical learning about materials in workshop would go hand-in-hand with the theoretical concepts of composition, colour, nature and construction, particularly during the final three years of instruction Pasin (2017).

The teaching-learning methodology of the Bauhaus School was to link art and craft with the technical subjects with the result that graduates of this programme will have the technical knowledge as well as the theoretical and creative knowledge of the design studio Broadfoot and Bennett (2003). As an educational method and paradigm, the Bauhaus aimed to merge students from secondary and elementary art education with the Basic course's introduction, created by Bauhaus master Johannes Itten Cross (1983).

Leaving a lasting impact on modern architectural and design education, the Bauhaus movement greatly shaped future developments in art, architecture, and interior design. The current design studio has evolved from the Beaux-Arts workshop and the Bauhaus approach in Germany. Though brief, the institution had a great impact on design education during its fourteen years of operation from 1919 to 1933 Sultan (2018).

2.4. ARCHITECTURAL EDUCATION IN INDIA AND ELSEWHERE

Though the *Academie Royale d'Architecture* was founded at Paris in 1671, professional architectural education had not evolved until the nineteenth century. The prestigious *École des Beaux-Arts* was founded in 1816; the first English-language school, London School of Architecture, at London in 1847; and the first North American university programme, at Massachusetts Institute of Technology (MIT), in 1868. Architectural education then abandoned the traditional practice of pupillage and welcomed universities as the sole provider of architectural knowledge Green and Bonollo (2003).

In India, the first institution to be established for formal training in architecture was Kalabhavan at Baroda, Gujarat in 1890. Then, in 1896, a two-year diploma in draughtsmanship was started at Sir J.J. School of Art in Bombay. The primary aim of the British to establish these institutions was to train the local people to assist their engineers and architects in drafting their technical drawings. So, the British funding for formal education in architecture laid the groundwork for the western methodical approach of architecture that which is still in practice today Chakraborty (2015).

3. THE PRESENT: INTEGRATION OF TECHNOLOGY AND THEORY

The contemporary approach to architectural training, wherein architects are educated at institutions that simultaneously engage in systematic research and scholarship across diverse intellectual domains, is a synthesis of educational frameworks from multiple nations: France's structured, formal architectural education; Germany's connection between teaching and research, which is supported by universities; and Britain's apprenticeship model Chakraborty (2015).

Similar to the atelier system that was first implemented at the French Royal Academy of Architecture, architectural education is currently run by working educators throughout the world. Since classroom instruction is closely related to real-world experience, the learning environment is not detached from the real-world environment of the architect's studio or practice. Simultaneously, academic instruction alone cannot fulfil the education of the architect. It is imperative that the conditions of theoretical preparation and practice be different. As a result, in order to promote a transition from theory to practice, most architecture schools today include a course on gaining hands-on experience Chakraborty (2015).

Many traditions have developed that are still in place in modern design education, such as the use of *esquisse* (early sketch solutions to problems which would be developed further into detailed design drawings), teaching by working professionals, and having a jury evaluate student work at the end Broadfoot and Bennett (2003).

The most significant element in the evolution of the design studio as an academic discipline is probably a recent rise in the capacity of the schools to carry out research. Although the amount of academic research done is far less than in other fields, there has been a significant rise coupled with a broadening of interest among graduate students and professors and the development of a group of young professionals educated in research methods. Reflecting a more positive environment for research funding and indicating their desire to help advance knowledge in the field, several universities in the United States have set up doctoral programmes since 1965 Chakraborty (2015).

Post-1968, the concept of "theoretical practice" emerged, prompting numerous young graduates of architecture to take up architectural journalism as their career instead of architectural practice. Meanwhile, from 1995 onwards, significant transformations have occurred, driven in part by apprehensions over climate change and in part by the novel opportunities presented by multimedia, parametric and performative design, as well as the growing engagement of the architectural profession with ecological and socioeconomic challenges Krupinska (2014).

Donald Schon, who studied the educational methods of various professions at MIT from 1980 to 1986, was fascinated by the architectural studio's seemingly unusual features. He argued that other professions' educational institutions should learn from it. Schon's support for revitalised studio functions suggests that academically rigorous courses could be taught without requiring a matching studio application methodology. Schon disputed the notion that professional practice depends on the rigorous application of theoretical knowledge and rejected the traditional approach in professional education, which emphasises the application of fundamental science and theory Green and Bonollo (2003).

Modern architectural design education continues to follow ideas, rules, and practices based on the conventional Beaux-Arts and Bauhaus frameworks despite the emergence of alternative studio teaching paradigms including the case problem model, the analogical model, and the interactional model in the 1960s, along with Critical Inquiry and Process-Oriented Design Pedagogy in the 1990s. Design studio education in many architecture schools worldwide, regardless of adherence to conventional or critical models, is characterised by two opposing extremes: one that is disconnected from the realities of the built environment and another that is aligned with the needs of the construction industry. Both ends affect the knowledge and abilities architecture students are supposed to gain Pasin (2017).

4. THE FUTURE: INTEGRATION OF TECHNOLOGY AND NEW PEDAGOGY

4.1. TECHNOLOGY

Advances in technology have a big impact on design thinking in professional practice, architecture, and design education. New approaches in digital fabrication, computational design thinking, and emerging paradigms of representation call for a reassessment of educational pedagogy for the next generation of designers in the digital age Tepavčević (2017).

The practice and teaching of architecture are being transformed by digital technologies Gross and Do (1999). The practice, technique, and technology of architectural design have not changed as rapidly and profoundly since the Renaissance, when perspective drawing first appeared. This is in contrast to the rapid and profound changes brought about by the development of reasonably priced computers and computer-aided design software Gross and Do (1999).

In design, designers use the right techniques to generate design concepts, use media as a means of communication to express these ideas, and then turn them into physical artefacts (products) so that clients and designers can see the design as it evolves. While the objects are external representations of the design, the various creation techniques are internal representations. According to Chan (2011), there are five types of design communication mediums that are frequently used:

- *Renaissance period (14th century)* – PDT (Paper-based Design Thinking -- Perspective drawings & Orthographic projections)
- *19th early 20th century* – LBM (Learning-by-Making -- scaled models)
- *Late 20th century* – CAD (Computer-Aided Design)
- *21st century* – DAD (Digital-Architectural Design)
- *Current period* – ER (Extended Realities -- advanced media for visualisation, simulation and recreation like Virtual Reality, Augmented Reality & Mixed Reality)… Tepavčević (2017) and Chan (2011)

Driven by developments in hardware and supported by the software industry, the evolution of digital media shows no signs of deceleration. From basic bitmap devices to complex multimedia workstations, computers have changed and teachers have found new uses for computing in the architecture course. Most schools have focused on teaching computer applications and encouraging the use of computer-aided modelling and draughting tools in conventional design studios Gross and Do (1999).

In the age of digital communication, technological innovations are upending traditional paradigms in architectural design and education. More complexity in architecture and new demands for architectural practice are brought about by computational design thinking in conjunction with digital tools for building performance analysis, geometric optimisation of freeform structures, creative digital manufacturing and fabrication techniques, and the development of new materials. Such demands call for a thorough reassessment of the curriculum for aspiring architects, with a focus on developing "collaborators" as opposed to "solitary genius" architects who can work cooperatively with a variety of experts in multidisciplinary design teams. New theoretical, computational, and cognitive approaches have made it necessary to create new instructional models and rebuild existing ones in architectural education Tepavčević (2017).

Technology is transitioning higher education from conventional physical campuses to virtual classrooms. Of all the tools available, the Internet has the greatest power to shape design education Bender and Vredevoogd (2006). By allowing architects and designers to research new products available in the market, download product specifications, access code information, transmit drawings online, and communicate synchronously with colleagues around the world, the Internet has revolutionised the design process Matthews and Weigand (2001). Numerous studies on digitally integrated classrooms and studios show how technology is impacting the process and culture of design education Matthews and Weigand (2001). It makes sense that integrating digital media into the conventional design studio would enhance the learning process and produce a more effective curriculum that enhances student learning outcomes Bender and Vredevoogd (2006).

Technology has completely changed how teachers impart knowledge to their students. As technology has advanced, higher education support services have also changed, but the studio has remained remarkably unchanged. Future architectural and design education cannot progress without the pedagogical integration of digital media. Distance is no longer a major barrier to education due to the increasing demand for global communication Matthews and Weigand (2001).

4.2. NEW PEDAGOGY: VIRTUAL DESIGN STUDIO

Since 1993, when the Internet became publicly available, architectural schools all over the world have been using different versions of Virtual Design Studio (VDS), which was first introduced in the early 1990s concurrently with the growth of the Internet Pektas (2012), Pektas (2015), Schnabel et al. (2001).

William Mitchell of the Massachusetts Institute of Technology (MIT) first used and defined the term "Virtual Design Studio" in his February 1993 presentation at the Media Lab. On February 8, 1993, 54 architecture students and tutors from five different colleges spread across four different time zones and thousands of kilometres apart began the first Virtual Design Studio (VDS). The VDS initiative was a two-week collaborative design experiment called "The Virtual Village Project" that involved the Massachusetts Institute of Technology's Department of Architecture, Harvard University's Graduate School of Design, the Department of Architecture at the University of Hong Kong, the University of British Columbia, and Washington University in St. Louis Wojtowicz (1994). Traditional studio instruction has been strained by the growing number of students enrolled in design programmes Pektas (2015), Schnabel and Ham (2013).

Today's design practice takes place in a global setting, which forces designers to deal with cross-cultural issues more frequently. Cultural sensitivity and teamwork abilities are now essential parts of design firms' employability requirements. The self-organization of people into unofficial peer networks to produce designs is a prevalent trend in professional design practice. Using Web 2.0 and cloud computing techniques, people who have never met in person are attempting to solve complex problems that have been "crowdsourced" to a community of interested parties Pektas (2015).

Major aspect of the virtual design studio is online discussion method – interaction and sharing of thoughts worldwide. Students are able to conduct joint study with the students of different countries and regions. Through the use of internet and web technologies, the Virtual Design Studio concept makes it possible for geographically separated design partners to collaborate. This allows teachers

and students in various locations to work together on a project by sharing ideas, critiques, and designs Gross and Do (1999).

5. CONCLUSION

The evolution of formal architectural training has mirrored the broader changes in society, technology, and professional practice. From the hands-on mentorship of ancient and medieval times to the institutionalised academic education of the modern era, architectural training has adapted over time to address the demands of the profession and the society it serves. In the present, technological advancements such as CAD, BIM, and sustainability principles have transformed both the practice and pedagogy of architecture. Looking forward, the integration of technology and a more collaborative, globalised approach to education will continue to reshape architectural training, ensuring that future architects are equipped to address the complex challenges of the 21st century.

CONFLICT OF INTERESTS

None.

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