RESTRUCTURING ARCHITECTURAL EDUCATION POST COVID-19: PROFESSIONAL PRACTICE AND CONSTRUCTION INDUSTRY EXPECTATIONS

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Abstract

Introduction: It is clear that there is a gap between academic knowledge and professional practice in the field of architecture. Based on feedback from the industry, recent graduates lack the required skills, technical knowledge, and professional competencies. To keep pace with the rapidly changing technological scenario, the entire curriculum and syllabus of undergraduate (UG) level architectural education in India need restructuring and revision with reference to the contents to be taught and technical skills to be gained. In the past few years, student enrollment in UG-level architecture programs in India has declined, whereas demand projected experiences an upward movement. **Purpose of the study:** We aimed to restructure architectural education post COVID-19 pandemic with reference to professional practice and market expectations. For that purpose, we needed to review various aspects of higher education, the current scenario, and graduate attributes and reformulate those in terms of architectural education. It has become imperative to strengthen architectural education, especially post COVID-19 crisis. Prospective future professionals should be trained to meet the construction industry expectations while continuing their independent lifelong learning to ensure their global acceptability. **Methods:** The study methodology involves a market survey to analyze the current situation and determine construction industry expectations for recent graduates of architecture programs. The survey covered representatives of academia and construction industry professionals. **Results and Discussion:** The findings show that there is potential for restructuring the architectural education curriculum to both suit the educational purpose and meet the industry expectations. Its restructuring with a fresh approach will help architecture students learn more thoroughly how to become professionals ready to work in the Indian market as well as accept the global challenges presented by changing technology. The outcome of this study is presented in the form of a simple model curriculum, which can be adopted by institutions imparting architectural education.

Keywords

Architectural education, curriculum design, post COVID-19 education, architects, market-ready professionals, construction industry expectations, B. Arch. model curriculum.

Introduction

The challenges experienced by higher education institutions (HEIs) imparting architectural education before COVID-19 have not gone away. Moreover, due to the pandemic, other issues (like admissions and retention of faculty members) have arisen. However, by utilizing digital tools and methods, academicians have proven that the sector can adapt to changing circumstances at a fast pace. Greater openness toward online learning and collaboration has not only helped institutions mitigate the challenges but also made it possible to do well and set new higher education directions in this digital era with higher confidence.

It is clear that there is a gap between academic knowledge and professional practice in the field of architecture. The entire curriculum and syllabus of architectural education in India need restructuring and revision with reference to the contents to be taught, especially post COVID-19 crisis. Long before the COVID-19 pandemic, many institutions imparting architectural education in India were already struggling with economic, competitive, and regulatory challenges. Enrollment was dropping, and the threat to the existence of institutions became very real. These days, institutions can analyze their strengths, weaknesses, opportunities, and challenges in order to respond to the unprecedented situation.

Architectural education in India traditionally focuses on training students to become market-ready professionals equipped with necessary technical knowledge and skills. However, feedback from the industry on graduates' fundamental knowledge

and skills is far from satisfactory. Academicians recognize the need to revise and strengthen the architecture curriculum by incorporating courses in new emerging areas while bringing them in line with changing market demands. This study involves the revision of the curriculum of a five-year full-time B. Arch. program. The purpose of the study is twofold: a) to explore the gap between academic knowledge and professional practice in the field of architecture, and b) to propose a model curriculum for an architecture program. In the course of the study, we conducted a survey approaching a number of professionals, academicians, and students related to the construction industry. The survey was our primary source of data. The findings show that there is clear potential for meaningful changes in architectural education, aimed at training students to become market-ready professionals able to accept global challenges.

Architectural design has been in a period of rapid change for the last few decades, but architectural education and, more specifically, faculty members have not been able to keep up with those transformations. Some institutions and individuals focus on design as a "process", and some focus on design as a "product". As a result, design students remain in a state of dilemma and continue to learn methods and techniques that have now become obsolete. Design students of the future must learn design during their formative years, studying both the abstract and practical. This approach challenges the traditional faculty system, in which educators who have repeated the same tired exercises for years may find themselves teaching something that it is without an audience, and as a result, they may well find themselves without a role to play. But a revamped approach would create competent designers for industry, government, and the non-profit sector, where design thinking and detailed, knowledgeable designs are fundamental to addressing the complex and dynamic qualities of our world (Ozkaynak and Ust, 2012).

The Council of Architecture in India issues enrollment numbers regarding students admitted by architectural institutions to ensure that only eligible students are admitted as per the

Table 1. Sanctioned intake approved by the Council of Architecture for the past five years

Academic year	Enrolled students	Number of colleges applied for enrollment
2015	19,241	395
2016	18,702	396
2017	14,677	382
2018	16,576	390
2019	8182	225

sanctioned intake approved by the Council. Data on enrollment numbers for 2015–2019 are presented in Table 1 (Council of Architecture, 2021).

Some of the major causes behind the decline in the number of enrollments are as follows:

(i.) The duration of programs (five years) is one year more than that of other UG-level engineering programs.

(ii.) Levels of scholarship for interns/trainees and salary for recent graduates are much lower than levels of initial salary packages for engineering graduates.

(iii.) Recession/correction in the real estate market.

There is a widely divergent figure for the ratio of architects to inhabitants in various countries, and broadly, it appears to be based on the position of the country on the growth curve of development. An approximate estimate in 2014 at the Venice Architecture Biennale showed the number of architects in 36 countries. There is one architect per 414 inhabitants in Italy, one for every 1300 in the USA, and one for every 1880 in the United Kingdom. The lowest ratio is for China, which shows there is one architect per 40,000 inhabitants (Council of Architecture, 2020b).

Keeping this information in mind, the Council of Architecture felt that a pragmatic figure of 1:9000 could be the approximate target in India for the next few years, possibly up to one decade, i.e., up to the year 2030. With this target, India is expected to have about 150,000 architects for a population of 1,320,000,000. As of 2018, there were 84,775 architects registered with the Council of Architecture.

In order to bridge the rapidly increasing gap between the number of required architects and the number of those admitted to B. Arch. programs in the country, we need to review the architectural education scenario and restructure it to mitigate the challenges.

Need for Restructuring Architectural Education Post COVID-19

The global pandemic has caused many challenges for the education sector, yet it has also provided higher education institutions with an opportunity to show that they can adapt rapidly. In many ways, however, the past year has distracted from fundamental challenges the education sector faced before the crisis, including the shift toward the platform economy and more collaborative, rather than transactional, ways of working. Universities must catch up with the skills needed to thrive in a networked economy. Rather than providing a "stamp on the forehead" for young undergraduates, universities need to focus much more on lifelong learning and reskilling (PA Consulting, 2021). In view of the availability of ample learning opportunities online and the many ways to access and share knowledge using digital platforms, institutions should ponder how they can strengthen their existence, avoiding the label of a channel partner to award

degrees.

This is the right time for deep reflection on the architectural curriculum, particularly as we struggle against the denial of scientific knowledge and actively fight misinformation. The UNESCO calls on all educational stakeholders to prioritize scientific literacy to ensure a curriculum with strong humanistic objectives that explores the relationship between fact and knowledge and is capable of leading students to understand and situate themselves in a complex world (UNESCO, 2020). Curricula should be increasingly integrated and based on themes and problems that allow us to learn to live in peace with our common humanity and our common planet.

The change from objective-based pedagogy to competency-based approaches appears to be no more than a change in the language rather than a change in the way the education system is structured or designed, as many countries are still organizing their education systems based on technological objective-based pedagogy (Martín-Alonso et al., 2021). Zhao and Watterston (2021) identified three big changes that education should make post COVID: a curriculum that is developmental, personalized, and evolving; pedagogy that is student-centered, inquiry-based, authentic, and purposeful; and delivery of instruction that capitalizes on the strengths of both synchronous and asynchronous learning.

India's education during the COVID-19 pandemic has been standing still and will continue to be in a state of confusion until this pandemic stands as a major threat to human lives. During this state of confusion and chaos, it's not only the classroom teaching that will be affected, but also numerous factors like organizational routines, employment rates/placement rates at various educational institutions, and other factors. At present, the two Golden A's of education, namely availability and accessibility, are being disrupted. Nearly all the Indian educational institutions are going to experience the negative impact of COVID-19 and a few revolutionary policies will be required to stabilize this system and the country at large (Dhanalakshmi et al., 2021).

It is incumbent upon all educators to use this crisis-driven opportunity to push for significant shifts in almost every aspect of education: what, how, where, who, and when. In other words, education, from curriculum to pedagogy, from teacher to learner, from learning to assessment, and from location to time, can and should be radically transformed (Zhao and Watterston, 2021).

Liberalization, privatization, and globalization of education have deteriorated remarkably due to limited mobility and limitedly confined exchange programs of academic activities among the countries during the COVID-19 lockdown. Third-world countries are facing policy paralysis in handling the sudden shifting scenario of educational planning,

management, and organization during this pandemic with their fractured technical infrastructure, academic incompetency, and lack of resources. Everyone must learn to live and survive in the present crisis as it is only the beginning. In the long run, no one can afford the negligence toward digital transformation in HEIs. Few steps should be taken in the wake of this pandemic to develop a curriculum that reflects the perceptible change in the content knowledge and learning experience of students as well as enables them to think critically (Mishra et al., 2020).

Institutions must place greater focus on their purpose. The economic viability of institutions remains challenged due to a decline in enrollments. The universities must also embrace openness by sharing resources and collaborating with competitors, building "ecosystems rather than sets of transactions". This could mean working with online education platforms or fostering collaborations with international providers. "There will be a need for more work-related content and continuing education, and universities need to find that symbiosis if they are to diversify and make a living" (PA Consulting, 2021).

Ultimately, this will require a reassessment of business models and how universities generate value. Arizona State University, for example, has launched a research and innovation facility with Starbucks to design more sustainable ways to run its stores and hone employees' decision-making skills. The university's president, Michael Crow, describes this approach as creating "knowledge enterprises, not cost centers". It's a trend that will see institutions reflect market demands, offering short courses, bespoke corporate learning, and stackable awards. Through partnerships and an openness to collaboration, universities can create "borderless higher education", ensuring they thrive for decades to come (PA Consulting, 2021). A few progressive universities in the UK are already investigating alternative norms, market strategies, and working practices. They are re-framing and expanding their relationships with learners, businesses, local communities, and each other — often using technologies common to other sectors.

Knowledge alone is not a key factor for success for an engineering student. A skill set is another factor required for sustaining in today's industrial work environment. Industries keep complaining to educational institutions about the low skill levels or lack of skill sets observed in engineering graduates across the country (Kulkarni et al., 2020). In this paper, we emphasize the need for restructuring architectural education while adapting to industry-oriented curriculum design.

Researchers, curriculum designers, education officers, and educational institutions work together to transform the education system during the closures. Educational institutions should design curriculums, prepare learning strategies and techniques for

post-COVID-19, and transform the education system itself (Tadesse and Muluye, 2020). With the rapid development of computer applications in the architectural profession, the need to find a framework to integrate computer applications into the architectural curriculum has increased. Hence, it became mandatory to examine the computer integration impact on architectural schools and, at the same time, explore the architecture profession's needs in order to help find an efficient framework for architectural education (Soliman et al., 2019).

There is a scarcity of research discussing the integration of fundamental, interpersonal, cognitive, problem-solving, and continuous improvement skills in architectural education. Therefore, Khodeir and Nessim (2020) were mainly concerned with analyzing the typical curriculum in the present scenario of architectural education, which is considered one of the root causes of the gap between architectural education and the changes in the job market. Various missing skills, which can be referred to as "employability skills", include, but are not limited to: problem-solving, creativity, communication, ethics, and accountability.

Approach and Policies of Restructuring the Architectural Education Curriculum

An architect is expected to possess abilities that include creativity, conceptualization, visualization, interdisciplinary knowledge, management skills, team spirit, and much more in order to make a worthwhile contribution to the profession. Such knowledge and skills are to be developed during five years of education and training. Academicians and professionals in architecture deliberate and decide the contents of courses and modules/topics to be taught in a particular course. At times, several topics and contents are eliminated from the syllabus and new contents are introduced in order to bridge the gaps. This is often done on the basis of best judgment by academicians and experts following their individual perceptions and prejudices. However, there is no scale or tool to judge the usefulness and impact of a particular topic/subject in measurable terms before taking such decisions. It is required to develop such a tool to evaluate and quantify usefulness and impact in order to facilitate the decision-making process while modifying the curriculum.

The word "curriculum" began as a Latin word, which means "a race" or "the course of a race" (which in turn derives from the verb *currere,* meaning "to run/to proceed").

Several researchers suggested various models for evaluating a curriculum. Prof. Pillai (2016) discussed types of curriculum, approaches to curriculum evaluation, and various models suggested by other scholars.

Olarinoye (Adirika, 2017) illustrated a narrow viewpoint of the curriculum by defining it as "a

blueprint consisting of subject themes, topics, performance or behavioral activities, content or subject matter, and students' activities". According to Taba, the chief functions of curriculum objectives are:

- Guiding the process of decision-making on what to cover, what to emphasize, what content to select, and which learning experiences to stress.
- Setting the scope and the limits of what is to be taught and learned.
- Helping with the selection of areas of knowledge in various discipline objectives.
- Serving as a guide for the evaluation of achievements.

Since the subject of restructuring architectural education is broad and comprehensive in nature, the scope of this study is confined to developing a tool to measure the impact of a particular topic or subject in quantifiable terms (for UG-level architectural education).

There is a challenge in incorporating new content into the existing curriculum, either as a module in available courses or as a new course. Most of the time, the existing curriculum is already at the upper limit in terms of the number of courses and credits. Since total contact periods per week remain constant in institutions, it is not advisable to increase those to avoid an undue burden on students and faculty members. Additionally, there are new technologies and applications that are desirable to be included in an existing curriculum but present bigger challenges for academicians when they try to include them in the existing curriculum (Rodriguez, 2020).

Learning is categorized into knowledge, skills, and attitudes as per Bloom's Taxonomy. These learning outcomes are attained by designing various courses for students. All courses are designed with measurable course outcomes. Courses can have sub-outcomes for detailed tasks designed for the students. All course outcomes can be mapped to knowledge (Cognitive domain), skills (Psychomotor domain), and attitudes (Affective domain). The courses and their outcomes are designed to attain program outcomes. Engineering education is made up of various formats of courses like lectures, seminars, workshops, tutorials, laboratory studies, elective courses, self-learning courses, projects, discussions, personality development courses, soft skills courses, social science courses, extra-curricular activities, and sports activities. The outcomes of these courses focus on the knowledge, skills, and attitudes required for employability (Johnson and Ramadas, 2020).

All courses in architectural education should be designed with a specific measurable outcome(s) in view of industry expectations for recent graduates of architecture programs. Courses should be judiciously designed so that all the program outcomes are addressed. To address all the program outcomes,

courses of various categories like lectures, tutorials, elective courses, laboratory studies, seminars, workshops, self-learning courses, projects, discussions, personality development courses, soft skills courses, social science courses, extra-curricular and co-curricular activities, and physical education are introduced.

Given the 21st-century requirements, quality higher education must aim to develop good, thoughtful, well-rounded, and creative individuals. It must enable an individual to study one or more specialized areas of interest at a deep level, and also develop character, ethical and constitutional values, intellectual curiosity, scientific temper, creativity, spirit of service, and 21st-century capabilities across a range of disciplines, including sciences, social sciences, arts, humanities, languages, as well as professional, technical, and vocational subjects. A quality higher education must enable personal accomplishment and enlightenment, constructive public engagement, and a productive contribution to society. It must prepare students for more meaningful and satisfying lives and work roles and enable economic independence (Ministry of Human Resource Development. Government of India, 2020).

In the National Education Policy (Ministry of Human Resource Development. Government of India, 2020), some of the major problems currently faced by the higher education system in India include:

a.) a severely fragmented higher educational ecosystem;

b.) less emphasis on the development of cognitive skills and learning outcomes;

c.) a rigid separation of disciplines, with early specialization and streaming of students into narrow areas of study;

d.) limited access particularly in socio-economically disadvantaged areas, with few HEIs that teach in local languages;

e.) limited teacher and institutional autonomy;

f.) inadequate mechanisms for merit-based career management and progression of faculty and institutional leaders;

g.) lesser emphasis on research at most universities and colleges, and lack of competitive peer-reviewed research funding across disciplines;

h.) suboptimal governance and leadership of HEIs;

i.) an ineffective regulatory system; and

j.) large affiliating universities resulting in low standards of undergraduate education.

This policy envisions a complete overhaul and re-energizing of the higher education system to overcome these challenges and thereby deliver high-quality higher education, with equity and inclusion. The policy's vision includes the following key changes to the current system:

a.) moving toward a higher educational system consisting of large, multidisciplinary universities and colleges, with at least one in or near every district, and with more HEIs across India that offer medium of instruction or programs in local/Indian languages;

b.) moving toward a more multidisciplinary undergraduate education;

c.) moving toward faculty and institutional autonomy;

d.) revamping curriculum, pedagogy, assessment, and student support for enhanced student experiences;

e.) reaffirming the integrity of faculty and institutional leadership positions through merit appointments and career progression based on teaching, research, and service;

f.) establishment of a National Research Foundation to fund outstanding peer-reviewed research and to actively seed research in universities and colleges;

g.) governance of HEIs by highly qualified independent boards having academic and administrative autonomy;

h.) "light but tight" regulation by a single regulator for higher education;

i.) increased access, equity, and inclusion through a range of measures, including greater opportunities for outstanding public education; scholarships by private/philanthropic universities for disadvantaged and underprivileged students; online education, and Open Distance Learning (ODL); and all infrastructure and learning materials accessible and available to learners with disabilities.

This vision of higher education will require, in particular, a new conceptual perception/understanding for what constitutes a higher education institution (HEI), i.e., a university or a college. A university will mean a multidisciplinary institution of higher learning that offers undergraduate and graduate programs, with high-quality teaching, research, and community engagement. The definition of the university will thus allow a spectrum of institutions that range from those that place equal emphasis on teaching and research, i.e., Research-intensive Universities, to those that place greater emphasis on teaching but still conduct significant research, i.e., Teaching-intensive Universities. Meanwhile, an Autonomous degree-granting College (AC) will refer to a large multidisciplinary institution of higher learning that grants undergraduate degrees and is primarily focused on undergraduate teaching, though it would not be restricted to that and it need not be restricted to that, and it would generally be smaller than a typical university.

Institutions will have the option to run Open Distance Learning (ODL) and online programs,

provided they are accredited to do so, in order to enhance their offerings, improve access, increase GER (Gross Enrollment Ratio), and provide opportunities for lifelong learning. All ODL programs and their components leading to any diploma or degree will be of standards and quality equivalent to the highest quality programs run by the HEIs on their campuses. Top institutions accredited for ODL will be encouraged and supported to develop high-quality online courses. Such quality online courses will be suitably integrated into the curricula of HEIs, and a blended mode will be preferred.

Various models of curriculum development were proposed by various curriculum theorists and authors:

a.) Ralph Tyler's model (1949)
b.) Wheeler's cyclic model (1971)
c.) Nicholls and Nicholls (1972)
d.) Giles
e.) Walker's model (1972)
f.) Hilda Taba's model (1962)

The intent of all these models is to serve educational purposes through the formulation of a curriculum. While these models have the same intent, they still pursue or approach education from different premises (Adirika, 2017). Tyler's model is objective, Taba's is interactive, Wheeler's is cyclical, and Walker's is naturalistic or descriptive. The models reveal both similarities and differences. All the curriculum models have components of process, planning, implementation, and evaluation. They all have "beginning" and "ending" points.

After analyzing the mentioned models, Adirika (2017) concluded the following: the curriculum development process is a continuous one. It is not a one-time affair, because the curriculum serves a dynamic society. It cannot effectively help society meet its needs if it does not move with society. This is why it is continuously reviewed to ensure that it contains those elements that can help achieve the educational goals of society.

The COVID-19 situation is unprecedented, and, hence, there is no bias with regard to any of the mentioned models, and an independent, fresh approach was adopted. For the purpose of the study, we relied on data collected through a market survey. The survey was conducted in July 2021 on a sample of professionals, faculty members, researchers, and students in order to investigate the architectural education scenario and industry expectations for recent graduates of architecture programs. The study was carried out to bridge the gap between architectural education and professional practice.

Hence, we suggest revisiting and revising architectural education and curriculum by optimizing the course contents and weighing academic contact hours, while removing contents that are not of prime importance, and incorporating courses in view of a futuristic vision.

The professional practice of architecture requires considerable training in the use of CAAD techniques. There is a need to explore ways of improving the use of CAAD among undergraduate students. It is useful to evaluate and re-evaluate the education process to ensure that it goes in a parallel way with the practice field and to be informed of up-to-date computer applications (Soliman et al., 2019).

Methodology

We prepared a survey questionnaire aimed at identifying industry expectations for recent graduates. The sample size was 300 intended participants, whereas the rate of response was 115%. We selected participants based on purposeful sampling. The target group included practicing architects, academicians, researchers, and students with varying years of experience in India. Among the respondents, 49.2% were professionals, 31.7% were faculty members, and the rest were researchers, students, and employers. The respondents were given the option to record their suggestions, in addition to marking check boxes and choosing multiple-choice options. The outcome of this study is presented after analyzing various aspects like the type of courses and their importance (in quantified terms) as well as contact hours assigned for various courses, during the typical duration of a five-year full-time B. Arch. program in line with the Minimum Standards of Architectural Education 2020 recommended by the Council of Architecture (Council of Architecture, 2020a).

Survey Analysis

A wider look at the curricula of more than 30 Indian institutions indicates that an average of 75 courses are offered in UG-level programs, which is higher than in leading international institutions, where 45 to 60 courses are offered in the equivalent programs. Some academicians and professionals believe that these programs should be more exhaustive and include more courses. However, students feel exhausted with the number of courses. We think that an increase in their number reduces learning outcomes due to overburden.

Question 1: Which type of work is assigned to recent graduates (B. Arch.) during internship / professional training? (Please select/check minimum three, maximum five boxes).

Aspect: Task	Responses (%)
Concept development / architectural design	43.6
Preparation of architectural drawings (2D)	89.7
Preparation of architectural drawings (3D)	75.6
Estimation (BoQ) and costing	20.3

Building construction and site supervision	35.8
Interaction with clients	17.2
Preparation of reports and PPT presentations	65.3
Some other suggestions received	
Assistance to senior architects	0.6
Model making	0.6
Documentation of old projects	0.3
Research	0.3
Data/sample collection	0.3
Printing and documentation	0.6

Question 2: Which of the following skills a recent graduate (B. Arch.) must possess? (Please select/check minimum five, maximum seven boxes, which you think are most important).

Aspect: Skills	Responses (%)
Creativity and concept development	86.1
Visualization and 3D modeling	76.9
Preparation of error-free architectural drawings (presentation drawings and detailed drawings) using CAD/BIM tools	78.9
Estimation (BoQ) and costing	42.5
General management and administration	17.5
Project execution, building construction and supervision	36.4
Fundamental knowledge of building sciences (acoustics, climatology, and lighting)	68.9
Fundamental knowledge of building services (water supply, sanitation, HVAC, electrical, fire fighting)	73.9
Structural design of buildings	23.1
History of architecture	22.2
Environmental impact assessment and planning	33.6
Humanities and social sciences	17.8
Some other suggestions received	
Ability to unlearn the irrelevant	0.3
Knowledge of building bylaws and approval procedure	0.6
Business development and funding	0.6
Communication/writing skills	0.6
Professional behavior and ethics	0.3
Presentation drawings	0.6

Question 3: B. Arch. curricula should be overhauled since Institutions are teaching too much and some of the syllabus units/contents are not utilized by recent graduates (B. Arch.) in their work. Do you agree?

Aspect: Rating scale	Responses (%)
Strongly agree	23.1
Agree	26.4
Cannot comment on this	14.4
The B. Arch. curriculum in the majority of institutions is OK	24.4
Disagree	10.8
Some other suggestions received	
The B. Arch. curriculum will always need to be overhauled. It should have only fundamental units and the rest needs to be revised annually since the rate of urbanization is increasing with changes in technology. I think this is the right time to create a new curriculum system since the principles of urbanization and technological development of the 1960s are not followed anymore.	0.3
As an institution, we mostly focus on design subjects and electives, and other skill development subjects are mostly neglected by both students and institutions. This leads to half-baked knowledge because design skills alone are not enough in the field.	0.3
Some institutions teach all the content but they do not emphasize important topics. They should teach accordingly with account for the future and the professional field.	0.3
Architecture is a very strong mixture of arts, science, engineering, and social studies. A young architect must have an understanding of all these.	0.3
To be relevant to the modern world, the curriculum needs to be reviewed rather than overhauled.	0.3
The curriculum should be relevant to market demands and the latest construction trends.	0.3
What is really necessary is not curriculum revision but recruitment of good teachers (not necessarily good researchers/academicians). Whatever the curriculum, teachers can teach only what they know.	0.3
An upgrade is needed in line with the current scenario and demands of the professional industry.	0.3

Results and Discussion

The architectural profession can be seen as a developing and multidisciplinary career. It is one of the major professions that affect the development of a country. Architectural education is somehow special. Unlike other disciplines, architectural courses are usually hands-on in which students are confronted with projects and assignments, which simulate real projects. In addition, architecture is one of the most influential professions in our society as it involves all aspects that affect the way in which our built environment is designed, constructed, and used, thus affecting the user experience. It has however often been assumed that the universities do not produce graduates with the appropriate employability skills. Architectural firms are dissatisfied with the quality of the graduates and still note that they have to re-train fresh graduates to make them fit for their jobs before starting their practice. In addition, employers usually seek other skills apart from the technical skills gained during undergraduate studies (Khodeir and Nessim, 2020).

Higher education needs to prepare engineers of the future with the skills and know-how, which they will need to manage rapid change, uncertainty, and complexity. The key here is the ability to tailor engineering solutions to the local social, economic, political, cultural, and environmental context and to understand the impact of local action on the wider world. Although there is a global dimension within all subject areas, engineering and technology have unique importance in addressing global challenges, delivering environmental sustainability, international poverty reduction, and economic growth. India also has the potential to be a global technology leader. The Indian industry is competing globally in software and even in areas such as automobiles, chemicals, and engineering equipment (Parashar and Parashar, 2012).

As a result, giving the knowledge to the student on time, referring the student to research and gaining the habit of doing research, providing integration between theoretical and practical courses, and using theoretical knowledge in the practical application of design will promote a certain amount of creativity (Khodeir and Nessim, 2020).

The main benefit of elective courses in higher education is the flexibility achieved because these courses allow students to study subjects that satisfy their interests, abilities, and career determination. Elective courses help students develop their talent and nurture their individuality (Ghonim and Eweda, 2018). Elective courses also help them choose among wider available options in view of their interests and aspirations. Besides, students can study at their own pace by using MOOC (Massive Open Online Courses) platforms. This model will save time and cost of education for institutions since the majority of courses offered by online platforms

have a nominal examination and certification fee, which is much lower in comparison to the classroom teaching costs. Pursuing elective courses with the use of online MOOC platforms will also develop the habit of self-study and strengthen lifelong learning abilities. It is likely that more students will be moving toward competency-based learning, which has an emphasis on developing unique skills and abilities. Learning has to be based on strengths and passions and become personalized.

Based on the market survey and policy/guidelines provided by Indian statutory bodies, the following recommendations can be made:

a.) Recent graduates (B. Arch.) should get jobs on the basis of their skills in preparing error-free architectural drawings (2D and 3D), and this is the fundamental expectation for recent graduates.

b.) Developing competencies in preparing error-free architectural drawings (2D and 3D) is more important than developing proficiency in architectural design and concept development. However, both are major core courses in the curriculum.

c.) Students must achieve proficiency in visualization and 3D modeling using computer applications.

d.) Knowledge of local and national building bylaws (as per the National Building Code of India) is a must.

e.) Knowledge of building materials and construction techniques is necessary.

f.) Building structures (analysis and design) courses can be revised since, in the current curriculum, significant contact hours are assigned to these courses, but students' learning outcomes are not satisfactory. The content of the syllabus and pedagogy of these courses require transformation.

g.) History of architecture courses are worthwhile but not so significant in the curriculum. The content and pedagogy of these courses require revision.

h.) Understanding building services is more important than understanding building sciences.

i.) Courses in environmental studies, together with environmental impact assessment and planning, must be given due weightage in the curriculum.

j.) More flexibility should be given to students to choose elective courses in view of their interests and aspirations.

k.) Online learning must be encouraged. Elective courses must be pursued with the use of MOOC platforms in order to develop the habit of self-study and lifelong learning. Some theory-based courses may also be pursued using online resources.

l.) The total number of courses offered in a semester may be restricted to six, with total credit limits in the range of 26 to 30, where the basic requirement for degree awarding is earning 270 credits. The definition of credit may vary among institutions since the weightage of contact hours vs. credits varies for lectures, workshops, and practical sessions.

m.) Flexibility should be considered for the inclusion of theme-based courses or courses in line with the specialization of the institution or in view of regional demands.

n.) Practical training of six calendar months (120 work days) must be considered to achieve the purpose.

o.) A thesis/project must be carried out independently by each student in the tenth semester with critical evaluation using checklists.

We consider 15 weeks of teaching in a semester of 18 weeks, where 3 weeks are reserved for examinations. As per the recommendations of Indian statutory bodies (Council of Architecture, 2020a), 30 contact hours per week are considered. Hence, the total contact hours are equal to 450 contact hours in a semester and 4500 contact hours during the entire duration of a five-year full-time B. Arch. program. The major challenge for academicians is to utilize those 4500 academic contact hours in a meaningful manner in view of the importance of various courses for prospective professionals.

Based on our understanding of architectural education, feedback from the industry market survey, suggestions from the respondents, and guidelines under the new education policy approved by the Government of India, we suggest a broad distribution of academic contact hours for various courses for a model curriculum of UG-level architectural education.

No.	Course Category	Suggested Courses/Modules/Units	Suggested Contact Hours	Suggested Credits
1	Architectural design	Can be distributed across min 6 to max 8 semesters Design aspects Theory of design Monofunctional units Multifunctional units Module-based units Campus planning High-rise buildings Mixed-use development Computational design	750	50
2	Architectural drawings	Can be distributed across the initial 6 semesters Freehand sketching Scaled drawings Orthographic projections Isometric drawings 3D visualization and sciography 2D architectural drawings 3D architectural drawings Rendering and presentation drawings Building Information Modeling Detailed (GFC) drawings	450	30
3	Basic design and visual arts	First semester	60	4
4	Building materials and construction technology	Can be distributed across the initial 6 semesters	450	30
5	Building sciences	Acoustics Climatology Lighting Can be taught in 2 or 3 semesters separately	150	10
6	Building services	Fire and life safety Water supply and sanitation HVAC services Electrical services Elevators and escalators Can be taught in 3 or 4 semesters separately	300	20

No.	Course Category	Suggested Courses/Modules/Units	Suggested Contact Hours	Suggested Credits
7	Building structures	Analysis and design courses can be planned in the initial 6 semesters	240	16
8	Environmental impact assessment and planning	Environment and ecology EIA and EMP Can be planned in 2 semesters separately	120	8
9	History of architecture	Can be planned in the initial 2 semesters	120	8
10	Principles of management and financial planning	Can be planned in the seventh semester	60	4
11	Professional practice	Can be planned in the seventh or eighth semester	60	4
12	Practical training / internship	Can be planned in the seventh or eighth semester	450	15
13	Estimation (BoQ) and costing	Cane be planned in the fifth or sixth semester	60	4
14	Thesis/Project	Can be planned in the tenth semester	450	15
15	Workshop practice	Can be planned in the first or second semester	60	4
16	Business communication	Can be planned in the seventh or eighth semester	60	4
17	Humanities, etc. as per the institution's specializations and/or mandated by statutory bodies	Human value and ethics Participation in social responsibility programs Health and fitness related activities Can be planned across the duration of the program	360	24
	ELECTIVE COURSES			
18	These shall be professional and/or any interdisciplinary courses, which should be mandatorily pursued with the use of MOOC platforms like SWAYAM/NPTEL/ATAL in order to develop the habit of self-study and lifelong learning. Students may choose courses based on their interests and aspirations.		300	20
		TOTAL	**4500**	**270**

It has been widely acknowledged that to thrive in a future globalized world, traditionally valued skills and knowledge will become less important and a new set of capabilities will become more dominant and essential. For humans to thrive in the age of smart machines, it is essential that they do not compete with machines. Instead, they need to be more human. Education must be seen as a pathway to attaining lifelong learning, satisfaction, happiness, wellbeing, opportunity and contribution to humanity. A new curriculum that responds to these needs must be simple, minimal, and easy to implement. It must help prospective professionals develop new competencies for the new era. The curriculum needs to focus more on developing students' capabilities instead of focusing only on the one-way transfer of content and knowledge.

Conclusions

The development of a student is like the growth of a plant. In this process, the curriculum and syllabus serve as the "seed". If the seed is defective, we cannot expect a healthy plant. It is imperative that curricula be formulated and refined from time to time. Besides, they shall be simple and easy to understand and implement. A well-designed curriculum facilitates faculty members to achieve educational goals without missing any content. Ambiguous curriculum and syllabus may lead to confusion among all process participants: students, faculty members, and examiners. Well-designed curriculum and syllabus are the key to maintaining similar information and understanding at all points. Though the curriculum is an ever-evolving entity, an attempt was made to suggest a simple model curriculum for UG-level architectural education, which can be adopted by institutions in the current scenario with further refinement in line with their vision and mission.

The COVID-19 crisis has forced us to review our educational model, which has been necessary for a long time. Education will undoubtedly go through major changes in this decade as the combined result of multiple major forces, including COVID-19

and the technological advancements of online learning. These changes include curricular changes that determine what is imperative to be learned by students and what is minimum to be offered by institutions to meet educational goals. We need to make sure that students have an educational experience that is relevant to the present time and globally accepted. With that in mind, we proposed a model curriculum for UG-level of architectural education in line with the expectations of the industry.

The new or updated education model will indeed determine how and what the future generation of architecture students will be taught. In our efforts to bring about a change, let us try and fight for a new and better world.

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