




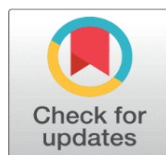
EVALUATING THE EFFECTIVENESS OF UNIVERSAL DESIGN PRINCIPLES IN ARCHITECTURE DESIGN STUDIO

Mohammad Noman Mansoori ¹ , Gulnaz ² , Mohammad Amir Khan ³ 

¹ Assistant Professor, Faculty of Architecture, Planning & Design, Integral University, Lucknow, U.P, India

² Assistant Professor, School of Architecture and Design, K.R. Mangalam University, Gurgaon, India

³ Assistant Professor, Faculty of Architecture & Ekistics, Jamia Millia Islamia, New Delhi, India



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Corresponding Author

Gulnaz, Khangulnaz532@gmail.com

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ABSTRACT

Universal design, also known as inclusive design, accessible design, and barrier-free design, is a worldwide concept aimed at making everyone feel comfortable in their surroundings. Making advantage of this notion would aid in the removal of current social and environmental barriers that some individuals face, such as disabled people, women, children, the elderly, and the sick. The study highlights accessible layout, visible information or guidance, suitable size and space to accommodate all users within a safe and hazard-free setting as major characteristics of an inclusive built environment. This research talks about to implement Universal design principles (UDPs) in architecture education. This research aims to develop the design studio framework for B.Arch. 3rd year to include the universal design principles. A comparative analysis study has been carried out with the undergraduate students of a third-year design studio in Jamia Millia Islamia between the pre and post-design exercise about universal design principles to analyze the difference if universal design principles are implemented in the course curriculum.

Keywords: Universal Design (UD), Universal Design Principles (UDPs), Universal Design Education, Barrier Free Design

1. INTRODUCTION

The production of products, environments, programs, and services that are usable by as many people as feasible without the need for adaption or specialized design is referred to as universal design. [Basnak et al. \(2015\)](#)

Universal or Inclusive Design is a design philosophy that aspires to create an inclusive, sustainable society in which everyone may contribute their full potential.

The universal/inclusive design goods assist handlers with various facilities, limitations, and requirements. The new challenge for designers is to make useful and enjoyable things regardless of whether the operator is distinct from others. Its goal is to make the atmosphere manageable and equivalent to universal/inclusive design. [Ergenoglu \(2015\)](#)

Universal design is not a “one-size-fits-all” approach to design; rather it is a user-centered approach that considers the functionality of the widest possible variety of users. The idea of “Design for Everyone” is linked to barrier-free design, which is another name for universal design.

While not exclusively for the architecture profession, the concept of universal or inclusive design is closely related to architecture. We will be closer to our goal of providing safe, accessible, and general settings for all when universal design elements are incorporated into the design process.

A compelling case for universal design can be made in terms of morality, the law, society, economy, sustainability, and the environment. It's also evident that architect Will's designs are now given priority in the program. Since architects influence the features and designs of the built environment, they must make sure that any design intervention is planned inclusively to satisfy the needs of the diverse population. [Helvacioğlu & Karamanoglu \(2012\)](#)

The following objectives are taken for the aim: To identify the universal design principles relevant to architectural design. To develop the curriculum based on universal design for 3rd year architecture design syllabus. To develop the design exercise framework integrating universal design principles for B.Arch. 3rd year architectural design studio. To evaluate the exercise on the markers of universal or inclusive design. The following research questions to be answered: What type of exercises are to be undertaken in a 3rd-year design studio? How to develop the design exercise by integrating universal design principles in a 3rd-year design studio? What are the methods applied to evaluate the design exercise?

Universal design maintains a holistic approach to create architectural objects. Holism holds that every element of architectural space matters and ought to be designed to accommodate the requirements of every user. The comprehensive design approach is supported by multifarious analysis and collaboration. The construction and installation of the object should be in keeping with the spatial and cultural context in which it is designed climatically. [Izani et al. \(2019\)](#)

1.1. MATERIAL AND METHODS

In this study, the research methodologies include a literature review and the comparative study of the student's work according to universal design pre and post-lecture. To contextualize the background investigation into the universal design principles in the design studio, some research publications were examined. Analysis of the B.Arch. syllabus of Jamia Millia Islamia shows a lack of implementation of universal design. Therefore, a studio design exercise relevant to universal design in the 3rd-year design studio has been introduced of which students' responses (pre and post-design work) analyzed and evaluated by the design teachers and researchers. [Khare & Mullick \(2012\)](#).

2. LITERATURE STUDY

In this study, the Centre for Universal Design's design guidelines for UD principles are used as heuristics. (The Center for Universal Design, 1997). Following keywords/phrases defined for the research understanding:

Equitable Use: Everyone, regardless of disability, should be able to use a building.

Flexibility in Use: Designers and architects must consider a variety of needs and physical constraints, such as left-handedness and color blindness.

Simple and Intuitive Use: Regardless of experience or expertise, universal design features should be straightforward to use.

Clear Information: Everyone, regardless of language or reading ability, should be able to understand signage and other forms of communication.

Tolerance for Error: Universal designs should reduce risks while staying safe for those who interact with them in ways that differ from what the architects intended.

Low Physical Effort: The navigation of universal design elements should take as minimal physical effort as possible.

Size and Space for Approach and Use: Regardless of mobility, body size, or posture, a structure should be sized and arranged to be comfortable for everyone. Consider elements like a line of sight and grip size disparities.

According to descriptions of universal design education in architecture, it consists of the three crucial components listed below:

User-Designer interaction: Whatever technique or instrument is used by designers to better match the end user's needs with the final product.

Understanding people: Information about statistics, demographics, the range of human abilities and the effects of deficiencies in any of these abilities, understanding of how people interact with their environment, etc.

Evidence-based findings: Any historical information on positive or negative experiences with the environment or products, like post-occupancy evaluation reports, can be incorporated back into the design process to help shape ideas for the future.

A wide number of topics are covered by Universal Design, which also offers the opportunity to put theory into practice. Determining the extent of universal design education is therefore essential. Teaching universal design requires not only lectures on theoretical issues but also other instructional strategies like audits, case studies, and discussions. Following aspects which determine the model's scope are: Developing empathy, Legal and social consciousness, Physical environment awareness, Universal design knowledge, Inclusive and universal design in architectural contexts, best practices, Typological research, Creating novel strategies and design solutions, Future directions for universal design.

The purpose of this specially designed course on UD is: To impart knowledge of the UD concepts and principles, to investigate how the UD method could help the entire society in an inclusive way, to debate a wide spectrum of human skills and come up with answers for a variety of real-world problems, to foster an understanding of the human race's diversity, to improve environments for optimum accessibility for all by developing the ability to recognize UD. [Khare et al. \(2012\)](#)

The UD Framework concludes with the process. The list below outlines a procedure for bringing universal design into higher education (UDHE). It is compatible with all UD applications.

Determine the field's best practices and applications: Specify the environment or product that UDHE should be used on. Determine best practices (e.g., evidence-based teaching practices, technology standards, architectural design specifications) in the application's field.

Think about the variety of traits that could make up potential users: Describe the potential users of the application: their gender, age, ethnicity, race, native language, learning preferences, size, and abilities to see, hear, walk, operate objects, read, and speak. You should also mention any potential difficulties they might have connecting with the environment or the product.

Adapt UDHE to industry best practices: To maximize the benefits of the application for individuals with a variety of characteristics, integrate UDHE methods—which are supported by pertinent UD, UDL, and WCAG principles—with best practices in the application domain.

Make a plan for accommodations: Create protocols for accommodating individuals with disabilities that prevent them from accessing the design (For instance, through sign language interpreters or assistive technology). Signage, syllabi, journals, and websites can all be used to publicize these processes.

Evaluate: After the product or environment has been implemented, gather feedback from people who use it and have different characteristics (e.g., through online surveys, and focus groups). Make adjustments in light of the results. Return to step 3 if the review's findings indicate that your design needs to be improved.

3. ANALYSIS OF JMI SYLLABUS

Table 1 elaborates on the objectives, content and design exercises/activities of architecture ug curriculum of Jamia Millia Islamia and also tries to analyze the syllabus content on the aspects of universal design aspects.

Table 1

| Table 1 Analysis of B.Arch. Syllabus (Jamia Millia Islamia, New Delhi) on Universal design Aspects | | | | | | |
|--|--|--|---|---|--|---|
| | 1 st Year | Analysis | 2 nd Year | Analysis | 3 rd Year | Analysis |
| Objectives | <ul style="list-style-type: none"> Encouraging students to develop an innate creative instinct by making them more aware of their surroundings. Introduction to the architectural field with an emphasis on developing a student's mindset regarding the field, its requirements, and its scope. | <ul style="list-style-type: none"> No concerns related to universal design. | <ul style="list-style-type: none"> Pay close attention to the patterns of horizontal circulation in built environments. Introduction to regional materials, utilization of vernacular architecture, understanding the socioeconomic status. | Focus: circulation, vernacular architecture, and local materials. Universal design concerns missing | <ul style="list-style-type: none"> Investigating and creating structural spanning systems for various needs. To become more aware of building bylaws. To comprehend various structural building systems. | <ul style="list-style-type: none"> The concerns which are highlighted in the 3rd year-innovative structural system and materials etc. The concerns which are missing here are Universal or Inclusive design |

| | | | | | | |
|-----------------|---|--|--|--|--|--|
| Content | <ul style="list-style-type: none"> • Overview of the architectural profession and associations such as COA, IIA, etc. • Introduction to design • Study of Anthro | <ul style="list-style-type: none"> • The content of this design program highlights the anthro concerns but is unable to find any concerns which highlight the factors related to Universal or Inclusive design. | <ul style="list-style-type: none"> • Design projects related to different climatic conditions. • One complex design problem. • Two short-time problems. | <ul style="list-style-type: none"> • The content of this design program highlighting the climatic concerns but is unable to find any concerns which highlight the factors related to Universal or Inclusive design. | <ul style="list-style-type: none"> • Four structural design projects • One complex design problem | <ul style="list-style-type: none"> • The content of this design program highlighting the structural concerns but is unable to find any concerns which highlight the factors related to Universal or Inclusive design. |
| ACTIVITY | <p>Quick exercises on the arrangement and design of rooms, personal spaces, etc.</p> <p>A measured drawing that shows the features of an old or existing building.</p> <p>Quick design exercises like the milk booth, tea stall, park shelter, bus stop, fuel station, etc.</p> | <p>In the activity of this design program unable to find any concerns which highlighted the factors related to Universal or Inclusive design.</p> | <p>The research of the built form and its relationship to the location, surrounds, and climate would be the focus of the projects.</p> <p>Studying basic, repetitive spaces like shops, hostels, and schools would be part of the project.</p> | <p>In the activity of this design program unable to find any concerns which highlighted the factors related to Universal or Inclusive design.</p> | <p>The main goal of each project would be to investigate the integration of form with structural spanning systems for large covered areas, whether they are temporary or permanent. Sports fields, exhibition halls, etc. could be used as design exercises.</p> | <p>In the activity of this design program highlighted the structural spanning system but was unable to find any concerns which highlighted the factors related to Universal or Inclusive design.</p> |

| | 4 th year | Analysis | 5 th year | Analysis |
|-------------------|--|--|---|---|
| Objectives | <ul style="list-style-type: none"> • integration of all design and operational components of a building, such as cutting-edge structural systems and materials, service details, environmental impact assessments, etc. | <ul style="list-style-type: none"> • The concerns which are highlighted in 4th year-services, innovative structural systems and materials, etc. • The concerns which are missing here are Universal or Inclusive design | <ul style="list-style-type: none"> • The development of the student's architectural knowledge and design philosophy must be reflected in their thesis projects. All aspects of the design process must be addressed and resolved through the project's design. | <ul style="list-style-type: none"> • The concerns which are highlighted in the 5th year-all aspects of the design process. • The Universal or Inclusive design concerns are not mentioned specifically here but in general included. |
| Content | <ul style="list-style-type: none"> • Group housing • Urban design | <ul style="list-style-type: none"> • The content of this design program highlights the structural and services concerns but unable to find any concerns that highlight the factors related to Universal or Inclusive design. | <ul style="list-style-type: none"> • Case studies, in-depth site analyses, first conceptual stage of shape and form experimentation, Detailed service details in the final proposal will be included. | <p>The content of this design program highlights the site study, concept, shape, forms, and services but is unable to find any concerns that specifically highlight the factors related to Universal or Inclusive design.</p> |

| | | | | |
|------------------------|--|---|--|---|
| <p>Activity</p> | <ul style="list-style-type: none"> The issue would be presented prior to the conclusion of the first term, and during the break between terms, a case study and site visit would be conducted. A medium-sized urban design intervention would be the goal of the project. | <p>The activity of this design program highlights the service's details but is unable to find any concerns that highlight the factors related to Universal or Inclusive design.</p> | <ul style="list-style-type: none"> The selected projects could range in size from single, tiny structures to expansive complexes and urban design initiatives. The project ought to demonstrate the student's unique inventiveness in the architectural design process. | <p>The activity of this design program highlighted the urban design but was unable to find any concerns specifically highlighting the factors related to Universal or Inclusive design.</p> |
|------------------------|--|---|--|---|

The overall finding of this comparative analysis syllabus shows that it lacks on the aspects of universal or inclusive design in the syllabus of B.Arch. in Jamia Millia Islamia. [Larkin et al. \(2016\)](#)

4. FINDINGS AND DISCUSSION: STUDENTS' RESPONSES

Figure 1

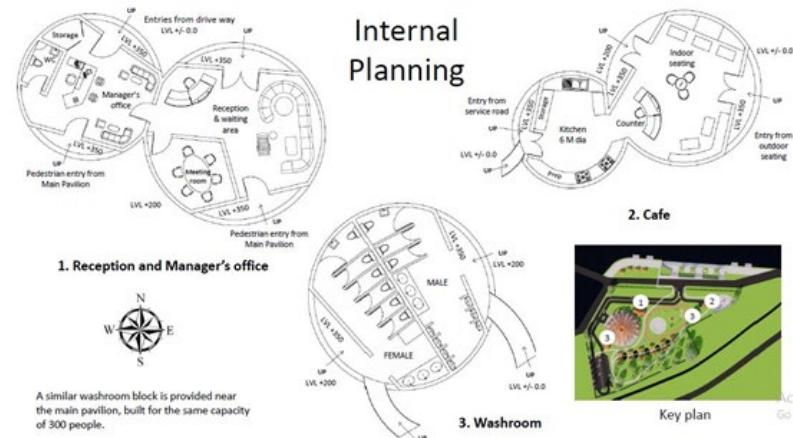


Figure 1 B.Arch. 3rd Year Students Work According to Universal Design Pre-Lecture

Figure 2

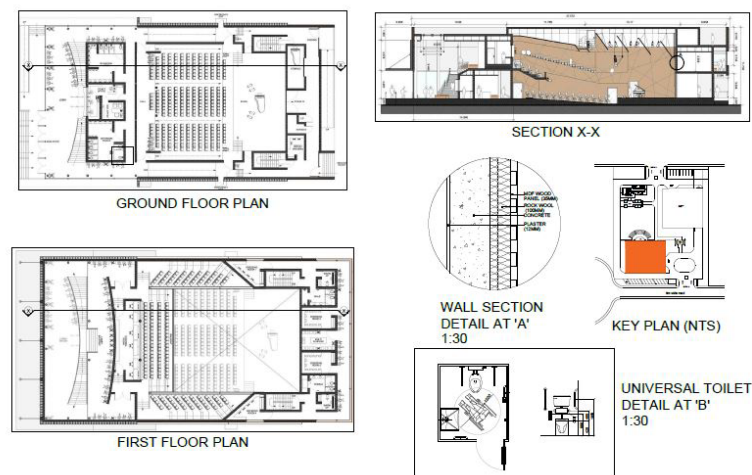


Figure 2 B.Arch. 3rd Year Students Work Acc. to Universal Design Post Lecture

Table 2

Table 2 Average Assessment of B. Arch. 3rd Year Students Work acc. to Universal Design Post Lecture

| S.N. | Students | PARAMETERS OF UNIVERSAL OR INCLUSIVE DESIGN | | | | | | | | | | | | | | Over all | |
|---------|-----------|---|------|--------------------|------|--------------------------|------|-------------------|------|---------------------|------|---------------------|------|-------------------------------------|------|----------|-------|
| | | Equitable Use | | Flexibility in Use | | Simple and Intuitive Use | | Clear Information | | Tolerance for Error | | Low Physical Effort | | Size and Space for Approach and Use | | Pre | Post |
| LECTURE | | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| 1 | FAIZAN | 1 | 2.5 | 1.5 | 2.5 | 2.5 | 2.5 | 1 | 2.5 | 2.5 | 2.5 | 1.5 | 2.5 | 1.5 | 2.5 | 11.5 | 17.5 |
| 2 | INSARAM | 1.5 | 3.5 | 1.5 | 3.5 | 1.5 | 3 | 1.5 | 3.5 | 2 | 3 | 1 | 2.5 | 1 | 2.5 | 10 | 21.5 |
| 3 | NEHA | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2 | 3 | 2.5 | 2.5 | 3 | 2.5 | 2 | 2 | 2.5 | 17.5 | 17 |
| 4 | NIDA | 2 | 3 | 1.5 | 3.5 | 1.5 | 2.5 | 1 | 4 | 1.5 | 3 | 3 | 3 | 2 | 3 | 12.5 | 22 |
| 5 | EHTISHAM | 2 | 3.5 | 2 | 3.5 | 2.5 | 3.5 | 1.5 | 3.5 | 2.5 | 3.5 | 2.5 | 3 | 2 | 2.5 | 15 | 23 |
| 6 | RICHA | 3 | 2.5 | 2.5 | 2 | 2.5 | 2 | 1.5 | 2 | 3 | 2 | 1.5 | 2 | 2 | 2 | 16 | 14.5 |
| 7 | ESHA | 2.5 | 3.5 | 2 | 3 | 2 | 4 | 2 | 3.5 | 2.5 | 2.5 | 2 | 4 | 2 | 3.5 | 15 | 24 |
| 8 | ANFIQ | 2 | 3.5 | 2.5 | 3.5 | 2 | 3.5 | 1 | 3 | 1.5 | 3 | 2 | 3 | 1.5 | 3 | 12.5 | 22.5 |
| 9 | SHARIQ | 1.5 | 2 | 1.5 | 2.5 | 1 | 2.5 | 2 | 2.5 | 3 | 2.5 | 2 | 3 | 1.5 | 2.5 | 12.5 | 17.5 |
| 10 | TABASSUM | 2.5 | 3 | 2.5 | 2.5 | 2 | 2 | 3 | 3 | 2.5 | 3 | 3 | 3 | 2 | 2.5 | 17.5 | 19 |
| | MEAN | 2.05 | 2.95 | 2 | 2.9 | 2 | 2.75 | 1.75 | 3 | 2.35 | 2.8 | 2.1 | 2.8 | 1.75 | 2.65 | 14 | 19.85 |
| | MEAN IN % | 41% | 59% | 40% | 58% | 40% | 55% | 35% | 60% | 47% | 56% | 42% | 56% | 35% | 53% | 40% | 57% |

Figure 3

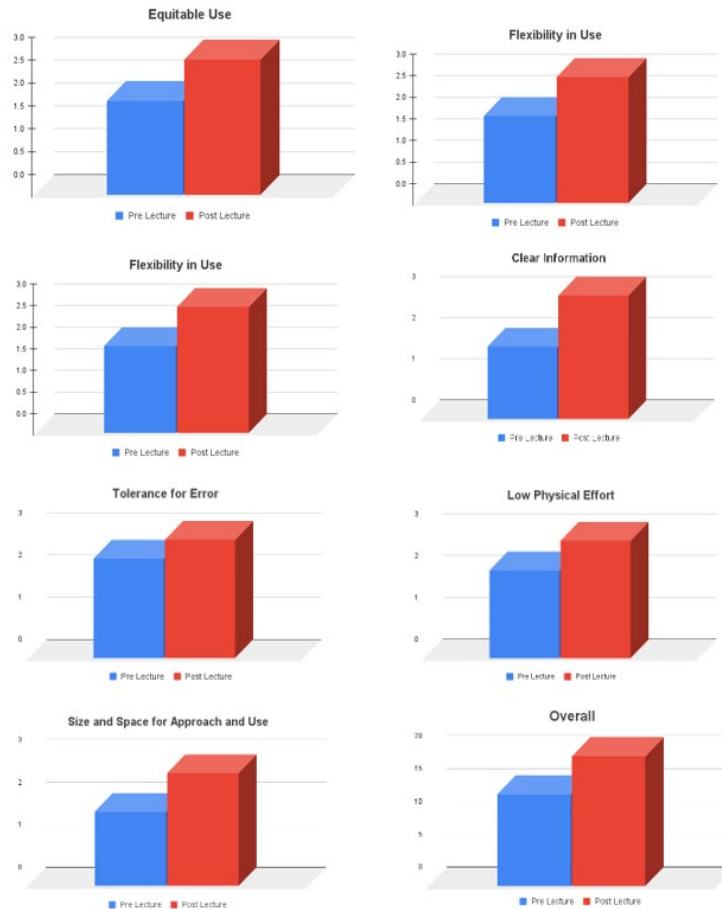


Figure 3 Analysis of Students' Marks Based on their Submitted Responses (Pre & Post)

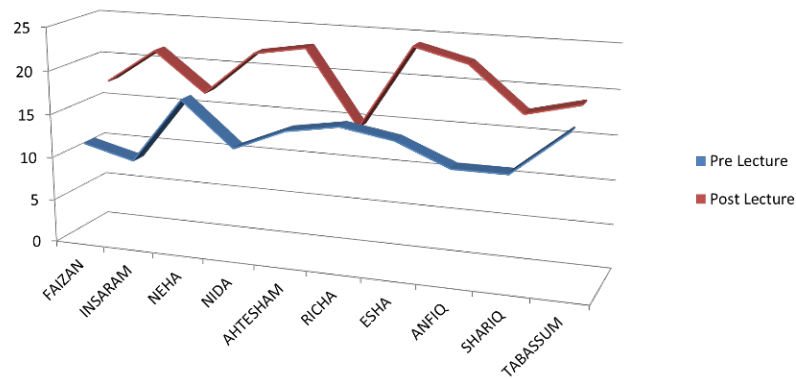
Figure 4

Figure 4 Mean of Performance Analysis of B.Arch. 3rd Year Students Design Exercise Acc. to Universal Design Pre & Post Lecture Differences Shown by Infographics

Table 2 and Figure 3 show the overall performance of 3rd-year students between pre-lecture design work and post-lecture design work, the average of post-lecture work is 19.8 which is significantly better than the average of pre-lecture work which is 14. Further, Table 2 demonstrate the assessment of pre-lecture students' design work is showing that except two students all the student's design work are less than 50% of the parameters of universal design. While on the other hand, the assessment of post-lecture students' design work shows that most students' design work is more than 50%. This analysis shows that all the parameters of Universal design are less than 50% in pre-lecture students' design work while in post-lecture students' design work, all the parameters of universal design are more than 50% except Clear information which is 60%. In this comparison we can see that all parameters of universal design are significantly better in post-lecture students' design work. The overall finding of this analysis shows that the universal design was not effectively or actively practiced in the 3rd-year architecture design studio. But when a designed framework for a 3rd-year design studio according to universal design principles was implemented then the situation has been totally changing the scenario as universal design is more effectively or actively practiced in the 3rd-year architecture design studio. [Manley et al. \(2013\)](#)

5. OBSERVATIONS

By using pre- and post-design assessments on third-year (Jamia Millia Islamia) students, this study aims to increase awareness of universal design principles and highlight the significance of universal design in architecture design studios. The architectural design curriculum ought to incorporate UD in the framework of the design studios. The general conclusion of this study is that universal design was not implemented successfully or actively in the third-year architecture design studio.

A lecture and exercise were given, followed by a post-design assessment on the implementation of universal design principles in the auditorium which is part of their design problem i.e. Cultural Centre. The situation changed dramatically when we created the design framework for the 3rd year design studio using universal design principles. Universal design is now more successfully and actively practiced in the 3rd year architecture design studio. [Mulligan et al. \(2018\)](#)

To raise student knowledge of UD, it is critical to develop a curriculum that incorporates the organization's values, beliefs, and philosophy. All design

professions, including architecture, interior architecture, industrial design, landscape architecture, and urban design, can use UD. [Olguntürk & Demirkan \(2009\)](#)

Given that most participants in the study were unable to incorporate UDPs into their designs, the results indicated a deficiency in the integration of UD in design education. To enhance integration, incorporate Universal design principles into the architecture design curriculum and put them into practice in architecture design studios. To support the development of UD, academicians and educators should offer a range of academic and design contexts, including workshops, conferences, seminars, and design competitions, in addition to courses that follow the UD methodology.

6. RECOMMENDATION

The Council of Architecture, minimum standard of architectural education regulation must be integrated with the Universal design principles and guidelines. Department of Architecture, Jamia Millia Islamia, New Delhi and other institutions lacking the parameters and aspects of universal design must redesign their B.Arch. curriculum following the guidelines of Council of Architecture 2020 to incorporate the universal design in their curriculum of architecture design. The integration of universal design principles in design problems should be mandatory in the design studios. At least one exercise should be done in the 3rd-year design studio to make students sensitive and responsive towards every section of the society.

Proposal of the design studio framework for 3rd year to include the universal design principles.

Figure 5

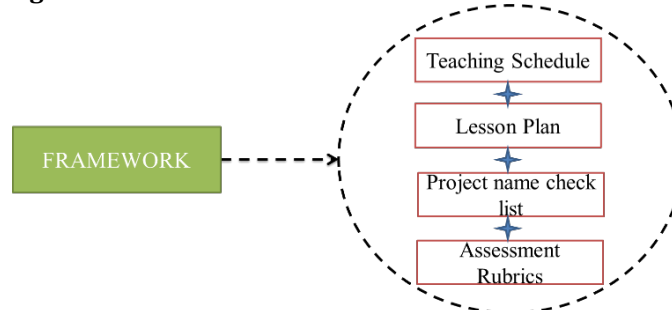


Figure 5 Proposed Design Studio Framework for 3rd Year to Include the Universal Design Principles

CONFLICT OF INTERESTS

None.

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