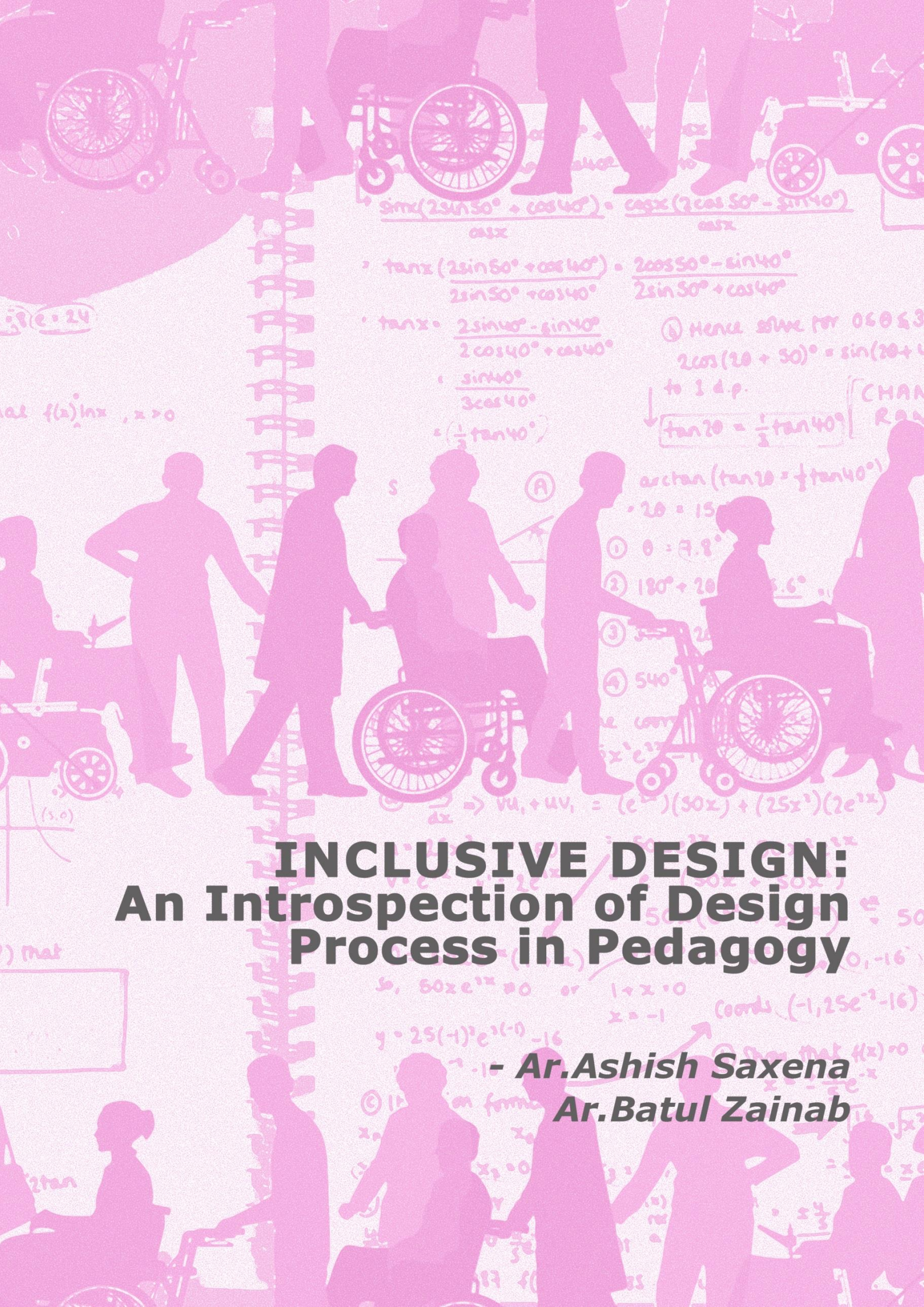

INCLUSIVE DESIGN: An Introspection of Design Process in Pedagogy

- Ar.Ashish Saxena
Ar.Batul Zainab

ISSN: 2582-8304

ASHISH SAXENA

He graduated from SPA, New Delhi and currently pursuing PhD from SPA, Bhopal. His research area is design thinking and cognition from designer's perspective. He has combined experience of over a decade in industry and academics.

ISSN: 2582-8304

BATUL ZAINAB

She is graduated in architecture and has keen interest in architectural pedagogy besides successful background of management of architectural projects. She received Master degree in Architecture with specialization in Pedagogy from JamiaMilliaIslamia University.

ISSN: 2582-8304

INCLUSIVE DESIGN: AN INTROSPECTION OF DESIGN PROCESS IN PEDAGOGY

Ashish Saxena, Apeejay School of Architecture and Planning, Greater Noida, UP 201308, India.

Batul Zainab, Apeejay School of Architecture and Planning, Greater Noida, UP 201308, India.

ABSTRACT

Inclusive design is a user-centred approach pivoted on diversity, equity and social inclusion. The architecture design process addresses inclusivity by focusing users' capabilities, needs and expectations. However, incorporation of such criteria faces constraints in formal integration of inclusive design due to lack of structured design course work and teaching strategies in architectural education. The aim of the study is to develop design process strategy in architectural education pedagogy from an inclusive design perspective. The methodology involves investigating the spectrum of phenomenology from experience to accessibility based on capability parameters: sensory, cognitive and physical aspects. Bloom's Assessment Tool for Inclusive Design (BAT-ID) based on capability parameters and Bloom's learning order is formulated. The paper presents the results of identified challenges based on assessment in architectural education; defining parameters; validating through survey among students and teachers. The study concludes by proposing teaching strategies of integrating inclusive design with the architecture design coursework in addition to the development of a framework to aid the implementation of appropriate inclusive methods and tools within the design process. The research outcome provides the basis of detail research which can further inform and integrate in architecture design coursework in B.Arch.

KEYWORDS: ***Architecture Design Pedagogy, Accessibility, Bloom's Taxonomy, Design Thinking, Inclusive Design***

INTRODUCTION:

The social responsibility of the architect is an important tool to enhance accessibility awareness in the society. Physical spaces are intended for everyone, have a significant impact and are undeniably require consideration in design education. Therefore, a shift and modification in 'existing' design approach towards 'universal user' is must for future professionals who will work in shaping the upcoming build environment (Universal design teaching in architectural education, AsliSungurErgenoglu, 2015).

Accessible design, barrier free design and universal design are internationally discussed concept intended to allow build environment inclusive for all people (Mulligan et al., 2018). However, teaching inclusive design faces several challenges to undergraduate students in design education. Dong (2010) identifies three major challenges i.e., positioning inclusive design in the design programme, making students to think consequence of impairments on user abilities and putting design projects into realistic situations.

There is a need to improve and develop the inclusive design structure of learning and teaching in architectural education. This paper will focus on positioning of inclusive design in the architecture design learning process. The aim of the study is to develop inclusive design process strategy in architectural education pedagogy. The objectives of the paper are:

- **To identify important aspects of inclusive design learning requirements in architecture design education,**
- **To classify the learning requirements into complexity levels,**
- **To develop integration strategy of inclusive design in architectural design pedagogy.**

Our study review spectrum of phenomenology from diverse user perspective to identify range of learning aspects related to inclusive design. It further explores various models of learning and thinking in design followed by design process models concern to architecture design. The methodology identifies challenges concerns to inclusive design learning and classification of learning content based on complexity. A framework is proposed to teach inclusive design process wise and stagewise. The paper discusses the gaps, recommendation and importance of further studies to make inclusive design integral part of architecture education.

INCLUSIVE DESIGN:

The inclusive design paradigm is founded on an attitude to design seeking to include as many people as possible. It is an approach to design striving for the greatest possible application that can address themes like diversity, equality and social inclusion (Heylighen et al., 2017). Barrier-free design, design for all and universal design are diverse design approaches those promote accessibility along with inclusive design. "Barrier-free" concept evolved to make building accessible and usable for physically challenged early during 1950's by American National Standard Institute (ANSI). "Design for all" is much more related concept to others defined as design for human diversity, social inclusion and equality according to the European Institute for Design and Disability (EIDD). Concept of universal design shoots from Barrier-free and accessible design approaches defined as ''The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design'' (Persson et al., 2015). Apparently, "disability" and "capability" becomes two paradigm approaches focusing user-centric design.

Inclusive design focus of heterogeneous capabilities of a user.Keates et al. (2000) emphasis on design approach that should principally

concern about physical capabilities rather on disabilities. Greater diversity in user needs and capabilities are anticipated with growth in aging population. Thus, capability range becomes important paradigm for user-centric design approach (Johnson et al., 2010). Keates et al. (2000) proposes conceptual user diversity model based on capability range and levels in design methodology. Capability range includes sensory, cognitive and physical parameters whereas capability level focus severity in impairment of the users. According to the National Baseline Survey on Disability, 2011 and other similar document, the sensory range is classified into visual impairment, hearing impairment and speech impairment. The major physical impairment is classified as strength and stamina, dexterity and locomotion, and the cognitive impairment is broadly classified as mental illness, autism, mental retardation. The capability range maps spectrum of user's phenomenology from experience to accessibility well implied to build environment with greater sensitivity in architecture design process.

ARCHITECTURAL DESIGN PEDAGOGY

Key dimensions of architecture design are elements, order and experience. It is a process of elements such as arches, vaults, domes (Roth & Clark, 2014); organised in certain order or principles (Ching, 2015) resulting in value-based experience such as functional satisfaction, emapathy and aesthetic experience (Hayes, 2002). Architectural curriculum is composed of fundamental courses that strengthen design, technology and artistic knowledge applied to the architecture design studio conducted in a non-traditional class room environment. Demirbaş&Demirkan (2003) describes design studios as conducive environment for organisational as well social process thus offering mediation between mental activity (invention) and social activity (realisation).

Design studio problems are formulated and spread in five-year graduate from program based on user size and scale of project. Design problems range from small scale – single user exercise such as personal room design in initial year, to large scale – dynamic users in an urban scale design exercise. User group can be classified based on number and relationship with the type of design environment. User group can be individual to small size for residence design, focus large for resort design and dynamic for public places. Experiential approach of teaching provoke reflection assisting development of concepts and changing practice. This provides greater satisfaction in process along with learning outcome among students (Mulligan et al., 2018).

Design empathy is designer's willingness to personally connect to user that motivates him to commit to a project (Kouprie&Visser, 2009). The capability to empathize with the user is crucial for inclusive designer. A user-expert designer is one who has developed natural experience in dealing challenges of build environment similar to the people who experience spaces differently (Heylighen et al., 2017). Kouprie&Visser (2009) proposes a framework describing process of empathy in design practice according to four phases, i.e., discovery, immersion, connection and detachment.

The objectives of inclusive design education are to increase awareness, foster responsibility, understand the rules and circumstances of the present, and grasp the historical context. By its very nature, universal design education takes an interdisciplinary and multi-professional approach. The area-specific courses are crucial instruments for reflecting "positive intentions" as the "correct actions and designs." Ergenoglu (2013) highlight insufficiency of appropriate knowledge content in architecture design syllabus as main cause of proper awareness of inclusive design. He emphasis

over mixture of active and passive methods of learning inclusive design as social model instead of medical model of disabilities.

DESIGN THINKING

Design thinking is an activity that is implicit in the process of design. However, design thinking emerged only in the latter part of the twentieth century (Koh, J. H. L., Chai, C.S., Wong, B. and Hong, H. Y., 2015). Theoretical perspective of design thinking attracts wide range of discourses. Johansson-Sköldberg et al. (2013) identifies five sub-discourses of design and designerly thinking as: creation of artifact, reflexive practice, problem-solving activity, way of reasoning/making sense of things and creation of meaning.

Design thinking is a people-oriented approach of solving problems. It is a process that provides designers with abstract divergence and convergence of ideas (Sandars&Goh, 2020). Divergent thinking is defined as psychological operation of generating a large number of alternative original, unexpected, or unusual ideas to an open-ended question. Whereas, convergent thinking is a focussed process of finding single correct answer out of many ideas or facts (Razumnikova, 2013). Partial models of the problem and solutions are constructed during the design process. Bridging is described as recognition of perceptual act by the designer in effort of mapping relationships between problem and solution. Such moments are described as flash of insight, creative leap, illumination, or "Aha" moment (Cross, 2010).

However, design thinking models have become an effective toolkit for the innovative design process, integrating various design tools and methods into the design process. Design thinking models represent structured framework of design thinking process. Mesarovic et.al.proposed Iconic model consisting of Analysis–Synthesis-Evaluation–Communication; similar to Archer's model structured as Programming-DataCollection-Analysis-Synthesis-

Development-Communication (Rowe, 1987). Imaging, Presenting and Testing are activity-based stages during design process (Zeisel, 2002). Institute of Design at Stanford propose five modes of design process: empathize; define; ideate; prototype; and test. Empathizing required three activities: one, observation of user's behaviours; two, engagement – interacting and interviewing users; and lastly, immersion – experiencing what user is experiencing. Luka (2020) conclude design thinking stages applicable to pedagogy are understanding problem; observing user; interpreting results; generating ideas; building and experimenting prototypes; and testing, implementing and improving the design.

BLOOM'S TAXONOMY: EXAMINING AND ASSESSMENT TOOL

Benjamin Bloom, defines the set of taxonomies in 3 different domains of learning which were the cognitive, affective and psychomotor (Anderson LW, Krathwohl D. 2005). The cognitive domain involves conscious intellectual activity (Goel S, Sharda N. 2004). It consists of 6 cognitive levels of: Knowledge, comprehension, application, analysis, synthesis and Evaluation. The first three levels are generally referred to as lower levels of thinking and the last three are referred as higher levels of thinking (Narayanan S, Adithan M. 2015). The learning processes in blooms taxonomy in each level can briefly summarized as:

- **Knowledge- an ability to recall and remember information**
- **Comprehension- an ability to understand and define concepts**
- **Application- an ability to use information in a new setting**
- **Analysis- an ability to analyse and distinguish parts**
- **Synthesis- an ability put things together and develop a new product**
- **Evaluation- an ability to judge, justify a decision or point of view**

Bloom's taxonomy is mostly applied in designing as well as assessment course works at undergraduate level (Britto&Usman, 2015). It greatly helps in designing examination which further improves quality of program assessment (E. Thompson et al., 2008). A. R. Thompson & O'Loughlin (2015) developed Blooming Anatomy Tool (BAT) utilizing Bloom's taxonomy for designing and evaluation of anatomical science assessments. The BAT-rubric provides discipline specific guidelines to develop multiple choice questions (MCQs) based on two dimensions, i.e., learning levels based on bloom's taxonomy and discipline specific knowledge domain. The learning levels are divided as lower (knowledge and comprehension) and higher order (application and analysis) whereas MCQs are formulated representing knowledge domain of the basis of feature of question, key skill assessment, type of information assessed and characteristic of enquiry. Assessment based on Bloom's taxonomy can be formulated with inclusive design parameters to evaluate gaps in current architectural curriculum from accessibility point of view.

METHODOLOGY:

It is important to understand complexities involved concerning incorporation of inclusive design into architectural pedagogy.

	CAPABILITY PARAMETERS	CNS-Social Policy & Planning Division, Calgary, 2010	Centre for Excellence in Universal Design, 2012	GOI-Ministry of Urban Development, 2016	Keates, S., Clarkson, P.J. , 2003	World Health Organization Geneva, 1980	Govt of India Ministry of Statistics and Programme Implementation, 2021	PARAMETER ASPECTS
USER-CENTRIC PHENOMENOLOGY	Sensory	Auditory	Speech	Visual impairment	Seeing	Speech	Speech	Visual, Hearing & Speech
		Visual impairment	Hearing	Blindness	Hearing	Hearing	Hearing	
		Blindness (partial / full)	Sight	Speech		Sight	Sight	
			Touch	Hearing				
	Physical	Agility: Loss of Dexterity	walking, balance, handling,	Inability/difficulty -walking	(Motion) Locomotion	Walking	Locomotor disability	Strength & Stamina, Dexterity & Locomotion
		Mobility: Ability to walk, move or carry	pulling, pushing,	Reliance / Mobility Aid	Reaching	Dressing		
			lifting	Lack of stamina	Stretching			
			strength and stamina	Limited motor movement	Dexerity			
	Cognition	Ability to pay Attention & Percieve	cognition,	Difficulty in Interpretation	Communicatio n	Behaving	Mental Retardation	Memory, Intelligence & Behaviour
		Memorize, Judge, Imagine	intellect, interpretation, Learning	Reacting to Sensory information	Intellectual Functioning		Mental illness	
		think and speak	Memory					

Table 1: User-centric Phenomenological Capability Parameters & Aspects

Therefore, assessment of inclusive design awareness among architecture students and their empathy evaluation to capability specific users becomes important. User-centric phenomenological capability parameters were analysed based on literature review, i.e., sensory, physical and cognitive (refer Table-1). Range of capability parameters became subject aspects of MCQs.

BLOOM'S ASSESSMENT TOOL FOR INCLUSIVE DESIGN (BAT-ID)				
	LOWER ORDER		HIGHER ORDER	
	Level 1 (Knowledge)	Level 2 (Comprehension)	Level 3 (Application)	Level 3 (Analysis)
Key skills assessed	Identify, recall, repeat, memorize	Describe or distinguish	Infer or predict	Interpret, judge, critique or analyse
Types of information assessed	• Basic definitions • Facts	• Basic understanding and overview	• Functional aspects	• Applying information • Interpretations
Characteristics of multiple choice questions	Only requires the information to recall Knowing the 'what' but not understanding 'why'	The direct questions, but more than simple definition	Applying information in new context	Students may go through multiple steps and 'Apply' those information to a situation
Sample Multiple choice questions	Blindness is the disability with: a. Those who rely on their sense of hearing, touch and smell b. Those who have very low vision c. Those who can recognise colours **d. None of the above**	Severe case of Intelligence disorder is: **a. Mental retardation** b. Autism c. Anxiety & Mood disorders d. Dyslexia	Hearing impaired people can be assisted in build environment by: a. Creating a less noisy environment b. To provision of assistive devices for better audible signals c. Supplementary visual information should be provided in public buildings **d. All of the above**	Office spaces for speech impairment should have: a. Writing boards **b. Mobile assistive technology or electronic** communication c. Separate corner d. None of the above
Inference (Author)	Requires only basic understanding or knowledge over the topic	Students can connect to the topic and relate with it	Students can recall and know how to apply in the real time situation	Students can relate detailed understanding and analyse after applying whether it is associated with the problems or not

Note: Bold font indicates the correct answers

Table 2: Assessment Tool (BAT-ID)

Similar to BAT (A. R. Thompson &O'Loughlin, 2015), assessment tool for inclusive design (BAT-ID) was developed with range of capability parameters as key aspects of knowledge domain. Lower order (knowledge & comprehension) and higher order (application and analysis) multiple choice questions (MCQs) were formulated using BAT-ID (refer Table-2) for the survey among architectural students representing five years of graduate program to understand two aspects: one, existing knowledge about user capabilities, and two, their self-rating to empathize with user capability range in respective design studios. A Faculty survey aim to validate the complexity level including inclusive design along with distribution of complexity in five-year design coursework was conducted separately.

32 students and 18 faculties participated in the survey conducted in architecture institution in national capital region of India. Year-wise distribution of students was as follows: first year (20 students), third year (8 students) and fifth year (4 students). Three capabilities with three aspects covering range of severity formulated 9 themes of users. Total of 36 MCQs were formulated considering four questions (2 lower order and 2 higher order) were formulated based on BAT-ID. Students were asked to rate at the end of each theme about how much connected they felt while empathizing in context of architecture design. At last, each participant was asked to rank capabilities based on complexity according to their perception.

A parallel faculty survey was conducted to understand feasibility to integrate similar inclusive design user-centric capability parameters along five years of design studios according to architecture curriculum. The syllabus of architecture design was analysed for entire course work. The recommended design problems were analysed based on user group and project scale. The result was analysed with current student's knowledge about inclusive knowledge and empathy ratings to understand existing gap and complexity levels from the perspective of inclusive design in architecture design studios along with faculty survey.

RESULTS AND FINDINGS

It was found that accuracy rate of lower order questions was consistently greater than higher order questions in almost all three student groups. Accuracy level was found almost similar among first year and third year student groups regarding inclusive design capabilities, though fifth year student group performance was considerable higher than other two groups. Students scores highest in physical capabilities and lowest in Sensory capabilities. Self-rating regarding empathizing with capability focused users was found to be constant and moderate in all three capability criteria. Though,

students scored least in sensorial capability but preferred it easiest to empathize. Students ranked cognitive capabilities highest and sensory capabilities as lowest in terms complexity from design point of view. None of the student rated sensorial empathy as difficult.

CAPABILITY-BASED COMPLEXITY DISTRIBUTION IN DESIGN STUDIOS			
DESIGN STUDIOS	SENSORY	PHYSICAL	COGNITIVE
II-IV SEM SMALL GROUP SMALL SCALE *(personal space, residence, resort)*	LOW	LOW	MODERATE
V-VI SEM FOCUS GROUP PUBLIC BUILDINGS *(sports stadium, shopping mall)*	LOW	LOW	HIGH
VII-IX SEM DYNAMIC GROUP URBAN SCALE *(Multi-purpose complexes, urban design)*	MODERATE	LOW	HIGH

Table 3: Capability-Based Complexity Distribution in Architecture Design Studios

Similar to students, inclusion of sensorial perspective is most feasible as compare to cognitive perspective which was rated most challenging in design exercises according to faculty survey. Third year design studios dealing with problem related public building with focused user groups such as shopping mall, stadium or a group housing found to be most viable for comprehensive (sensory, physical, cognitive) inclusive design learning capabilities. Viability of teaching inclusive design for dynamic group at urban level design studios was found to be most challenging.

DISCUSSION

It is required to understand gap to develop integration strategy of inclusive design in architectural design pedagogy. The gap can be understood by analysing complexity and feasibility in current

situation. Our study presents one of the case studies to analyse complexity and feasibility based on Bloom's assessment tool for inclusive design (BAT-ID). Capability parameters (sensory, physical and cognition) becomes one the ways of teaching and learning that make inclusive design approach feasible in architectural design process as one of the key imperatives of design studios is user beside building type. It is realised that certainly capability parameters can be classified based on ease on understanding, application and empathy based on students and teachers survey in our study. Sensory found to be most convenient and therefore most feasible as compare to Cognition which was rated most complex.

The paper provides fundamental structure of framework distributed based on capabilities range and design problem diversity which can be further developed based on detail studies. Teaching strategies must consider distribution of complexity along five years of course work based on learning capacity and feasibility to comprehend in studio-based design problems. It was also realised that learning of inclusive design is more viable in first three years of design studio whereas last two years of design studios are more applied and analytical. Thus, knowledge of user capabilities range should be imparted by third year either by introducing dedicated electives or creating user-centric capabilities-based design problems in design studios. The project sizes and design problem complexities further support such strategies. Dong (2010) suggest to initiate simple abilities in design exercise concern to small user group along with spreading the learning content in different levels.

Developing empathy among students becomes critical to inculcate user-capabilities in architecture design. Learning by doing or similar experiential approach allow to concept formation, reflection and greater satisfaction (Mulligan et al., 2018) promote affective learning. Empathetic learning could be developed based on Kouprie&Visser (2009) framework (discovery, immersion,

connection, detachment) among students. Studio design process also require detail introspection from users' capabilities range perspective. Thus, it becomes important to analyse and integrate design thinking models with empathetic learning framework. We propose design thinking approach in seven stage process: Discovery, Immersion, Connection, Detach and Define, Ideate, Prototype; and Test.

Architecture design process in itself is a user-centric approach. Inclusive design approach is aligned with greater sensitivity towards user. Empathy allows intimate connection to learn user experiences. Learning range of capabilities makes designer more aware about user need, capacity and expectation thus succeeding the purpose of inclusive design promoting diversity, equity and social inclusion.

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