Journal of Accessibility and Design for All

Volume 10, Issue 2. (CC) JACCES, 2020. ISSN: 2013-7087

INTEGRATING BEHAVIORAL RESEARCH IN UNDERGRADUATE DESIGN STUDIO IN ARCHITECTURE FOR DESIGNING INCLUSIVE ENVIRONMENTS

Abhijit Natu

[1] BKPS College of Architecture, Savitribai Phule Pune University,
Pune, India.

ORCID : https://orcid.org/0000-0001-7874-8746

asnatu@bkps.edu

Received: 04-06-2019 | Accepted: 2020-06-19| Published: 2020-11-30

***Abstract*:** Behavioral research as a part of a design process in an undergraduate design studio in architecture can help bridge the gap between the user needs and design decisions and sensitise the students to the concept of accessibility and social inclusion. This paper presents the process and outcome of three academic design projects in which the students employed behavioural research. The design researches at undergraduate level occurred at different times and with diverse groups of students. The study for the design for the park for the blind used quasi-experimental research while the research for the other two design projects viz.; The project design for the Home for Elderly and the project of designing an Orphanage used case study research employing qualitative strategies of behaviour mapping and in-depth interviews with key informants. The findings which emerged certainly provide the evidence for the overarching hypothesis that behavioural research sensitised the students to the concerns of accessibility and social inclusion and accessibility has to be looked at from both physical and social angles to facilitate inclusion. Hence the model of incorporating design research as part of the design studio proves to be a useful one. Developing empathy in the students towards the disabled and towards those who need social inclusion, can facilitate social inclusion through design. The contribution of the paper

Natu, A. (2020). Integrating behavioural research in undergraduate design studio in architecture for designing inclusive environments. Journal of Accessibility and Design for All, 10(2), 209-228.
https://doi.org/10.17411/jacces.v10i2.231

lies in the development of a framework for design research for undergraduate students of architecture for inclusive design.

Keywords: empathetic, accessibility, social concerns, built environment, design

Introduction

Designers are typically criticised for designing without the knowledge of human behaviour in public realms (Chakravarti, 1993) or assuming a doctrinal stand (Rutledge, 1985). Architects designing in their own image often centralise their own experiences of space and marginalise and negate the experiences of others (Morrow, 2002). Architects many times tend to make decisions about function or aesthetics based upon their own intuition or preconceived ideas. Berleant (1988) noted that designers can encourage or inhibit participation by the design of environments. The gap between demands on the person and the individuals' capabilities can be closed or at least decreased through suitable control over the environment (Kroemner, 2006). It is the responsibility of the designers to create settings which offer "all" the opportunity to realise their different potentials (Lindel, 1991). The mainstream practices of education and standards limit themselves to the conventional spectrum of "normal" excluding numerous user groups and victims of social circumstances (Mostafa, 2013). Hence, designers need to be empathetic to the needs of the users and various user groups.

Behavioural Research For Inclusive Design

Environment behaviour studies are about the interrelationships between behaviour and properties of the manmade environment (Teklenburg, Zacharias, John, & Teresa, 1996) and there is a need for placing more emphasis on "environment-behaviour" studies in architecture schools (Boyer & Mitgang, 1996). Integrating behavioural research in the architectural design

process can help the students to understand the user requirements and after that, prepare a more user sensitive spatial program.

One of the objectives of Architectural Education spelt out by UIA UNESCO Charter [2011] is training in research techniques as an inherent part of architectural learning, for both students and teachers.

Roberts (2007) extends the Healey's model of teaching research nexus to design project stating four paradigms which are as follows:

- *"Research-tutored paradigm" - students apply research findings of their tutors in their project work,*
- *"Research-based paradigm"- students use the design process as a means to advance knowledge,*
- *"Research led paradigm" - students learn about the findings of their tutors' research though not linked to their project work and*
- *"Research-oriented paradigm" - students are encouraged to develop research skills and design enquiry and related information gathering skills through focussed teaching.*

Episodic research (Groat & Wang, 2002) at various stages of the design process helps in design program evolution. In the integrated design paradigm, exploratory as well confirmatory research can be carried out in the rational phase of design and knowledge gained from this research can be applied in the creative phase (Bashier, 2014). The pedagogic model for the design studios described in this paper uses a "research-oriented paradigm" which employs the "exploratory as well as confirmatory research" for understanding the concerns of various users and generating design brief.

Case study is the most commonly employed research method in architecture schools. It is a research method, which can be qualitative, quantitative or can combine both (Groat & Wang, 2002). The researcher embeds oneself in the field, and various methods of data collection can be used, such as talking to users, observation, mapping etc. It enables the students to observe the

Volume 10, Issue 2. (CC) JACCES, 2020. ISSN: 2013-7087

phenomenon on the setting and learn about the interactions of the users with the setting as well as within them. Case studies are useful to gain insight into past projects to successfully design new ones (Francis, 2001).

Salama (2009) calls for utilising the built environment as an open textbook wherein students can learn about the supportive environment for human behaviour and recommends techniques such as socio-behavioural mapping. Observation is an important and easy tool for the students. Systematically observing behaviour can give an idea about how the environment is used or misused and the way in which design and arrangement of elements result in particular behavioural patterns (Laurie, 1975).

Inclusive design aims to meet the needs of people who have been unable to use mainstream products because of age or disability (Morrow, 2002). Inclusive design education must provide students with knowledge and skills in brief making, participatory methods and environmental auditing (Morrow, 2002). Thus the students must be sensitised about the diverse types of users and their needs and the need for an inclusive design approach. The duty of education is to cultivate and support the human abilities of imagination and empathy (Pallasmaa, 2009). Empathic Modelling enables an individual using of various props and scenarios, to simulate the deterioration of physical and perceptual abilities in everyday scenarios (Nicolle & Maguire, 2003). Consulting experiences of persons with impairment can help gain insights into the gap in the designers' intention and visitors' expectations (Heylighen, Doren, & Vermeersch, 2013).

Behavioural Research In Design Studio: A Study Of Three Cases

The curriculum of the undergraduate course in Architecture emphasises upon accessibility and addressing the social concerns as one of its objectives. Accordingly, the design projects in the studio are planned to focus on some

concern or user group, so that the students are trained to address its specific needs through design. This paper takes a pedagogic review of learning outcome of three research studies [listed in table 1] undertaken by the students of Architecture of the BKPS College of Architecture, Pune [India] and presents findings of each study and its applicability addressing the social concern of inclusivity in the respective settings.

Table 1. List of Case studies

Sr. No.	Design Program	Number of student(s)	Level
01	Park for the visually impaired	36	Third Year B.Arch. Landscape studio
02	Home for the Elderly	40	Third Year B.Arch. Landscape and Architectural design studio
03	Orphanage	01	Final Year Architectural Project

All three researches were primarily undertaken to identify the design issues/challenges in designing settings for the different user groups.

The third-year students underwent an exploratory research to design a park for the visually impaired persons, which employed quasi-experimental method. The other two studies used case study method as a precursor to the design of "Home for the Elderly" and "Orphanage" in which unobtrusive observation and interviews of the gatekeepers and managers of the settings were the tools used for data collection. Following sections describe the three studies separately and then present the pedagogic outcome, and design applicability of the findings.

Case 1: Design of Park for the Blind

Landscape architecture is a compulsory course in the third year of the architecture curriculum in which, along with theory, students are also given design assignments as part of their studio work. The intention of asking the students to design a park for the blind was twofold. Firstly and importantly,

to understand the needs and design considerations for the visually impaired persons to evolve barrier-free public parks. The second objective was to sensitise the students to the non-visual characteristics of the landscapes such as the olfactory, the tactile, the auditory for a holistic understanding of landscape space and its attributes.

The Procedure of the Study

Without briefing the students about the intent of the project they were taken to Saras Baug, an important public park in the city of Pune, Maharashtra State, India [refer figure 1]. The park is characterised by its sunken setting, which is about 5 meters below the surroundings. There is a temple in the centre of the park, surrounded by a shallow pool of water. The park has a peripheral loop of pathway and four cardinal pathways dividing the park into four quadrants. Each quadrant has lawn as a dominant ground plane element and sparse planting. The edges of the park are characterised by stone retaining walls with vegetation.

There were 36 students who were divided randomly into twelve groups of three each. One person from each group was blindfolded and was asked to be barefoot. Blindfolding is one technique to simulate the experience of visual impairment (Nicolle & Maguire, 2003). This student was then asked to take a walk in the park with the help of a group member guiding him/her. The blindfolded student continuously described his/her spatial experience of moving through the park with details like surfaces, sounds, smells, enclosure, openness etc. The third person in the group took down these descriptions in the form of transcripts and logs. A blindfolded walk in the park took around 30 minutes which otherwise would take 10 minutes [refer figure 2].

Volume 10, Issue 2. (CC) JACCES, 2020. ISSN: 2013-7087

Figure 1. View of Saras Baug – The Research Setting

Figure 2. Blindfolding -Part of the Quasi Experiment

Natu, A. (2020). Integrating behavioural research in undergraduate design studio in architecture for designing inclusive environments. Journal of Accessibility and Design for All, 10(2), 209-228. https://doi.org/10.17411/jacces.v10i2.231

After this exercise, the students were taken to the classroom and the logs written by them were collected and cross-compared. In all total, twelve logs (one per group) were studied and analysed to find out if there were patterns of perceptions across the twelve logs. Following were the findings based upon the commonality of experiences observed across the twelve logs.

The findings

- It was found to be scary to walk over the grass mounds and one could not gauge the path ahead.
- Curbing of the pathways was creating problems for walking.
- Walking in sun gave the “feeling of expanse”.
- Cobbled stone paving had directional/guiding quality but it was not so with the interlocking blocks.
- Sounds helped in understanding one's location in the park. E.g., sound of vehicles indicated proximity to a road, the sound of birds indicated proximity to trees.

The findings brought forth the “non-visual” perception of space experienced through tactile, auditory stimuli. The students also mentioned that with the eyes blindfolded, they were more alert with respect to the other senses to understand their spatial locations and navigation through the space. This little research, which was a precursor for the design assignment, enabled the students to undertake the park for the visually impaired persons in a compassionate manner.

Case 2: Home for the Elderly

India has always cherished its joint family system wherein almost three generations have been staying together in one house. However, owing to changes in socio-economic realms, a nuclear family system has become common. Hence, elderly persons in the family either have to stay alone with the younger generation moving out to a different house or the elderly move into the homes for elderly – the need for which is growing. In order to

understand the physical and psychological aspects of ageing and design considerations for designing a home for the elderly, a project of Home for the Elderly was assigned to the third-year students.

The students were asked to undertake case study research of five homes for the elderly in the city of Pune. The cases were purposely selected to have diversity in terms of architectural form, type of management (private/public) and funding (admission by payment or charitable). Grant of permissions from the gatekeepers was also a criterion, which governed the selection of the cases.

The Protocols, Ethical considerations and Procedure of Case study.

The managers of the homes were approached for permission with a request letter from the Principal of the college, asking the informed consent and undertaking for non-disclosure of names of the respondents. In all the cases, the students were granted permissions but during specific timings. The students were allowed only to do observations. They were not permitted to talk to the residents.

As manager of one of the home for the elderly mentioned as follows:

"Frequent visits of various study groups disturb the residents and also sometimes they probe into their lives which open up their wounds. As many times staying in these homes is not by choice but due to negligent behaviour of the family members / younger generation".

Accordingly, the students refrained from talking to the residents. Each case was studied for a period of two days. Architectural drawings were procured wherever available and were used for mapping behavioural observations indicating the use of space and user behaviour. Photographs were also taken wherever permissions were granted. Unstructured interviews were conducted with the managers and the supporting staff. Critical understanding of the homes from the perspectives of the residents was not possible due to the restraint, and hence it was one of the limitations of this research.

The findings

Following are the findings derived from the study of the Old Age Homes.

The room typology in the homes varied from dormitories (8-bed capacity) to triple seated rooms (in some cases a double room converted to triple room) to single/double rooms for single persons or couples. It was noted that the rooms had institutional furniture units mostly in steel, which was very not comfortable given the physical needs of the elderly persons who had age-related disabilities such as arthritis, knee joint problems etc.

The verandas/corridors tended to get used more for sitting and interacting by the residents. Of the three cases studied, two homes were ground and the first floor having wheelchair access while the third one was ground and two floors high without any lift or ramp. In the former two cases, residents were using the ground/site freely for various passive as well as active recreational pursuits due to easy access. The case which lacked accessibility inhibited the use of the ground level courtyard by the residents staying on upper floors.

Provision and availability of facilities for recreation, medical clinic etc. depended upon the funding. Open spaces contributed substantially in serving the recreational and health pursuits of the residents. Working in the garden, participating in daily chores etc. helped the residents in developing a feeling of contribution and maintaining mobility and fitness. This further developed feeling of community amongst the residents.

During the discussions with the managers of the home for the elderly, it was noted that living in an old age home was not definitely by choice of the elderly persons. There appeared to be an air of pathos in all the homes. Interestingly one of the old age homes had a crèche for small children where some of the inmate women worked. The presence of small children was a big fillip for adding joy in the otherwise monotonous environment, and the crèche created the opportunity for elderly persons to interact with the outside world.

Having undertaken the study of old age homes, the students were able to develop empathy towards the needs of the elderly persons and were sensitised to the social issue of exclusion of the elderly. Developing connections with the society through the introduction of shared facilities, kids play areas; crèche etc. can create opportunitiesof interaction. An example of one such design is presented in figure no. 3.

Figure 3. Facilities and Spaces in a Home for elderly.Source: courtesy of Ms Karishma Joshi

Case 3: an Orphanage: a Children's Village

A home for the orphan children was final year Architectural Project / Thesis project of a student. The student undertook literature studies, meetings with the experts in the field of child psychology, sociology before embarking upon the case studies. This background research brought forth the difference between an orphanage and a children s village. In an Orphanage, children live together and are looked after by caretakers. They usually have a dormitory with a few common facilities. On the contrary, the unique feature of the

Balgram (*Bal*- children *gram*- village thus - Children's village) concept is a home-like environment. Each house is a self-contained unit. Every child who comes "home" steps into a family which has a caretaker referred as mother and the children are referred as brothers and sisters. Each house has a mother looking after her 8-10 children. Within the family, each child is protected and independent. S/he enjoys a sense of belonging and forms lifelong bonding with the inmates. Having realised this difference, the student decided of designing a children's village and accordingly selected cases three for her research.

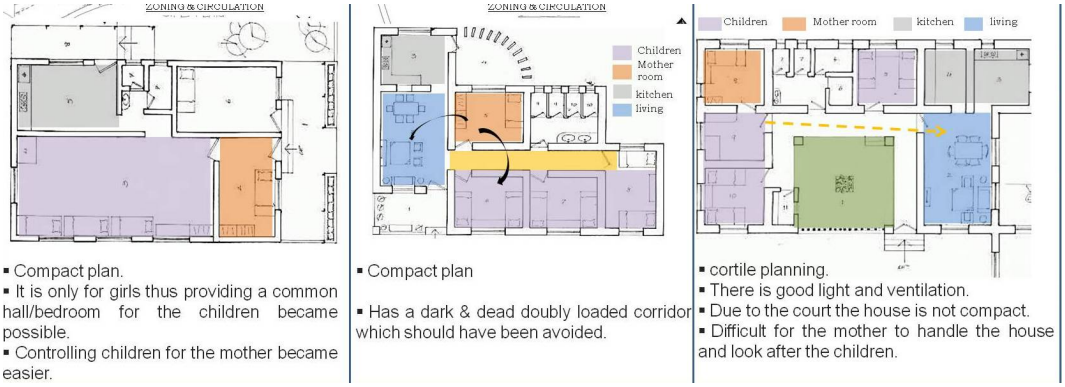
The Protocols, Ethical considerations and Procedure of Case study

Prior permissions were sought from the administration of the children's villages. Since this was a research study of a single student (unlike the group study of the home for elderly mentioned case 2) seeking permission was much easier and at none of the three cases, entry was denied. However, as a research ethic, it was decided to not to ask any personal questions to the children but limit the items only to the activities they do and the spaces they use. Observations were recorded in the form of field notes and sketches. Roughly, two days were spent in studying each case. Unstructured interviews were conducted with the mother, the administrative heads and the managers.

The findings

All the three cases studied had sprawling layouts of family cottages connected by a path. This kind of spatial arrangement afforded open spaces between the cottages and at campus level. The open spaces in the proximity of the cottages were used by the children for studying, playing, etc. The campus-level open space was a common ground for various activities ranging from community prayers, informal play, sports, cultural activities etc. Field observations revealed that the spaces between the cottages and at the campus level were settings for interactions between the children and informal learning.

Figure 4. Comparative study of Homes for Orphan Children. Source: courtesy of Ms Sarvari Harpale



In the analysis of an individual cottage, it was found that proximity of the mother's room to the children's room was necessary to have visual as well as physical control of the mother over the children. Case 1 had a large hall with a mother staying in the same hall [on the extreme left in Figure 4]. Case 2 had a compact plan with rooms of mother and children close to one another along a double-loaded corridor [in the centre in figure 4]. Case 3 had a cortile plan with rooms around it [on the extreme right in figure 4]. In the former two cases, it was easier for the mother to look after the children while in the third it was difficult due to the courtyard in the centre. The double-loaded corridor in the second case was ill-lit and ill-ventilated. The courtyard in the third case was a pleasant open space for various activities.

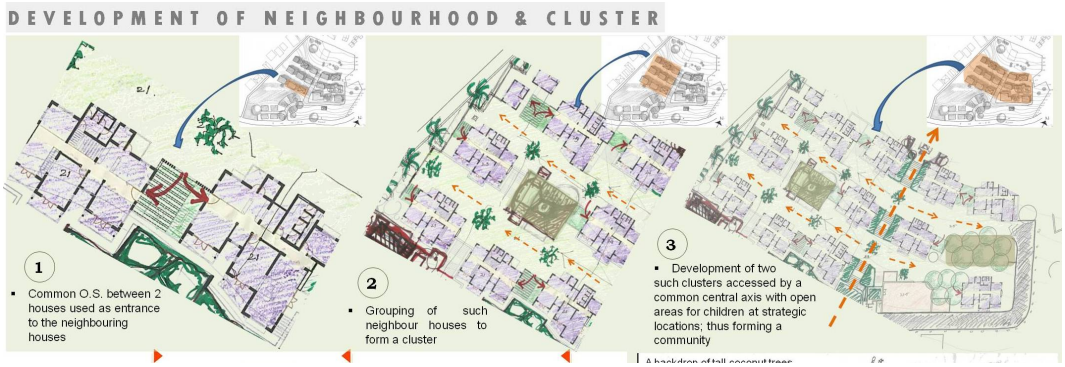
All the three cases had recreational facilities, studying facilities, health centre within the campus. As a rule, these children's villages are generally located in closer proximity of a neighbourhood so that they can be provided schooling in that neighbourhood. Apart from this consideration, it was understood from the managers of these campuses that the proximity provided them the opportunity to mix with society and participate in the community festivals and programs.

One crucial aspect came up from the discussions in all the three centres that these children have a desire to personalise their own space. In the rooms, the children drew pictures on walls, put pictures, and wanted to have pets and so

on. In one of the case, rabbits, dogs, cats were kept on the campus that the children really loved.

Though the student started her topic as an orphanage, her study guided her to revise and redefine her project as “Children’s village”. She realised that the architects could facilitate bonding between the otherwise “lone strangers” through unit design and creating opportunities for interaction. In addition, foster a sense of belonging in the children. To promote social interactions between the children at the cluster level as well as the neighbourhood level, the student planned hierarchy of open spaces in the project proposal [Refer figure 5]

Figure 5. Hierarchy of open spaces to promote social interaction on the campus in the proposal of the Children's' Village. Source: courtesy of Ms Sarvari Harpale



Findings From The Three Studies

The author being one of the studio teachers in case of all the three design projects could very closely interact with the students and engage with them in the process of research and design. The author could categorise the learnings from these researches broadly in the following heads. These categories are inductive and based upon the discussions with the students in the research process, assessment of the design outcomes and the feedback given by the students and other teachers involved in the studio.

- Evolving the Design Program and Intent

Volume 10, Issue 2. (CC) JACCES, 2020. ISSN: 2013-7087

- Design development
- Learning Process and Outcome

Evolving the Design Program and Intent

The research studies in all the three cases were “episodic” as Groat and Wang (2002) refer to it, and they were undertaken with the aim of program formulation and evolving the design intent. In the case of the park for the blind persons, students were initiated to understand the non-visual characteristics of the landscapes. They were in a better position to employ landscape elements for other than visual qualities for better appreciation and perception of the landscapes by the persons with visual impairment.

In the project of designing old age homes, apart from the understanding of physical accessibility needs of the elderly, the students came up with the finding that the elderly need social contact. A crèche and community hall was incorporated in the design program so that the elderly would get an opportunity to meet children and society which otherwise in an exclusive elderly housing they would not get. Similarly, in the case of the children’s village, the student identified the need of contact of the orphan children with the society, and hence the student selected a site, which was closer to a neighbourhood and allowed sharing of facilities like playground, an art centre that the children in the adjoining communities could use. The design brief for the children’s village was evolved to create a family cottage wherein a mother with around six girl children of ages 4 to 9 could stay together like a family.

In all the three cases, the students realised that sheer provision of areas in square meter is not enough for the development of an architectural program. Sensitively identifying the psycho-social dimensions of user needs is required for developing the program. During the informal feedback sessions after the academic project was over, students mentioned that the programs helped them to develop empathetic understanding of the social issues and concerns

Volume 10, Issue 2. (CC) JACCES, 2020. ISSN: 2013-7087

and thus developed design program and intent in response to the issues identified.

Design Development

Though design tends to be an iterative and subjective process (Groat & Wang, 2002) the research study informed the design program formulation and also the design itself. Owing to these, the decisions regarding the development of design were based upon empirical observations and findings.

In the design for the blind, the students used a palette of landscape elements that afforded multi-sensory stimuli. They came up with designs, which allowed ease of movement, offered tactile legibility and avoided elements such as sharp corners, thorny plants, abrupt changes in levels etc. In “The home for elderly”, the students developed schemes which incorporated accessibility features. They also made open spaces accessible from the rooms or corridors so that the open spaces could be accessed effortlessly and elderly could engage with the landscape. Both the Park for the Blind and the Home for the Elderly were projects given to a class of 35 students. However, not all the students succeeded well on design quality but, at least, they were sensitised to the issues of universal design and inclusive environments, as was revealed from the informal feedback session after the completion of the academic projects.

In the thesis project of Children’ s village, the student developed hierarchy of open spaces ranging from cottage level space, to cluster level to campus-level space which became multi-functional spaces needed for various activities and interaction between the residents. At cottage level, the student designed the rooms to give individual alcoves to the children at the same time, allowing visual access of the caretaker mother.

Volume 10, Issue 2. (CC) JACCES, 2020. ISSN: 2013-7087

Learning Process and Outcome

As discussed, the research could sensitise the students to the needs of different types of users. Apart from physical needs and physical meaning of accessibility, the students could understand psycho-social needs of various users and means to generate inclusive environments by architectural interventions.

Apart from the findings for architectural programming and design, the students were exposed to behavioural research and its importance, which is extremely important, particularly in the discipline of architecture, which tends to be intuitive. The ethical protocols followed in case study research, notes taking in qualitative interviews, behavioural mapping were important aspects the students learnt in the process of the research. Furthermore, being embedded in the settings allowed students to become more sensitive to the concerns of the users.

The feedback from the students about their learnings from the behavioural research studies and their application in the design was not formally collected and analysed in the present research. This is a limitation of the study. However, informal discussions with the students, during the research and design phase brought forth their understanding about the needs of various user groups. Inclusive design strategies incorporated by the students in their designs also evinced their learnings. Research can be carried out by collecting data on the use of the research studies in design development and issue identification, using structured survey instrument.

Conclusion

Sensitising the designers about the concepts of accessible and inclusive environments can be best done at the schools of design. A rationale approach of research to understand the needs of various user groups is required, rather than to presume the requirements of the users. Small but significant research

studies can contribute meaningfully in the process of design of the built environments. The research-oriented paradigm of teaching (Roberts, 2007) used in the three cases helped the students to learn research skills, use them in the design process and apply the findings. For example, as illustrated in figure 3, the student planned facilities and spaces in a home for the elderly. The discovery in this paper supports the finding by Hitch, Dell and Larkin (2016) that education around universal design may promote more positive attitudes towards people with a disability for architecture students.

Inclusive environments enable participation of people with different disabilities or various social groups. A limited view of the idea of accessible design as providing physical accessibility features like ramps or railings can be apathetic to the visually disabled persons. The psycho-social outlook for creating design intent and a program is essential, and it is only possible using the empathetic model (Nicolle & Maguire, 2003) of teaching.

Acknowledgement

The author is thankful to Ms Sarvari Harpale who shared drawings and findings from her design thesis on Orphanage [Figure 4,5] and Ms Karishma Joshi who shared drawings from her architectural design project on Home for Elderly [figure 3], and allowing them to be part of the illustrations for this paper.

References

[1] Bashier, F. (2014). Reflections on architectural design education: The return of the rationalism in the studio. *Frontiers of Architectural Research, 3*, 424-430. https://doi.org/10.1016/j.foar.2014.08.004

[2] Berleant, A. (1988). Aesthetic Perception in Environmental Design. In J. L. Nasar, *Envrionmental Aesthetics : Theory, Research and Applications* (pp. 84-97). Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511571213.010

[3] Boyer, E. L., & Mitgang, L. D. (1996). *Building Community: A new future for architecture education and practice*. New Jersey: The Carnegie Foundation.

[4] Chakravarti, P. (1993). Learning from Ordinary Places. *Ekistics, 60* (1), 305-308.

[5] Francis, M. (2001). A Case Study Method for Landscape Architecture. *Landscape Journal, 20* (1), 15-29. https://doi.org/10.3368/lj.20.1.15

[6] Groat, L., & Wang, D. (2002). *Architectural Research Methods*. NY: John Wiley and Sons Inc.

[7] Hitch, D., Dell, K & Larkin, H. (2016). Does Universal Design Educaiton Impact on the Attitudes of the Architecture Students towards People with Disability. *Journal of Accessibility and Design for All*, 6(1), 26-48. DOI: 10.17411/jacces.v6i1.103

[8] Heylighen, A., Doren, C. V., & Vermeersch, P. W. (2013). Enriching our Understanding of Architecture through Disability Experience. *Open House , 38* (1), 7-19.

[9] Kroemner, K. (2006). *Extra Ordinary Ergonomics - How to accomodate small and big persons, the disabled and elderly, expectant mothers and children.* Boca Raton: Taylor and Francis.

[10] Laurie, M. (1975). *An Introduction to Landscape Architecture*. New York: American Elsivier Pub. Co. In.

[11] Lindel, M. (1991). The Living Environment. In M. Shaw, *The Challenge of Aging [2nd Ed.]*. London: Churchill Livingstone.

[12] Morrow, R. (2002). *Building and Sustaining a Learning Environment for Inclusive Design: A Framework for teaching inclusive design within built environment courses in the UK. Online: Centre for Education in the Built Environment*. Retrieved from Queens University Belfast Research Portal: https://pure.qub.ac.uk/ws/files/13453576/CEBE_Building_and_Sustaining_a_Learning_environment_for_inclusive_design_full_report.pdf

[13] Mostafa, M. (2013). Expanding Normal: Towards a More Inclusive Approach to Designing the Built Environment. *Open House, 38* (1), 4-6.

[14] Nicolle, C., & Maguire, M. (2003). *Empathic Modelling in Teaching Design for All*. Retrieved October 18, 2018, from https://dspace.lboro.ac.uk:

https://dspace.lboro.ac.uk/dspace-jspui/bitstream/2134/722/1/PUB184%20Empathic%20Modelling.pdf

[15] Pallasmaa, J. (2009). *The Thinking Hand: Existential and Embodied Wisdom in Architecture*. London: John Wiley and Sons Ltd.

[16] Roberts, A. (2007). The Link between Research and Teaching in Architecture. *Journal of Education in the Built Environment, 2* (2), 3-20. https://doi.org/10.11120/jebe.2007.02020003

[17] Rutledge, A. J. (1985). *A Visual Approach to Park Design*. NY: John Wiley and Sons.

[18] Savitribai Phule Pune University. (2015, 12 1). *3-4-5 Detailed Syllabus [Annexure A]*. Retrieved from www.unipune.ac.in: http://collegecirculars.unipune.ac.in/sites/documents/Syllabus%202017/3-4-5%20Detailed%20Syllabus%20[Annexure%20A].pdf

[19] Teklenburg, J., Zacharias, J., John, H., & Teresa, V. (1996, August 3). *Spatial Analysis in Environment Behavior Studies : Topics and Trends*. Retrieved March 12, 2001, from IAPS 14 Conference - Evolving Envrionmental Ideals, Chaning Ways of life, values and Design Practices: www.bwk.tue.nl/bwk/urb/p/Jan/Spatial.htm

Journal of Accessibility and Design for All

Volume 10, Issue 2. (CC) JACCES, 2020. ISSN: 2013-7087

©© Journal of Accessibility and Design for All, 2020 (www.jacces.org)

This work is licensed under an Attribution-Non Commercial 4.0 International Creative Commons License. Readers are allowed to read, download, copy, redistribute, print, search, or link to the full texts of the articles, or use them for any other lawful purpose, giving appropriated credit. It must not be used for commercial purposes. To see the complete license contents, please visit http://creativecommons.org/licenses/by-nc/4.0/.

JACCES is committed to providing accessible publication to all, regardless of technology or ability. Present document grants strong accessibility since it applies to WCAG 2.0 and PDF/UA recommendations. Evaluation tool used has been Adobe Acrobat® Accessibility Checker. If you encounter problems accessing content of this document, you can contact us at jacces@catac.upc.edu.

Natu, A. (2020). Integrating behavioural research in undergraduate design studio in architecture for designing inclusive environments. Journal of Accessibility and Design for All, 10(2), 209-228. https://doi.org/10.17411/jacces.v10i2.231