JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Construction System Models Deepen Design Sensibilities in Formative Design Studios

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Abstract:

The first-year studio is the most challenging of all the years as the students have to be encouraged to develop certain traits very crucial for designers. Particularly the pedagogy followed in the Design studios sets the learning curve for the students and is thus very crucial to be framed very cautiously. In this respect the challenges typical to the learning in this formative year of architectural education is being discussed and then in the Experimental studio methods to mitigate the same are outlined. It is found that Physical Construction System Models used not as end product as per most conventional studios but as a mode for Design Development from the beginning has deepened the Design Sensibilities of the students in all aspects including response to cultural context, development of independent logical thinking, Ability to Appreciate the relation of building technology, structural integrity and Design development as interdependent, appreciation and appropriate application of improvised vernacular systems of construction. The Process of Design Development as followed in the studio in both groups and individual capacity have showcased better Peer learning and self-motivated learning aptitude in students. Thus, Construction system models can be considered as a crucial tool for developing Design Sensibilities in Students in Formative years of Architectural Education and can be further explored in future research.

Key Words: Physical Models, Construction systems, Vernacular architecture, Design Studio

Introduction:

Design pedagogy has been researched upon since decades now and yet there are no defined fixed methods illustrated. In fact, the flexibility and dynamic nature of architectural pedagogy is its merit. The first-year studio is the most challenging of all the years as the students have to be encouraged to develop certain traits very crucial for designers right from this formative year of Architectural education. Particularly the pedagogy followed in the Design studios sets the learning curve for the students and is thus very crucial to be framed very cautiously. Design develops within a collaborative environment in which there is the free play of enabling metaphors (Richard Coyne, 1994) A holistic

way of design thinking encourages students to deal with the uncertainties and to manipulate the paradoxes of design issues, and are motivated to transform their creative thinking into critical thinking (AKPINAR, 2003) but, this is a complex process and way of thinking and is often found to be difficult for the first-year students leaving them overwhelmed and confused. If we are interested in producing an architectural citizen, a person interested in contributing to civic life via her/his skills as an architect, then the entire process of the studio teaching - needs to be examined (Deamer, 2005).

Thus, before framing of the pedagogical approach giving way to the intent of the Design studio and the process, it was felt essential to understand and define the challenges of the First Year Design Studio

The Challenges of first year Studio:

Development of independent logical thinking

Successful architects cannot survive the competition without critical thinking skills, interpersonal skills, and communication skills, all of which can be developed by ability to reason logically for establishing a practical argument (JOHN V. YANIK, 2000). This practical argument can be well grounded if the Design problem is in a context sensitive real life setting instead of a hypothetical setting posing real challenges to students and pushing them to conceptualize real practical arguments based on logical thinking.

Visual perception from 2D to 3D and vice versa

Traditional beginning design studios take students outside the world of their experience by teaching representation strategies that rely on abstraction (LIN, 2012) but, as discussed earlier this is a complex process and way of thinking and is often found to be difficult for the first-year students leaving them overwhelmed and confused. The visualization skills develop better with time and are thus are most challenging at the first step of formal education in Architecture – First Year. Reliance on Physical Models for visualization to apprehend sense of scale and proportion, material dexterity, volumetric play is thus most suitable. Thus the reverse order of making physical models for Design development as against sketching or making plans was encouraged in the studio. The conversion of 3D to 2D drawings by simply 'seeing' and 'drawing' from the completed models was implemented.

Ability to Appreciate the relation of building technology, structural integrity and Design development as interdependent

Materials are the media of architecture and the properties of materials, alone and in combination, are basic to design thus an education in building technology must attempt to integrate design and construction for the student (Reno, 1992). Thus, Integrating Material Culture is defined by the notion of material research as a process of innovation in design (Margolis, 2006)

It has become increasingly important for students of architecture to be aware of what the construction process thus, focusing on method of design that responds to construction processes, is essential to the pedagogy of future design (Erlandson, 1997)

Learning of the Structural concepts to the first-year architectural design studio clearly emphasizes on structures as fundamental to both the design process and architectural expression. At the Illinois Institute of Technology, modeling techniques and large-scale installations help students develop a visual and tacit structural intelligence and develops greater interest in structural systems as a design concern (WETZEL, 2012).

Thus, physical modelling demonstrating construction systems in specified material culture and structural design are highly recommended and tested catalyst for design development. In this studio we stressed on it further and entire design development was undertaken through modelling.

Ability to Develop Rooted culture responsive contextual design

Approach to understanding history and theory, context should not merely replicate art historical approaches but should be capable of treating the specific issues raised by design, from its imbrication in material and economic networks to questions of sustainability and environmental impact, determinations of use (Bresnahan, 2015)

Architectural education is not simply the imparting of knowledge and skills necessary for practice, but involves the development of values and philosophical positions and it should emphasize on consideration of the social context, the local people and their social and human problems during the process of Design (Mazumdar, 1993)

Thus, ability to Develop Rooted Culture Responsive Contextual design is very crucial to be inculcated.

Appreciation of improvisation of vernacular building techniques

The University of Cincinnati defined a new design studio curriculum and recognized that architecture is an extending tradition (Meunier, 1980) Materials and building technologies support identifiable aesthetic qualities and manifest specific characters of form, space, and poetic experience (Kucker, 1997)

The creation of architecture that endures, rather than architecture that surrenders to the latest trend, is a crucial issue in the education of an architect and must therefore encompass both continuity and change to prepare students to meet the demands of the profession (Brady, 1996)

Thus appreciating vernacular as ever developing and not static and thereby appropriating it to the needs and aspirations of the people with the use of latest know how and technology is stressed upon in the studio as a culture.

Peer learning and self-motivated learning aptitude

A peer learning environment not only encourages students to discuss their work and any issues they maybe having in design development and communication but also builds a platform for sharing knowledge, experience, technical tips, ideas and expertise on learning in the studio (Wilson L. Z., 2015)

Peer tutors play a pivotal make a significant contribution to the development of a positive studio culture and the enhancement of a collaborative community of practice, and amplify students' engagement with iterative processes of design learning (Wilson, 2017)

Thus group works encouraging more peer interaction. Discussion and reliance on each other for learning has been encouraged in the studio.

The outlining of the challenges of the First Year learning gave way to the development of the Studio Intent.

Studio Intent:

The intent of the studio was to mitigate the challenges identified as typical in the formative first year of architectural education (as discussed in the previous section) through an appropriate process driven Design program. Hence, three major decisions were taken into account consciously while formulating the design brief for the studio program. Firstly, It was decided to introduce the design site as a context sensitive site having rich vernacular architecture of its own, thereby giving them an opportunity to respond sensibly to the cultural context and employ improvised vernacular techniques of building through secondary research sharpening their research skills at the foundation levels of education. Secondly, design development was to be undertaken by development of physical models of the designed buildings strictly and drawings were to follow suit in the very last month of the semester as against the typical reverse methodology of working in sketches and drawings and then developing the models post production of drawings followed in conventional studios. These models were to be made not only as a visually scaled look alike of the true designs but they were to follow the process of construction of the models similar to the processes followed in practice. This reliance on physical models of construction systems for design development right from the beginning ensured Appreciation of the interdependence of building technology and Design development, Development of independent logical thinking and strengthened their visual perception from 3D to 2D and vice versa. Thirdly, the students were to produce design solutions by working both in groups as well as at individual level ensuring strong peer learning and development of critical thinking and argumentative abilities most crucial for growth as a designer.

Keeping in consideration the intent of the studio the brief of the Design Studio was prepared. The culturally rich context of Bastar region of Chhattisgarh, India was chosen as having a strong vernacular building practice. The students were divided into six groups and were given six different public function buildings to be designed, creating two alternatives of design involving different improvised vernacular building techniques from each group. Thus, a total of 12 design solutions were to be worked out working in groups of 3 students per group. The building typologies chosen were as per the need of the rural context of the Bastar villages; a Rural bank, a Small elementary village school, a Primary Medical Care facility, a granary and village market, a crafts training cum exhibition facility, and a Local Panchayat cum community facility.

The outlining of the Studio Intent further helped in outlining the Process of Studio and its various stages.

Participants and contributors:

The Design studio which was analyzed post its culmination had a total of 36 students from First year, section A from the course of Bachelor of Architecture, University School of Architecture and Planning, Guru Gobind Singh Indraprastha University for the session of 2022-23.

Stages of studio

Study of Cultural Context of Site: The site for Design, Villages of Bastar region in Chhattisgarh, India are home to 70 percent Tribal communities such Gond, Muriya, Halba, Bhatra to name a few. The tribal communities are experts

in rare craft practices and showcase liberal cultural traits. (Chhattisgarh, n.d.). Each of these tribal communities has their sacred traditions closely linked to the natural resources and all activities including building activities are a reflection of the same. Each of the student groups chose one tribe to study as the target group for whom the Design would evolve, thus their preliminary secondary studies of the tribes brought to the forefront the relationships of their cultural practices to their needs of lifestyle and buildings.

Preparation of Area Program: The detailed area program of the six rural contextual building typologies were formulated by the groups of the student based on secondary research and case studies of similar facilities matching the scale and rural context. Parity was being maintained in terms of the scale of the building (approximately 3000 sqm) to be designed for different functions ensuring the same level of learning opportunity in class.

Research and selection of appropriate improvised vernacular construction system: Each of the twelve groups choose different systems of vernacular construction prevalent in the context or similar context. They studied and understood through class critical discussions and peer discussions that each system of construction involving specific materials has its own set of potentials and limitations. They further studied the improvised systems of these constructions being practiced by architects worldwide which overcome the disadvantages of these traditional construction styles by modern technological interventions. This stage of the study was intended to make students realize that vernacular architecture is not static and is ever-evolving for the future as per the changing needs of the people and the advancement in technology.

The above three stages of rigorous secondary study built a holistic understanding of the context and construction technologies to be adopted. The next stages involved the evolution of the design through Physical model-making based on the informed decisions formulated based on the secondary study stage.

Primary Study of Vernacular Construction Systems: Unfortunately, a scheduled study trip to the Bastar region had to be cancelled due to the sudden surge of Covid cases, thereby our dampening our plans of primary study of the vernacular structures and cultural setting at the site of Design. However, post the decline of Covid surge a study trip to a Museum housing full scaled vernacular houses from all over Indian States, The National Crafts Museum, New Delhi was being conducted where students documented and understood the vernacular construction techniques to Bastar Region and similar contexts as well. This was a crucial primary study which strengthened the understanding of their construction systems in terms of details of joinery, specifications and sizes of members used etc.

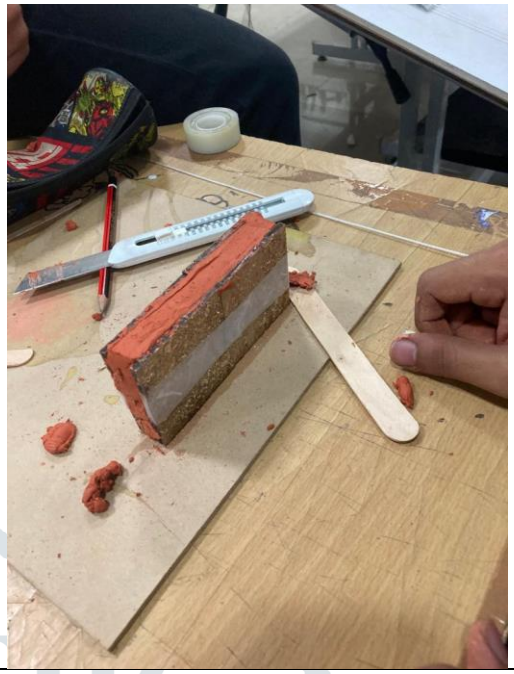

Figure 1 & 2 above: Initial process of walling techniques (Rammed earth) modelled as per the processes true to construction of ramming and building in sections of 1.2m high at one time, by the Students of control group (1A, USAP, GGSIPU, session 2022-23)

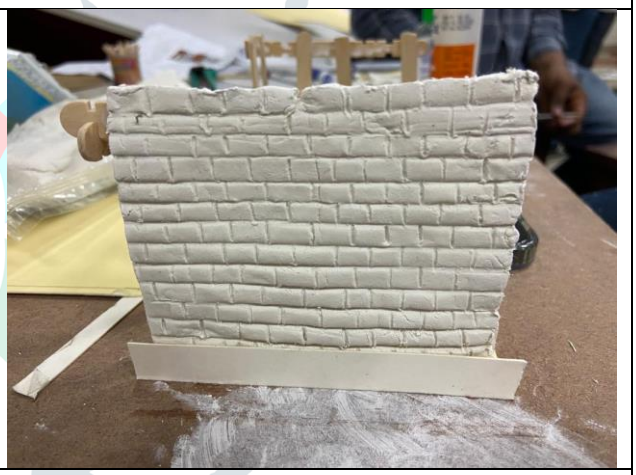

Figure 3 & 4 above: Initial process of walling techniques (Cob Walling Technique and Adobe walling technique) modelled as per the processes true to construction by the Students of control group (1A, USAP, GGSIPU, session 2022-23)

Figure 5 & 6 above: Initial process of walling techniques (Sun dried Adobe walling technique and Wattle and bamboo walling technique) modelled as per the processes true to construction by the Students of control group (1A, USAP, GGSIPU, session 2022-23)

Physical Construction System Modulation: The students started modulating their designs without producing drawings first. They carefully chose the materials for model making which would not only visually resemble the actual vernacular materials but also structurally behave the same way in the scaled model as the true materials would in buildings. The materials naturally found in the context of Bastar region and adopted by students were Mud, Bamboo, Timber, Thatch, etc. They studied different construction materials, for mud architecture cob walling techniques, rammed earth techniques, and adobe walling techniques were explored. For bamboo and timber construction, improvised versions of wattle and daub were experimented with. Similarly, different types of roofing systems with vernacular materials and techniques ranging from mud vaults, green roofs, bamboo trusses, and timber roofs were modeled to suit their requirements.

The process of modulation itself was great learning in terms of understanding the challenges of each process and pushed the students to find out alternative improvised processes of building with vernacular materials. It was an entire cyclic process of experimenting with models, stumbling upon challenges, researching better resolutions, and then improvising the models.

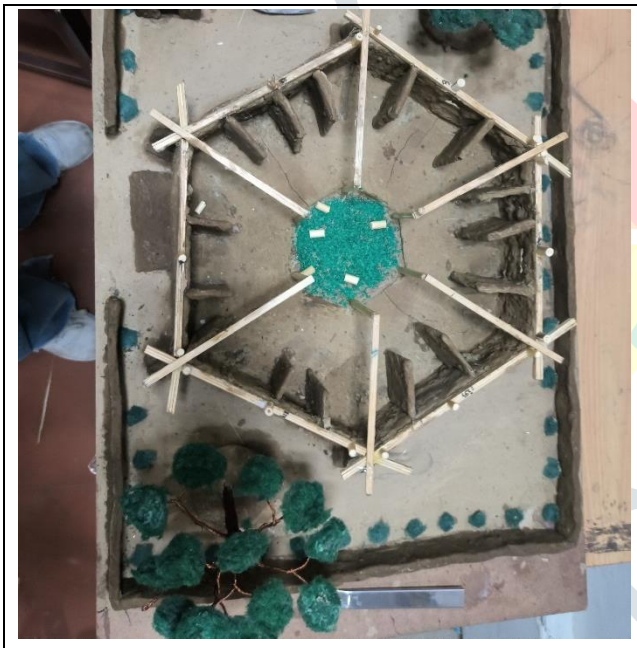

Figure 7 & 8 above: Finished models of rural bank in rammed earth with pylons and bamboo truss with thatch roof by the Students of control group (1A, USAP, GGSIPU, session 2022-23)


Figure 9 & 10 above: Finished models of rural bank in wattle and daub having mud vault roofing and panchayat office cum community facility in wood and dry stone masonry with bamboo light weight dome by the Students of control group (1A, USAP, GGSIPU, session 2022-23)


Figure 11& 12 above: Finished models of rural health care facility in improvised wattle and daub walling with wooden truss supporting a green roofing , model showcasing all the layers of roofing with a monitor roof admitting light and air by the Students of control group (1A, USAP, GGSIPU, session 2022-23)


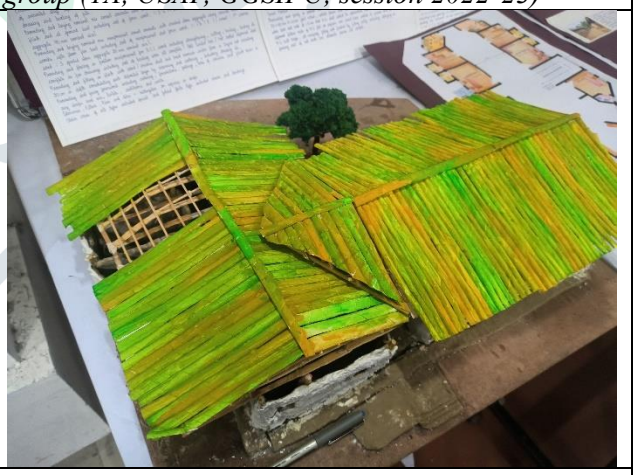

Figure 13& 14 above: Finished models of rural health care facility in mud walling with bamboo split layers as support on both sides having a bamboo truss supporting a flattened split bamboo roofing envelop by the students of control group (1A, USAP, GGSIPU, session 2022-23)


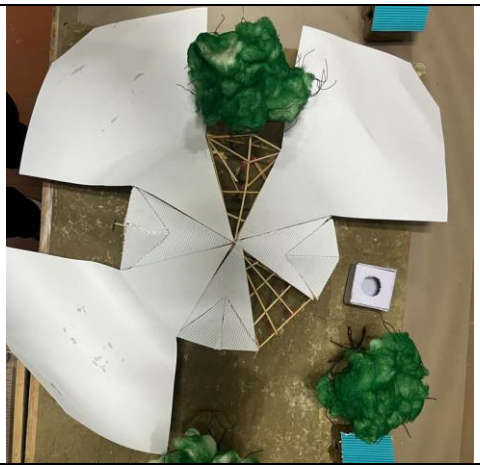

Figure 15& 16 above: Finished models of craft training facility in rammed earth walling with air catching shafts having bamboo truss supporting clay tiled roofing and rural granary and market in bamboo piers supporting a dynamic hyperboloid paraboloid bamboo roofing by the students of control group (1A, USAP, GGSIPU, session 2022-23)


Figure 17 & 18 above: Finished models of craft training facility in bamboo piers supporting a butterfly truss and bamboo mat envelop roof covering by the students of control group (1A, USAP, GGSIPU, session 2022-23)


Figure 19 & 20 above: Finished models of individual houses sensitively designed for particular cultural traits of the tribes of Bastar region in clusters by the students of control group (1A, USAP, GGSIPU, session 2022-23)

Drawing Stage: Post the design development of the Models to a mature level the students were advised to produce the drawings for the same. This stage of drawing was intentionally pushed to post-design development by the model. The students had a complete understanding of the Design and construction system details before they set themselves

to drafting the drawings for the buildings. Thus, their cognitive abilities to translate between two dimensions and three dimensions which is rather underdeveloped in the formative years were less challenged as they simply had to 'See' and 'Draw'. This made possible understanding of drawing of buildings much easier and apprehension simpler resulting in accurate drawings.

Individual House design in Cluster setting : Post the Design development of the public buildings in groups, individually students were encouraged to design vernacular Residences in the setting of a cluster belonging to the tribe they studied.

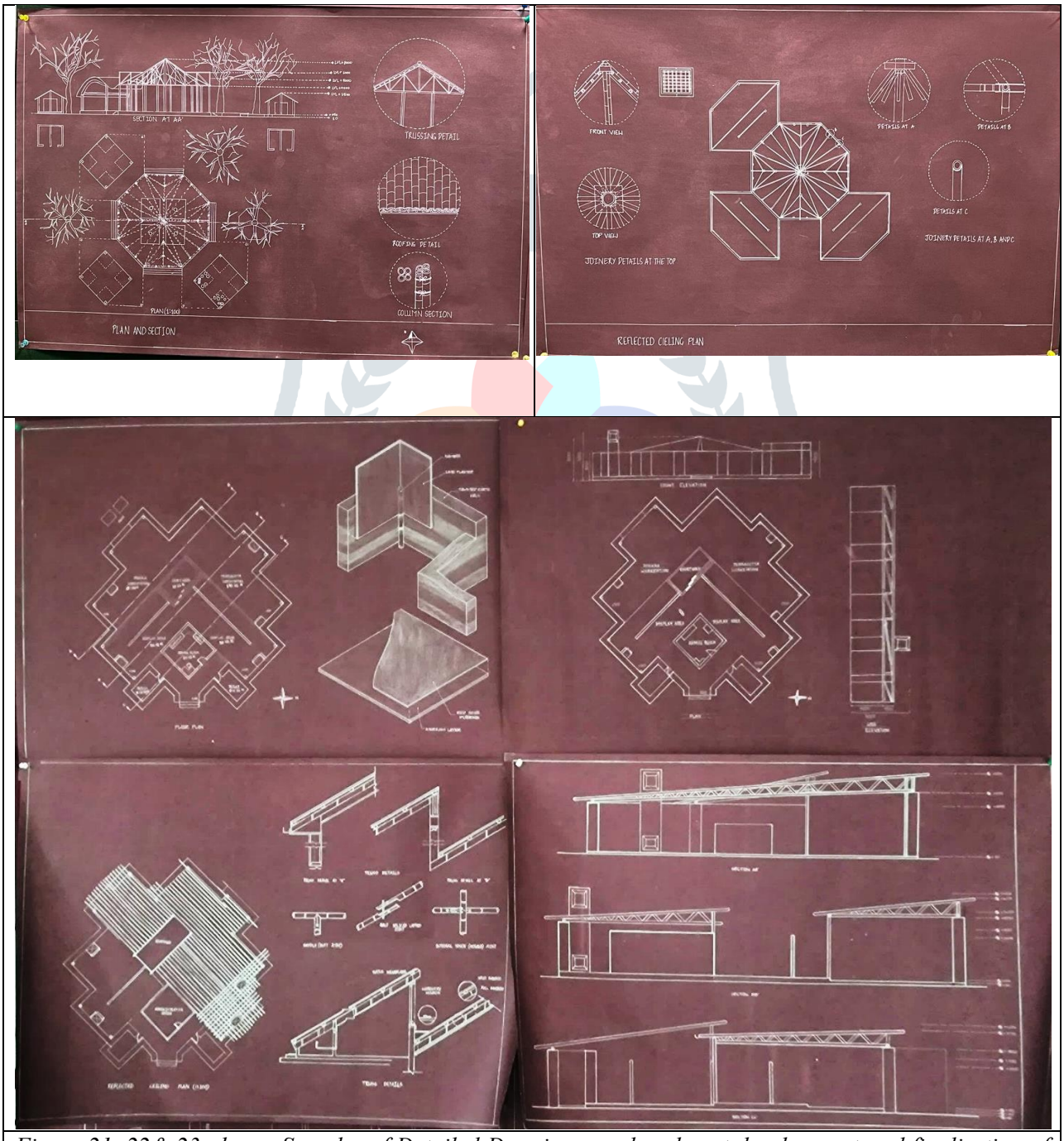

Figure 21 ,22& 23 above: Samples of Detailed Drawings produced post development and finalization of Design by modulation process by the students of control group (1A, USAP, GGSIPU, session 2022-23)

Discussion :

The entire studio was self-driven by students and proved to be very engaging and challenging for them ensuring that they were self-motivated at all times. The physical Construction system models and the process of Design Development through modelling instead of drawings was pivotal to this experimental studio pedagogy. In developing the models, itself the students developed a culture for research, developed sensibility towards the cultural and physical context as a designer, imbibed logical critical thinking, appreciated the interdependence of building technology and Design Development on each other, developed deeper understanding of structural factors for building design. It eased their process of production of drawings, understanding of the details and their learning greatly improved through peer discussions and support.

The analysis of the studio process clearly demarcates the significance of Process of Design Studios, the importance of integration of subjects like material and construction technology and understanding of structural aspects, and needless to say emphasizes on the crucial role played by physical models in the optimization of the learning process in the formative years of Architectural Education.

Acknowledgment:

Control group students of First year section A, USAP, GGSIPU in the academic session 2022-23.

Core Design Faculty of the control group of students from First year section A and my worthy colleagues Ar. Aditi Kundu, Assistant Professor, USAP, GGSIPU and Ar. Medha Sobti, Assistant Professor, USAP, GGSIPU Dean of University School of Architecture and Planning, GGSIPU

References:

AKPINAR, S. A. (2003). Heraclitus & the design studio. *ITU journal*.

Brady, D. A. (1996). The Education of an Architect: Continuity and Change. *Journal of Architectural Education*.

Bresnahan, K. (2015). Design Studies in Canada (and Beyond): The State of the Field. *Canadian Art Review*.

Chhattisgarh, G. o. (n.d.). *DISTRICT BASTAR History*. Retrieved from bastar.gov.in: https://bastar.gov.in/en/about-district/history/#:~:text=There%20are%2070%20percent%20tribal,%2C%20Tokapal%20%2CDarbha%20and%20Bastar.

Deamer, P. (2005). First Year: The Fictions of Studio Design. *The MIT Press*.

Erlandson, J. S. (1997). Primal Adaptation: Natural Selection in Construction. *Journal of Architectural Education*.

JOHN V. YANIK, B. L. (2000). Argument for Argument in Architectural Education. *Journal of Architectural Education*.

Kucker, P. (1997). Recognizing a (Fertile) Gap. *Journal of Architectural Education*.

LIN, T. (2012). Figure It In. *Journal of Architectural Education*.

Margolis, T. S. (2006). Integrating Material Culture. *Journal of Architectural Education*.

Mazumdar, S. (1993). Cultural Values in Architectural Education: An Example from India. *Journal of Architectural Education*.

Meunier, J. (1980). Teaching Design and Technology in the First Two Years. *JAE*.

Reno, J. (1992). Constructing Beginnings: A Role for Building Technology in Architectural Design Education. *Journal of Architectural Education*.

Richard Coyne, A. S. (1994). Metaphors in the Design Studio. *Journal of Architectural Education*.

WETZEL, C. (2012). Integrating Structures and Design in the First-Year Studio. *Journal of Architectural Education*.

Wilson, L. Z. (2015). Developing an embedded peer tutor program in design studio to support first year design students. *Journal of Peer Learning*.

Wilson, L. Z. (2017). "Conversation Leading to Progress": Student Perceptions of Peer Tutors' Contribution to Enhancing Creativity and Collaboration in a First Year Design Studio. *Journal of Peer Learning*.