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Art of Facilitating 'Problem-Driven Outcomes' in an Architectural Design Studio

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Abstract

Studies reveal that subjective knowledge and irrational creativity dominate architectural design studios in the current scenario. With an intention to facilitate 'problem-driven outcomes' in a design studio, we framed a series of tasks specific to the framed design problem planned. The tasks were introduced sequentially at the beginning of design studio. For this purpose, a design problem with a time frame of 12 weeks of focusing on 'multifunctional spaces' was introduced to two groups of students pursuing second-year architecture To examine the effectiveness of the strategy, 39 students participated voluntarily in framed tasks like 'story boards', 'reels to reality', 'collage' and 'dialogue between known and unknown context' to construct appropriate knowledge. Triangulation of qualitative and quantitative analysis of the emergent outcomes processes from three different perspectives was investigated. The performances of the two groups display a stark difference in problem structuring, design processes and the outcomes.

Keywords: Art, facilitate, effectiveness, design studio, problem-driven outcome.

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1. Introduction

'Constructivism is a theory about learning' and the facilitators need to have in-depth knowledge of the content and context for better outcomes (Fosnot, 2005). It helps the learners to internalise and transform new information, based on active involvement of students in learning process. It is strongly intertwined with the teachers' levels of involvement and reflections from both the ends are crucial (Cornu & Peters, 2005). Constructivism revolves around knowledge acquisition emphasising knowledge building amongst the learners and stimulates thinking for deeper understanding (Applefield, Huber & Moallem, 2001). It emphasises knowing as a process rather than knowledge as a product (Jones & Araje, 2002). The focus is on the ways through which students defend the outcomes that display the reasoning power and not on the responses (Pagan, 2006). Taber (2011) claims it to be both teacher directed and student centred. Hussain (2012) posits that the participants show enthusiasm in constructing knowledge through participating in various tasks. It is observed that constructivism and motivation are closely related (Palmer, 2005). It promotes the creation of multiple directions in diverse contexts (Vrasidas, n.d.). In architectural education, Kurt (2009) claims that constructively structured design studios yield appropriate, collaborative and shared design processes.

Design studio is the core in architectural pedagogy, which advocates 'learning by doing'. In the 18th century, Ecole des Beaux initiated the architectural design studio, which adopted theory in classroom and design in the studios. Fostering experiences to the next generation in evolving and developing the capacity to design built environment in context is the primary objective of architectural education (Demirbilek & Demirbilek, 2007). Design problem is introduced in studios and novices are facilitated to explore the design processes and creativity to evolve appropriate outcomes. Studies reveal that subjective knowledge and irrational creativity dominate architectural design studios.

In today's context, methods to foster 'creativity and rationality' simultaneously are the primary focus. Rationality in a design studio plays a vital role to understand the intricate systems in design projects (Bashier, 2014; Wade, 2010). Kruger and Cross (2006) posit that a deeper understanding and definition of the task always result in problem-driven outcomes and a quick scanning of the assignment with basic requirements end in solution driven outcomes.

Kahvecioglu (2007) posits that studio setting should enable creativity through different types of activities like workshops, work-trips, one-day-charettes, or casual studio programmes, competitions, etc., either individually or collectively, where the role of the studio instructor is significant. According to Eli (2013), the initial phase of a design studio needs to be poetic, promoting appropriate problem structuring in novices, where the role of the studio instructor and the relationship with young minds is critical. The desire of students and teachers also play a vital role in pedagogy (Franz, Lindquist, & Bitner, 2011). The design problem is determined by the kind of knowledge to be invested and the level of understanding (Pugnale & Parigi, 2012). Framing design brief is crucial as it sets the student out on a process of discovery (Orr, Yorke, & Blair, 2014), facilitating a paradigm of creativity that emphasises the ability of defining and transforming a puzzle (Celik & Aydinli, 2007). Motivating young minds in design studios is identified as a channel to constructivism (Eigbeonan, 2013). It is observed to stimulate the search for creative solutions based on scientific reasoning (Kowaltowski, Bianchi, & Paiva, 2010). In such a context, the role of the faculty is to plan activities that foster the novices to organise ideas around 'big ideas' and to connect them with their previous learning (Bhattacharjee, 2015).

Kurt (2011) proposes the strategies for a constructivist approach in design studios to improve the standards and quality of architectural education. The strategies are as follows: provide experience to students for construction of design knowledge, facilitate students to find alternative solutions to design problems through multiple perspectives, present learning activities in a realistic and relevant context, make learners feel themselves as the owner to the process and feel responsible for their learning, practice learning as a social activity, promote the students to use various representation modes, generate self-awareness, form self-motivated and self-reflective students, encourage to use

strategies and make students to be respectful to multiple perspectives. Irrespective of an optimistic view, Kirchner, Sweller, & Clark, 2006 argue that minimally guided instructions are ineffective as they result in failures.

With an intention that the constructivist approach in an architectural design studio as an apt method to facilitate creativity and rationality, we have adopted a series of collective and individual tasks for the students in the second-year specific to the framed design problem. The primary goal is to examine the effectiveness of the planned tasks, through observing the approaches, ideas, design processes, the experiences and outcomes qualitatively as well as quantitatively.

2. Method

A mixed method was adopted to comprehend the effectiveness of the planned activities (Creswell, 2003). Qualitative and quantitative techniques are combined or mixed while seeking a holistic understanding of a phenomenon (Onwuegbuzie, 2004; Venkatesh, Brown, & Bala, 2013). It provides richer insights into the phenomenon being investigated (Caruth, 2013). We adopted 'desk crit', 'group crit', 'interim' and 'formal review' in the design studio (Yeonjoo et al., 2013) to assess the outcomes continuously and regularly. Multiple evaluation methods need to be adopted to understand the learners' growth and thinking skills (Vrasidas, 2007). The assessment focuses on outcome, processes, hard skills, soft skills and learning style (Harpe & Peterson, 2008).

A qualitative component requires detailed perspectives of individuals (Curry, Nembhard, & Bradley, 2009). The primary focus is to capture the participants' views (Onwuegbuzie & Johnson, 2006). Closed- and open-ended questionnaires and classroom observations are the tools to examine the validity in qualitative studies (Heyvaert, Maes & Onghena, 2013; Zohrabi, 2013). Triangulation enhances the internal validity in qualitative studies (Meijer, Verloop & Beijard, 2002). It entails the collection of information about the same phenomenon through more than one method (Creswell & Miller, 2000; Kopinak, 1999). Design processes by each student were continuously observed to establish reliability (Golafshani, 2003). Data integration requires a clear rationale and is always a matter of innovation (Bryman, 2006, 2007; Fielding, 2012).

The emergent outcomes were assessed by experts with a minimum of 15 years of experience. The design process was evaluated during the third, eighth and the eleventh week. Three architects with a minimum of 8 years of experience were invited regularly to review the design at three different stages. The designs by two groups were monitored, discussed and reviewed weekly by two different pairs of internal faculty members at the Department of Architecture, Sathyabama University. Site analysis, conceptual sketches and study models were expected deliverables during the first stage. The second stage revolved around the three-dimensioned thinking and conceptual ideas and approaches, schematic site plan, floor plans, sections, schematic elevations and the third was on the design development, associated detailed drawings and models, respectively. When external members were invited for review, the students from the two groups were mixed randomly in equal numbers. The weightage for the overall internal and external component is the same so as to give equal importance to both the process and outcomes. With respect to external evaluation, the proportion to assess the design process at three stages and the overall impression score is the same. To examine the reliability between various inter-raters, the method developed by Dorst and Cross (2001) is adopted. The qualitative analysis on the planned activities, design problem and emergent outcomes based on the capacity of the spaces to transform in an unknown context and the respective classification such as problem-driven and solution driven is interpreted as in Figure 1.

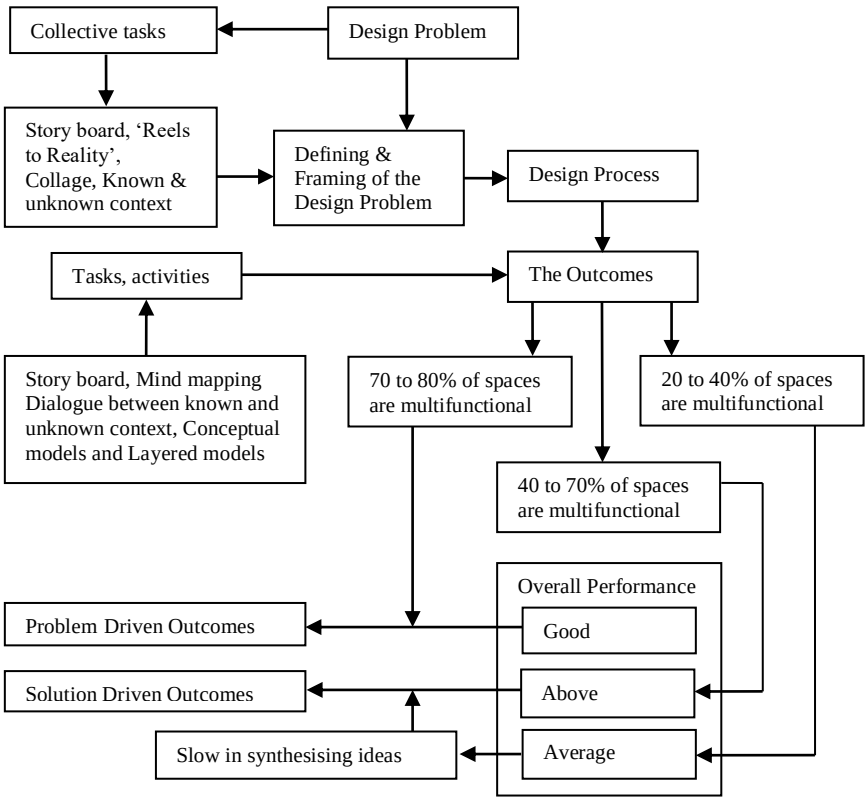

Figure 1. Interpreting the emergent outcomes

2.1. The Design Problem

A design brief 'Transition centre' (see Appendix A), primarily a youth hostel revolving around 'flexible and multifunctional spaces' was framed with a time frame of three months addressing 'Chennai floods 2015'. The primary objective of the design problem was to explore the degree of flexibility in spatial organisation, circulation, built form, response to site and how it would be transformed, used in an unknown future. Four sites were identified within the city boundary with an area of approximately one acre were identified for the design studio. Students were given flexibility to add on additional facilities according to the respective problem structuring.

2.1.1. Participants

The design problem was introduced as part of Design Studio IV at Department of Architecture, Sathyabama University, India. The design task was introduced to seventy eight students (Girls -54; boys – 24; average age -19 years). However, only 39 students (Girls-32; boys-7; average age – 19 years) participated in the planned tasks and activities voluntarily.

2.1.2. Data Collection

The outcomes by 78 outcomes were analysed quantitatively on a 10-point scale by three groups. Two intra-raters assessed the design process every week. In addition, the ideas, approaches and the design were continuously assessed by three practicing architects with a minimum experience of 7 years, thrice within the stipulated timeframe. Finally, the emergent outcomes along with the think maps, design processes along with layered and block models were examined by three external members with a minimum of 15 years of experience. In addition, we analysed the outcomes

qualitatively by interpreting the level of multifunctional and flexible concepts incorporated by novices. Structured questionnaires were obtained from the 39 students who participated in the series of tasks to gather the experiences, strategies adopted in their design and deliverables at the end of 3 months just before their final jury as part of the self-reflective processes (see Appendix B).

3. The Emergent Outcomes

It is observed that with respect to group I, only one-tenth of the outcomes are considered to be problem driven. Nearly half the outcomes fall under the solution-driven approaches. The remaining was information driven as the students were slow in synthesising the appropriate ideas within the stipulated time. However, with respect to group II, the problem-driven outcomes are approximately three and half times more than the other group. Solution-driven outcomes are only 5% more than the problem-driven outcomes and only one-fifth of the outcomes were information driven, which when compared to group I is lesser by 50% as in Figure 2.

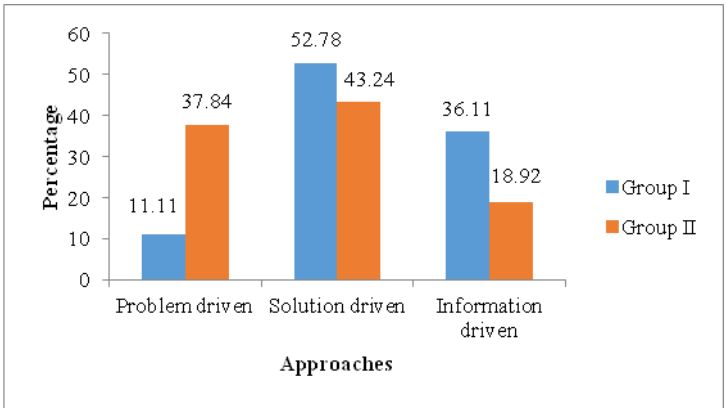

Figure 2. Interpreting the emergent outcomes

3.1. Assessing the Framed Activities from the Participant's Perspective

All tables should be numbered with Arabic numerals. Headings should be placed above tables, underlined and centred. To evaluate the degree involvement in the framed activities and the learning factor, participants' response to questions the framed activities were incorporated in the questionnaire (See Appendix B). Most of the students who participated in the activities responded very high and high degree of involvement with 'story board' (25.64% + 28.46% = 64.1%), 'reels to reality' (30.77% + 41.02%=71.79%), 'collage on multifunctional spaces' (25.64% + 48.72% = 74.36%) and 'known versus unknown context' (41.03% + 33.33% = 74.36%) as in Table 1.

Table 1. Students response rate on degree of involvement on the framed activities

Framed activities	Percentage of agreement				
	Very high	High	Moderate	Low	Very low
Story board	25.64	38.46	35.9	-	-
Reels to reality	30.77	41.02	25.65	2.56	-
Collage on multifunctional	25.64	48.72	25.64	-	-
spaces	41.03	33.33	25.64	-	-
Known versus unknown					

A qualitative study on the outcomes by the students who participated in the framed activities is consolidated as in Table 2. The findings display a comprehensive understanding of 'disaster', psychology and the needs of the victims in unknown situations and how the existing spaces are used in such contexts.

Table 2. Qualitative study on the emergent outcomes from the framed activities

Task 1: Story board on 'DISASTER'
A pictorial representation of life under normal conditions, during and post floods in an urban context. Importance of storm water drains, rain water drainage and how public buildings were effectively used to handle such situations. The essence of 'equality' in nature's eyes, addressed the natural disasters like flood, earthquake, tsunami, hurricane, cyclone. Graphical expressions on the problems related with telecommunication, epidemics, scarce of the day-to-day needs. Different modes of rescuing disaster struck victims. Different ways through which the disaster struck victims were rescued. Alternative spaces where the people moved during floods and the nightmare they underwent. Reasons for the occurrence of natural disaster.
Task 2: Reels to reality 'Movies and cartoons'
Emotions of people – fear, panic, tears, helpless, mentally disturbed, stress, depression, hunger, hopeless, worried, anger, pain, hurt, physically down, silent, anxious and anger Basics to be provided – food, shelter, drinking water, clothing, toilets, first aid, enquiry centres, medicines, blankets and counselling Use of public spaces – collection of commodities, segregation and distribution of goods, registration of volunteers, disposal of waste, rescue squads and medical camps
Task 3: Collage on 'Multifunctional spaces'
Relief and rescue initiative by individuals and Non-Governmental Organisations. Using community halls, stadium, bus terminus, religious buildings, malls and schools for segregation of goods for distributing to the victims. Hotels opening kitchens to cook for the community and people living on terraces. Organisation of medical camps at railways stations and educational institutions. Boats and helicopters to rescue victims and to distribute goods. Lorry containers were used as alternate living areas.
Task 4: Known versus unknown context
Brainstorming exercise on how different spaces single bedrooms, double bed/twin sharing, 4 in one room, dormitory , lobby, administration office, multipurpose hall, Indoor and outdoor recreation space kitchen and dining hall and open spaces can be used for different uses in an unknown context
Areas identified – Educational institutions, theatres, malls, religious spaces, hostels, hospitals, play grounds and community halls.

The level of learning was assessed by each student who participated voluntarily in the framed tasks as in Table 3. It is observed that these activities have fostered certain level of understanding about the design problem which will be integrated from the conceptual stage onwards.

Table 3. Students' response rate at the level of learning from the framed activities

Framed activities	**Percentage of agreement**		
	Deeper	**Moderate**	**Superficial**
Story board	38.46	58.98	2.56
Reels to reality	64.1	33.33	2.56
Collage on multifunctional	41.02	58.98	-
spaces	58.98	41.02	-
Known versus unknown			

Diverse perspectives on integrating the series of activities as part of the 'Design studio', skills developed and self-realisation about directions are interpreted from the questionnaire and consolidated as in Table 4.

Table 4. Reflections on 'design studio' and 'self-realisation'

Design studio	Unique, filled with fun, stress free, interesting, interactive, use and user centred, transformation of spaces, fostered clarity on thinking, time management, visual presentation techniques, importance of the context, three dimensional thinking, need for intrinsic motivation and involvement
Skills developed	Model making, communication, learnt to work in groups, sketching, creativity, involvement, determination, time management and thinking skills
An insight to the 'SELF'	'Need to work hard', 'I am good at model making and sketching', 'Found it difficult to work in groups', 'Need to be unique always', 'improved my thinking skills', 'improved my drafting skills', 'involvement is important', 'need to design in context', 'time management is crucial', 'need to develop visual representation skills', 'interpreting the design brief is important' and 'intrinsic motivation is crucial'

3.2. Problem-Driven Outcomes

The various outcomes were studied qualitative according to the transformation and flexibility spaces in an unknown context. The ideas adopted by the students are consolidated as in Table 5. The task 'known and unknown context', facilitated the students in mapping the design processes as well as the conceptual mapping of design ideas. In order to reflect the learners' domain knowledge in context, think maps (Oxman, 2004) were graphically done to present the ideas to the external jury.

Table 5. Ideas in problem-driven outcomes

Flexible space, wide corridors, raised plinth, stilts, movable/foldable partitions, larger rooms like dormitories and multipurpose halls in the ground floor, connecting the indoor and outdoor spaces at the ground level, kinetic structures, flat terraces, public and private dining, rentable spaces for community activities, different typologies of rooms and hydraulics to raise the floor level, community toilets	
Known context	**Unknown context**
Reception	Information desk, enquiry counter, waiting space for donators, help desk, report or registration counter, area for public addressing
Administration	Fund collection, collection and consolidation of data, management of materials, coordination of activities
Rooms	Single or double rooms – accommodation for volunteers, flexible spaces. Four in one rooms or dormitories – accommodate more individuals
Courtyard (covered/semi covered)	Congregation space, distribution of commodities, to organise medical camps
Corridors	Wide corridors to accommodate other activities
Restrooms	Private and public
Multipurpose hall	Accommodation, storage and segregation of commodities, distribution of goods, counselling, first aid facilities
Community kitchen	Cooking for the victims
Open areas	Organise medical camps, to locate emergency shelters, parking for the vehicles bringing in goods and community activities

4. Conclusion and Discussion

The inter-rater reliability between the overall internal and external assessment display values ranging from moderate to strong relationship as in Table 6. It is observed that four values are below 0.7, which is due to the mixing of the students in equal numbers from both the groups.

Table 6. Inter-rater reliability between the overall internal and external assessment

Group	Panel I (A)	Panel II (B)	Panel III(C)
I	0.62	0.55	0.68
II	0.78	0.66	0.86

However, a detailed study of the assessments during the design process by the internals and the externals at three different stages displays weak, moderate and strong relationships in different combinations as in Table 7. Inconsistent work, poor time management, inadequate problem structuring, level of understanding are the identified reasons.

Table 7. Inter-rater reliability between the internal and external at three stages as part of continuous assessment

Inter-raters	Group	Review I	Review II	Review III
Panel A	I	0.01	0.45	0.59
Panel B	II	0.39	0.66	−0.31
	I	0.58	0.78	0.9
Panel C	II	0.55	0.68	0.41
	I	0.72	0.45	0.46
	II	0.82	0.29	0.73

Similarly, the reliability between the external assessment in three stages and the overall impression score also display inconsistency in the design process as in Table 8.

Table 8. Inter-rater reliability between three phases and the total impression score by externals

Inter-raters	Group	Review I	Review II	Review III
Panel A	I	0.11	−0.15	−0.12
	II	0.63	0.85	−0.29
Panel B	I	0.37	0.68	0.64
	II	0.43	0.51	0.43
Panel C	I	0.05	0.39	0.53
	II	0.58	0.54	−0.74

The analysis of the students' performance whose outcomes were classified as 'problem driven' portrays three distinct categories. Consistent performances in a minimum of two–four reviews were observed to fall under this nomenclature as in Table 9, where the circles located lower to the others represent a mediocre performance and the other circles denote a good performance, whereas the grey circles located at the end of the line represent the overall performance in three months. The alphabets 'G' and 'M' denote a good and a mediocre performance respectively. The degree of performance at four stages is decoded, consolidated and interpreted as in Table 9.

Table 9. Performance of students with respect to four reviews and the overall impression

G-G-G-G-G	5G	Consistent (1)
M-G-G-G-G	1M + 4G	Almost consistent
G-M-G-G-G		(4/5)
G-G-M-G-G		
M-M-G-G-G	2M + 3G	Partially consistent
G-G-M-M-G		(3/5)

It is observed that the outcomes with 70%–80% of transformable spaces display appropriate problem structuring, however, only 37.84% of outcomes by the students who voluntarily participated in the planned activities are categorised as problem-driven outcomes. Participation in the activities like the story board on disaster, reels to reality, multifunctional spaces and known versus unknown context have made the students to understand different dimensions of 'transformable' spaces.

We posit that framing a series of tasks associated with the problem brief requires a deeper understanding by the design faculty first. Framing of appropriate tasks are based on the kind of knowledge and levels of understanding we wanted to invest amongst the novices is effective in fostering 'creativity and rationality' in design studio. The findings reveal that the identified direction is effective when compared with the traditional methodology adopted in design studios. The framed tasks and the related activities improved the hard skills, soft skills and learning styles.

This study portrays that design problems are partly determined, under determined and undetermined reinstating the postulate by Dorst (2003). The different aspects of the design problem is be explored only through intensive engagement by the studio instructors as well as the novices. The study stresses that 'reflections' from both the teachers' and students' perspectives play a crucial role in constructivist design studios. Students explore the design process and the outcomes, whereas the teachers examine the implications of the methods adopted to invest creativity and rationality in design studios. The degree of appropriate problem structuring by novices is directly proportional to level of involvement and the inner strengths of the studio instructors, the teaching methodology adopted as well as the relationship with the students. This gives directions to investigate the roles and interests of teachers adopting constructivist pedagogy in architectural education as it is both teachers directed and student centred. It is established that adopting constructivist approaches in architectural education is promising when compared with a traditional studio. Diverse ways to incorporate constructivist strategies in architectural education need to be further studied.

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Appendix A. Transition Centre - A Public and Private Realm

'Design for the present with an awareness of the past for a FUTURE which is essentially unknown'
– Norman Foster

Objective: To explore the degree of flexibility in spatial organisation, circulation, built form, response to site, typology and the unknown future.

Disaster is a sudden accident or a natural catastrophe that causes great damage or loss of life. It may be an event or fact that has unfortunate consequences. Calamitous, distressing or ruinous effects of a disastrous event (such as flood, fire, hurricane, earthquake, break of epidemics, etc.) of such scale that they disrupt (or threaten to disrupt) critical functions of an organisation, society or system, for a

period long enough to significantly harm it or cause its failure. A society or community experiences potential losses in the existing social, economic, political, cultural, technical and environmental conditions. To manage these unexpected scenarios, there is an utmost need to be proactive in diverse aspects. It is in this context that the approach to design need to be reframed with 'multi-functional spaces' as the primary objective.

A multi-functional space can be described as a true integration of different functions in time and space. Within communities creates spaces that have multiple purposes. Due to their access to diverse uses in one place, these spaces can contribute to a community's vitality. Also, these multi-functional amenities often appeal to diverse community members, including activists, artists, academics and social entrepreneurs, allowing them to act as incubators for new ideas, knowledge exchange, shared experience and experimentation.

'Transition' – 'an in between state' is defined as the connecting space between two confined spaces. In the current context, 'Transition centre' is observed to be a human-centred, interdisciplinary process that seeks to create desirable and sustainable transformations in the built environment, making it suitable to meet the unforeseen situations in reality. Even though the design task is about accommodating young travellers in normal conditions, the spaces must be evolved focusing on flexible use of spaces offering security, safety for the private and public users in unexpected scenarios.

Programme (for 50 males and 50 females)

Single bed (leaders, individual)-2 Nos with attached toilet

Double bed/Twin sharing- 6 Nos; 4 in one room – 4 Nos; 2 Dormitory – 10Nos with toilets

Lobby/Admin office/Multipurpose hall /Indoor and outdoor recreation space

Kitchen and dining hall – Capacity 40 Nos for in house occupants / Capacity 20 Nos for public

Community Canteen; Wash Room; Public Toilets; Open spaces

Appendix B. Reflections on Design Studio IV

Name: Age:

1) What did you understand from the following collective activities?

Collective activities	Reflection
Story board on disaster	
Reels to reality	
Collage on 'multiuse spaces'	
Dialogue between the known and unknown context	

2) Clarity in understanding – disaster, multifunctional spaces, psychology of disaster struck people

Collective activities	Deeper	Moderate	Superficial
Story board on disaster			
Reels to reality			

Collage on 'multiuse spaces'
Dialogue between known and unknown contexts

3) Opinions on the degree of 'YOUR' involvement

Collective activities	Very high	high	Moderate	Poor	Very poor
Story board on disaster					
Reels to reality					
Collage on 'multiuse spaces'					
Dialogue between known and unknown contexts					
Mind mapping					

4) Describe 'YOUR' innovative approaches to the framed problem.

5) Use 'Key words' to portray YOUR concept, approaches and design.

6) Successful completion of deliverables by individuals

Deliverables	Completed
Story board for concept	
Mind mapping	
Block model	
Dialogue between known and unknown contexts	
Layered models	

7) Unknown context and associated functions

Known context	Unknown context	Is it reflected in your design?
Reception		
Administration		
Rooms		
Courtyard		
Corridor		
Multi-purpose halls		
Community kitchen		
Dining		
Open spaces		

8) Strategies adopted in 'YOUR' design.

Ideas	Strategies adopted
Flexible spaces	
Extension of spaces	

9) Learning experience in Design studio IV

10) Tick the skills developed and feel to add on.....

Sketching	Communication	Appropriate ideas
Reading	Ability to work in groups	
Model making	Unique	
Interpretation	Visualisation	

11) What did you discover about 'YOURSELF' in the process?

12) Any suggestions on the design method adopted?