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Exploring Spatial Comprehension In Architectural Education

The Role of form and grid in studio Pedagogy

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Abstract: The Foundational Design Studio is an important first stepping stone for first-year architecture students, giving them a broad introduction to basic design principles, such as but not limited to form, space, order, and human scale. This study explores the importance of including hands-on exercises in the education of fundamental architectural concepts, particularly highlighting the investigation of forms and grids. Through the formal workshop framework, students become actively engaged with exercises that incorporate exploration of spatiality, anthropometry, and design fundamentals in the detailed creation and analysis of a 2m x 2m x 2m grid. Through shared exercise, learners can analyze how different activities affect space arrangements, which culminate in the development of scaled models that facilitate the understanding of form transformation from basic geometric forms to more organic and fluid ones. Through this detailed exploration, the central function of grids in structuring space is revealed, enabling students to contribute to issues of proportions, modularity, and the interaction of people with engineered spaces. The ongoing process of modeling and experimentation works to advance students' understanding of architectural visualization methods and the dynamic interaction of space. In addition, the results clearly prove that interactive learning experiences through experiential exercises promote a greater degree of critical thinking, creativity, and innate understanding of spatial relationships than is possible through more conventional lecture-driven instruction. Technically, the final results of this research accentuate the extremely valuable gain produced by implementing practical workshops in architectural curricula because it allows students to develop their skills in imagining, manipulating, and perfecting design ideas with unprecedented effectiveness.

Index Terms - forms and grids, hands on workshop, basic forms, fluid forms, activities

I. INTRODUCTION

The foundational design studio is a critical entry point into architectural education, where students begin their journey of understanding design principles and spatial relationships. This studio focuses on exploring core concepts such as form, space, order, and human scale through hands-on exercises and creative experimentation. Students are introduced to iterative design processes, learning to represent ideas through sketches, models, and digital tools while engaging in discussions and critiques that refine their understanding. By integrating creativity with technical skills, the studio provides a strong foundation, preparing students to tackle more complex architectural challenges in the future. This studio is designed for first-year architecture students who are new to concepts such as form, space, design principles, and anthropometry. It serves as an introductory stage to teach them the fundamentals of architecture, which is why it is called the Foundational Design Studio. In addition to textbook learning, hands-on workshops will help them learn quickly and

maintain their interest in the subject. This paper focuses on the hands-on exercises related to forms and grids in the Foundational Design Studio.

II. FORMS AND GRIDS IN ARCHITECTURE STUDIO

In an architecture studio, form refers to the shape and structure of a design, while the grid is a system of lines used to organize and structure space. Together, they help students understand spatial relationships, proportions, and composition. The grid provides a framework for experimenting with form, allowing students to explore design possibilities and maintain order while fostering creativity in architectural concepts.

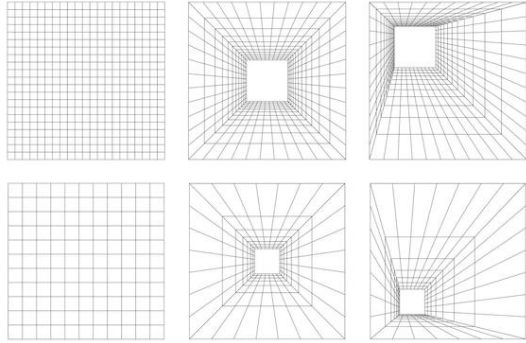


Figure: 2.1. Grids in a form

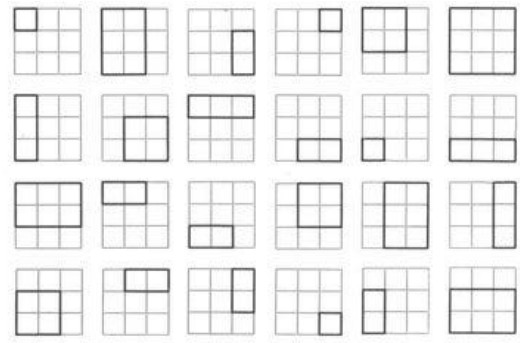


Figure: 2.2. Grid organization

III. WORKSHOP METHODOLOGY

3.1 Form and Grid Workshop

The primary goal of this workshop is to introduce participants to fundamental design principles by examining the relationship between form (the shape and structure of a design) and the grid (a system for organizing space). The workshop helps students grasp concepts of spatial organization, proportions, and the role of structure in design. By engaging with both form and grid, students develop a foundational understanding of how to create cohesive and well-organized spaces within their architectural designs.

3.2 Objective of the Workshop

3.2.1. Understanding form and space is the first step to understanding fundamental geometric shapes, their transformations, and their spatial relationships.

3.2.2. Grid as a Design Tool - Understanding how grids direct spatial composition, alignment, and modularity in architectural design

3.2.3. Investigating Proportion and Scale - Trying out various proportions to produce layouts that are both aesthetically pleasing and useful.

3.2.4. Hands-on Model Making - Reiterating conceptual learning through digital or physical modeling.

3.2.5. Architectural Representation - Using models, sketches, and diagrams to practice verbal and visual communication of concepts.

3.3 Framework of the Workshop

The flow outlines the structured sequence of a foundational architecture workshop. It begins with an introduction, followed by data collection from architectural references like Neufert's and Time Savers, which are then documented and compared with real-life furniture dimensions. The next phase involves constructing a 2m x 2m x 2m grid, where students take individual measurements to understand human proportions. Various activities are conducted within the grid, and feedback is gathered on spatial comfort and usability. The process then transitions into transforming basic geometric forms into fluid structures using grids, enabling students to explore form evolution. The workshop concludes with observations and reflections, reinforcing spatial awareness, anthropometry, and design principles.

To explore this workshop, first-year B.Arch students are divided into four groups, each consisting of seven members. The students will start by measuring basic dimensions of their group mates, such as height and the length of their reach when stretching their arms. To investigate spatial dimensions, the students will construct a 2m x 2m x 2m grid in their design studio. Within this grid, they will perform three different activities and analyze the results. Finally, the students will create a small kiosk using the 2m grid, analyze the space, and produce a scaled model of fluid structures derived from basic shapes.



Figure: 3.1. Construction of the live scale grid (2mx2mx2m)

IV. DESCRIPTIVE STUDY RESULT

Basically each team conducting two stages of work one is activity work (they understanding the help of grid and space) another one is model making (understanding the form development from basic form to fluid form)

4.1. ACTIVITIES (STAGE ONE)

4.1.1. Team 1 - Arshikha John, Daveena Janish, Fenil Richards, Jerush Christo, Joal sulson, Mariyam Shajidha, Pradeep Raj

Team 1 is conducting three different activities: model making, group discussion, and casual talking, in a specified space. They are evaluating which types of activities are best suited for the given space. Among these activities, they found that model making is more comfortable compared to group discussions and casual talking. Model making primarily involves one or two people, allowing for enough space and avoiding a cramped environment. In contrast, the group discussion involves seven people sitting in a circle, which feels a bit crowded. Additionally, casual talking also tends to be somewhat inconvenient in this space.



Figure: 4.1. Activity 1 - Model making



Figure: 4.2. Activity 2 - Group discussion



Figure: 4.3. Activity 3 - casual talking

4.1.2. Team 2 - Adlin Joe, Aksha Reni, Anantha Krishnan, Briseneem, Jerishiha Raj, Nanjil Hiritick, Shine Ahinsar

The team engaged in various activities, including design discussions at the drafting table, group play, and singing. They found that group discussions were more comfortable than singing or group play. The group play felt congested because all seven members participated, leading them to conclude that a small space cannot accommodate many people effectively.



Figure: 4.4. Activity 1 - design discussion
Activity 3 - singing



Figure: 4.5. Activity 2 - Group play

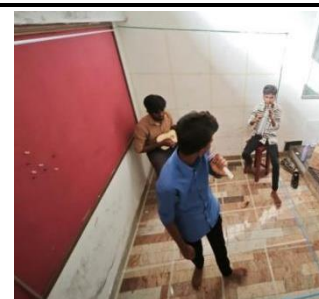


Figure: 4.6.

4.1.3. Team 3 - Altrick, Amarsin, Bency mol, Hari karan, Jersha, Mohammed Shadiq, Preethi

This team conducted activities such as sleeping, lecturing, and group discussions within the designated space. They found that sleeping was more comfortable because it didn't require any furniture. The area was used entirely by people without the interference of furniture. As a result, they concluded that sleeping is more comfortable than engaging in group discussions or lecturing.



Figure: 4.7. Activity 1 - Sleeping
3 - Group discussion



Figure: 4.8. Activity 2 - Lecturing



Figure: 4.9. Activity

4.1.4. Team 4 - Christal Dafini, Grace, Immanuel, Jeghashini, Rakshan, Reshma, Rijo

This team engages in three different activities: solo dancing, teaching, and boxing. They have found that solo dancing is the most comfortable of the three. During the teaching sessions, all group members participate, which makes the space a bit crowded and less comfortable. Furthermore, boxing requires more space than what is currently available. Therefore, they conclude that solo dancing is the most comfortable option.



Figure: 4.10. Activity 1 - Solo dance
Activity 3 – Boxing



Figure: 4.11. Activity 2 - Teaching

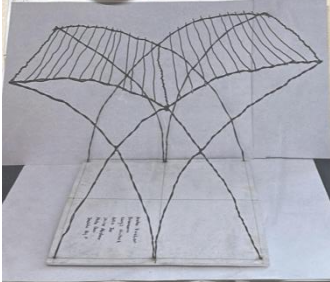
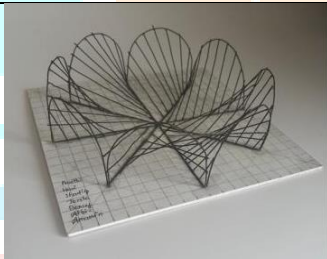
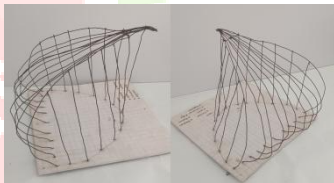


Figure: 4.12.

4.2. TRANSFORMATION OF FORMS (STAGE TWO)

After completing the first stage, every group done a scaled model using ms binding wire, in that they created a fluid forms using with the help of grids, they converted the basic form structure into fluid shapes using grids, that will help them to learn a form transformation. Every grid will help them to guide the transformation, from this they understand the flow of the structure.

Table 4.2.1. Form Transformations

Team	Photo	Form Description
Team 1		4.13. Form : Parabolic structure Description : This flowing arches that converge to form a tunnel-like structure on a rectangular base grid. The design appears to emphasize organic, free-flowing lines, spatial movement and fluidity resembling natural patterns such as vines, waves, or tree branches.
Team 2		4.14. Form : Hyperbolic paraboloid (saddle-like form) Description : This form represent a hyperbolic paraboloid (a saddle-like surface) due to the way the wires bend upward and downward along different axes that emphasizing its geometric complexity. This shape is commonly used in tensile structures, and roofing due to its stability and aesthetic appeal.
Team 3		4.15. Form : Multiple intersecting parabolic curves Description : This type of form is often seen in architectural shell structures . The use of a grid base suggests precision in mapping out the curves, indicating a connection to conic sections like parabolas.
Team 4		4.16. Form : Parabolic structure Description : This form is arranged in a curved pattern, forming a sweeping, fan-like shape. The base is rectangular, supporting the dynamic, asymmetrical curvature above. This form is commonly seen in architectural shell structures.

Each team come with the unique forms, from this they will understand the form transformation from basic form to fluid form

V. DISCUSSIONS

Using these two stages, each team will analyze the given space (2m x 2m x 2m) while achieving the following objectives:

The workshop allows for the understanding of the use of measuring tools through the concept of grids and application in spatial planning. It enlightens them as to the understanding of anthropometric principles and relations between furniture measurement and human sizes. Hands-on activities help establish a basic principle of grid planning and how multipurpose spaces accommodate different uses on the basis of their needs. By engaging in physical activities, they realize volume and gain insights into user dynamics concerning dimensions. The workshop teaches them how to measure objects with grids, the process of converting scales, and analyze various activities in a defined space. Additionally, students are able to envision proportions and spatial relationships, as they understand how it impacts their designs. They improve their spatial thinking by enhancing their understanding of form transformation and spatial relationships when working with binding wire models.

Basic knowledge of grid planning requires understanding how a structured system of intersecting lines can be used to organize, measure, and design spaces. It forms the basis for spatial planning that will allow the student to understand proportion, align elements correctly, and ensure functionality in layouts. The use of grids allows students to understand scale, modularity, and alignment both in two-dimensional planning and three-dimensional form-making. This knowledge then carries over to actual design considerations: furniture layouts, architectural drawings, and town planning, as grids ensure order and functionality. Doing hands-on activities, for instance, constructing models of binding wire, the students are actually converting abstract designs into actual objects; they therefore further their capability of visualizing spatial relationships between different forms which change dynamically. Through this process, they do not only build on their technical skills but also foster a more profound appreciation of how grids become the basic instrument for architectural design and problem-solving.

This is an important aspect of architectural design, as it could allow for students to translate from real-scale dimensions to manageable representations on paper or physical models. On the workshop, students learn to utilize grids as a reference system with easy scaling, ensuring proportional consistency between all elements of the design. Practicing scale conversion develops their ability to shrink or expand measurements without compromising spatial accuracy in the case of architectural drawings, model-making, and urban planning. The process further reinforces their understanding of how variations in scales can impact the way space is perceived, functions, and how it interacts with the user. By the help of exercises in measuring objects, drawing to scale, and the construction of scale models, a student improves her ability to understand dimensions and can translate abstract concepts into practical architectural solutions.

Appreciation for how proportions come about in design determines the functionality and aesthetically beautiful spaces that designers and stakeholders would want to undertake. The workshop emphasizes how proportions impact spatial harmony, ergonomics, and human response in buildings. By using grids, students learn the relationships of the different elements to determine scale, ensuring furniture, circulation space, and other architectural features balance with human dimensions. Students realize the importance of well-balanced proportions in achieving comfort and usability through hands-on exercises such as measuring objects, constructing models, and analyzing spatial relationships. This understanding will guide them in making informed design decisions, so that spaces are neither too cramped nor too vast but optimized for efficiency and visual appeal. By experimenting with binding wire models, they further explore form transformation, reinforcing the idea that proportion is a crucial factor in shaping spaces that are both practical and engaging.

VI. CONCLUSION

In conclusion, this research underscores the importance of hands-on workshops in architectural education, particularly in enhancing spatial comprehension through the use of form and grid systems. By engaging students in tactile, experiential learning environments, workshops bridge the gap between theoretical knowledge and practical application. The study demonstrates that working directly with physical models, grids, and forms not only solidifies students' understanding of spatial relationships but also encourages a deeper exploration of design concepts in a more intuitive and dynamic manner. The hands-on workshop approach allows students to experience the direct impact of form and grid on space, helping them to visualize and manipulate architectural elements in real time. This immersive learning method fosters creative problem-solving, critical thinking, and a stronger grasp of architectural principles that cannot always be conveyed through traditional lecture-based instruction. Furthermore, it provides an opportunity for students to experiment, iterate, and refine their designs in a collaborative environment, enhancing both individual and collective spatial awareness. Overall, the research affirms the value of integrating hands-on workshops into architectural studio pedagogy as a means to deepen spatial comprehension, reinforce design skills, and cultivate a more holistic understanding of architecture.

VII. ACKNOWLEDGMENT

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