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Exploring the Role of Hands-on Learning in Architecture Education

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ABSTRACT

Architecture is a profession that requires a combination of technical knowledge, creativity, and practical experience. It is a complex field that requires not only theoretical knowledge but also practical skills. These techniques also enhance the cognitive (Knowledge) and affective (Attitude) domains of the learners. Hands-on learning is an integral part of architecture education as it allows aspiring architects to gain practical experience and develop the necessary skills to excel in the field. However, the value of practical experience in the education of aspiring architects has become a topic of interest in recent years. This also helps in bridging the gap between the Architecture Education and Practices. This paper aims to explore the importance of hands-on learning in architecture education, the various methods of hands-on learning, and the impact of technology on this type of education. Additionally, the effectiveness of hands-on learning in preparing architects for real-world challenges and the importance of incorporating this type of education into the overall curriculum of architecture programs will be discussed. The effects will be explained from the various experiences in pedagogy. The learning outcomes of activities conducted in class were framed with the reference of the Bloom's Revised Taxonomy.

Keywords: Hands-on Learning, Architecture Education, Teaching Methodology, Practical Experience.

1. INTRODUCTION

"Tell me and I forget,
teach me and I may remember,
involve me and I will learn."
- Benjamin Franklin

To become an architect, students typically go through a rigorous educational program that involves both theoretical and practical coursework. This involves teaching and learning methods that allow students to engage in hands-on, immersive experiences that deepen their understanding of the design and construction processes. This approach is based on the idea that students learn best by doing, rather than just reading about or hearing about concepts. While theoretical coursework is important in developing a strong foundation of knowledge, hands-on learning is essential to applying this knowledge in real-world situations. Hands-on learning, also known as experiential learning or kinesthetic learning, provides students with the opportunity to develop problem-solving skills, critical thinking, and the ability to work in teams. It also enables students to understand the practical aspects of architecture, including construction, materials, and building systems.

Architects must have an in-depth understanding of the construction process and how to create a structure that is safe, functional, and aesthetically pleasing. Practical experience allows students to understand the complexities of the construction process and learn how to work with different materials and tools. Hands-on learning prepares students for the challenges they will face in the field, including budget constraints, construction delays, and unexpected design changes.

2. METHODS OF HANDS-ON LEARNING IN ARCHITECTURE.

There are various methods of hands-on learning in architecture education. Few are as listed below:

- Design build programs
- Studio courses
- Field Trips & site visits
- Building Models
- Sketching and Drawing
- Digital modeling and visualization
- Computer simulation
- Material testing
- Mockups
- Role play
- Internships

Design-build programs are hands-on learning methods that allow students to work on real construction projects. These programs provide students with the opportunity to work with real clients, contractors, and other professionals in the construction industry. Studio courses are the most common method of hands-on learning in architecture education. In these courses, students are given design projects and are required to create physical models and drawings to represent their ideas. Many architecture schools offer studio courses that simulate real-world design projects, allowing students to work on projects that closely resemble those they will encounter in their professional careers. Another way to incorporate experiential learning is through field trips and site visits. By visiting existing buildings and structures, students can gain a better understanding of how different materials, design elements, and construction techniques are used in real-world applications. Students can use digital modeling software and visualization tools to recreate and explore historic buildings and structures. This activity can help students understand the design and construction techniques used in different styles and periods, as well as the potential for digital tools in architectural design and visualization. Internships are also an effective method of hands-on learning, as they allow students to work in architecture firms and gain real-world experience. This type of program not only provides practical experience in the design and construction process, but also helps to foster teamwork and project management skills.

There are numerous tried and tested methods to incorporate hands-on learning and there can be many more. A particular method or a combination of the methods can be used by the faculty depending on the complexity of the topic to be taught. The examples in this paper will help us understand how these methods have helped faculties to achieve the objectives. It also shows how effective these methods were for the students in their learning processes across their academic journey.

EX. 1) HUMANITIES.

This activity was conducted by one of the authors. A model making activity was conducted to help students understand “Construction techniques in ancient times”for the 1st Year students of SPPU 2015 syllabus at D.Y. Patil School Of Architecture, Pune.
The objective was to make the students understand how the ancient man has dealt with available materials and developed the dwelling units. The students were asked to collect only natural materials available in and around the campus and on the given base they had to construct a house. When students started erecting the houses the natural materials with their natural curves were not stable in the desired shape. so they needed to use a combination of two materials like stone and mud, leaves and stones, wooden sticks and stones etc. To make the joints of the two materials strong, they used a third material as binders. The parts of creepers & long and thin roots were used to tie the things in place. This activity had fun, exploration, experimentation with different materials & their nature as learning factors. Students had to put in a lot of effort to keep the things in place but with faculty guidance they came up with the following outputs.

Fig.1 Different models of ancient man dwelling units with natural materials only.

They basically understood, every material has a different nature hence, for the combination of two materials a special attention is required.

EX. 2) HISTORY OF ARCHITECTURE.

Teaching the history of architecture through hands-on activities can be an engaging and effective way to help students understand the concepts and principles of different architectural styles and periods. Students built models of famous buildings or architectural styles using materials such as paper, cardboard, clay, etc. This activity helped the students to understand the design and construction techniques used in different styles and periods. Students also practiced sketching and drawing different architectural styles and details. This activity helped students develop their observational skills and understand the design elements and proportions of different styles. Visiting historic buildings and structures can help students understand how architecture has evolved over time and the cultural and societal factors that influenced its development. This activity can also help students

appreciate the beauty and significance of architectural masterpieces.

Fig.2 Models and sketches of various Indian temples done by students of Brick School of Architecture, Pune.

Additionally Students can also work on restoration or preservation projects of historic buildings or structures. This activity can help students understand the challenges and techniques involved in restoring and preserving historic architecture.

EX.3) THEORY OF STRUCTURES.

Teaching the theory of structures through hands-on learning can be a highly effective way to help students understand the concepts and principles of structural engineering. Students can build models of different structures using materials such as paper, cardboard, or balsa wood. They can then test the models by applying different loads or forces to understand the behavior of different structural elements and systems. Visiting construction sites and observing different structural systems in real-world applications can help students understand the practical considerations and constraints involved in structural engineering. Students can also work on design projects that involve creating and analyzing structural systems for different applications, such as buildings, bridges, or towers. This activity can help students apply the principles and theories learned in the classroom to real-world scenarios. Here are some examples of hands-on activities that can be used to teach the theory of structures:

Fig.3) Models done by students of B.D. College of architecture to understand load transfer in long span bridges and one way two way slabs.

EX.4) BUILDING CONSTRUCTION & MATERIALS:

Teaching building construction and materials through hands-on learning can be a highly effective way to help students understand the practical and technical aspects of the construction process. Here are some examples of hands-on activities that can be used to teach building construction and materials:

Mock-up models: Students built mock-up models using different materials and construction techniques to understand the basics of construction and the different options available. This activity can help students learn about the strengths and limitations of different materials, construction techniques, and assembly methods.

Material identification and testing: Students can learn about the properties of different building materials by conducting material identification and testing experiments. This activity can help students understand the characteristics of different materials and how they perform under various conditions.

Field trips and site visits: Visiting construction sites and observing the construction process can help students understand the practical aspects of building construction, such as site preparation, foundation work, framing, and finishing. This activity can also help students learn about the different roles and responsibilities of various professionals involved in the construction process.

Fig.4) Field trip before laying of concrete for slab, Pune

Building and finishing projects: Students can work on building and finishing projects that involve using different materials and construction techniques to create functional structures, such as shelves, tables, or benches. This activity can help students gain practical experience and develop skills in carpentry, masonry, and other construction trades.

Design-build projects: Students can work on design-build projects that involve designing and constructing a small structure, such as a garden shed or a playhouse. This activity can help students apply the principles and

techniques learned in the classroom to real-world scenarios.

Studio Models: as shown in Fig. 5) students had used different materials like mount board, card boards, glass, foam sheet, PVC sheets, transparent films, etc. to make the working models for hydraulic lifts, different staircases of different shapes and different materials, sliding windows, steel trusses, etc. To elaborate, when students actually tried making the glass staircase as shown in the fig.5), it was bending at the landing as the dead load of the structure was high so they understood the need of a vertical member at the landing on the width of the flight to make it stable and functional.

Fig.5) Working models by the students of D.Y. Patil School Of Architecture of Sliding window, Spiral staircase, Glass staircase, Hydraulic lift using Injection to apply the pressure.

Overall, incorporating hands-on learning in teaching building construction and materials can help students gain a deeper understanding of the subject matter, as well as develop important skills and techniques relevant to the construction industry.

EX 5) MUD ARCHITECTURE WORKSHOP

The Workshop was conducted by Ar. Kanchan Shinde and Ar. Omkar Kale, faculties at Brick School of Architecture, Pune. The aim was to impart knowledge and skills in the use of sustainable and eco-friendly materials like mud, clay, and earth for constructing buildings that are durable, affordable, and energy-efficient and also to provide students with practical knowledge and skills in the use of sustainable and eco-friendly materials for building structures that are durable, affordable, and energy-efficient. Students also understood the proportions of Soil mixture used for construction. The hands-on component of the workshop involved actually building a small structure or prototype of 1:3 scale using mud and other natural materials. Students went through the entire process of wall construction from foundation, to making of mud bricks up to understanding various construction techniques in Mud Architecture. Students had to work in a group of 8. They came up with design or wall in different techniques in Mud Architecture like Cob, Adobe, wattle and daub, CSEB, rammed earth etc. Then the students had to prepare the mix, work on background research and prep for wall construction. The students then dug the ground for the foundation, assembled the foundation. After which the students started with construction of each technique in Mud Architecture as mentioned above.

Fig.6) On site construction done by students of Brick School of Architecture, Pune

Creating interesting ways to teach mud architecture is her methodology to gain the interest of students to understand mud architecture in a practical way.

3. BENEFITS OF HANDS-ON LEARNING

Active engagement: hands-on learning encourages active participation, enabling students to become actively involved in the learning process. This helps improve focus, motivation and retention of information.

Better understanding: by physically interacting with the tools and materials, students can develop a concrete understanding of the concepts. They can touch, feel and manipulate materials, which enhance their comprehension and bridge the gap between theory and practice.

Practical application: The method of learning by doing helps students to apply what they have learned in the classroom to real life situations. It also helps them develop the skills necessary to transfer knowledge from classroom to practical settings.

Problem solving skills: Hands-on learning promotes critical thinking and problem-solving skills. When faced with real-world challenges or experiments, students must apply their knowledge, analyze situations, make decisions, and find creative solutions.

This enhances their ability to think critically and adapt to different scenarios.

Skill development: The learning by doing method is particularly effective for developing practical skills. It allows students to refine their motor skills and hand eye co-ordination.

Long term retention: Due to the active engagement, problem-solving nature, and practical application, hands-on learning often leads to better long-term retention of information. Students are more likely to remember and recall concepts and skills that they have directly experienced and actively worked with.

Team building: Hands-on activities often involve working in groups or pairs, promoting collaboration, teamwork, and communication skills. Students can exchange ideas, share knowledge, and solve problems together, fostering social interaction and interpersonal skills.

When it comes to the **"Maxims of Teaching,"** there are several principles that faculties often follow to guide their teaching practices. These maxims are derived from general observations and best practices in teaching. It's important to note that these maxims serve as general guiding principles, and their application may vary depending on the specific context, subject area, and grade level of instruction. Effective teaching involves a combination of pedagogical knowledge, instructional strategies, and a deep understanding of students' needs. In addition to the above by incorporating **"Bloom's Taxonomy"**, faculties can design hands-on learning experiences that address various levels of cognitive engagement. They can ensure that hands-on activities go beyond simple recall and incorporate higher-order thinking skills such as analysis, evaluation, and creation. This approach enhances the depth and complexity of learning and supports students in developing a range of cognitive abilities. Blooms Taxonomy is highly relevant to hands-on learning as it provides a framework for understanding the different levels of cognitive learning and can guide the design and assessment of hands-on activities. Let's understand in brief what Bloom's Taxonomy is. Benjamin Bloom developed a system to classify the cognitive skills and learning behavior, in 1956. The levels are ordered from simple at the base to complex at the top. In 2001 a revised version of Bloom's taxonomy was published which talks about the following 6 cognitive processes.

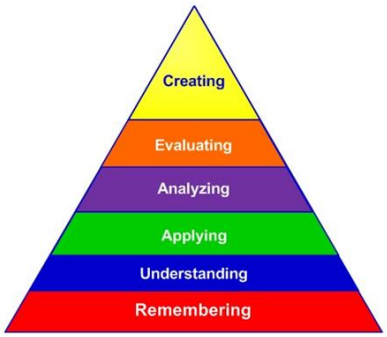

Fig.7) Bloom's Taxonomy - Revised

In 2001 a revised version of Bloom's taxonomy was published which talks about the following 6 cognitive processes.

1) **Remember** – Faculties can frame hand-on activities that require recalling and remembering information, facts and basic concepts (list, memorize, repeat & state)
2) **Understand** – Hand-on learning promotes understanding by allowing the students to ask questions, seek clarifications and explore the concepts in an experiential way. (describe, discuss, explain, recognize, report, select & translate)
3) **Apply** – Applying the knowledge gained (in levels 1 & 2) via hands-on activity enhances students' understanding and ability to use the information effectively. (implement, use, demonstrate, interpret & sketch)
4) **Analyze** – Hands-on learning can involve activities that require students to compare and classify the information and analyze the data. (organize, compare, contrast, differentiate examine, experiment, question & test)
5) **Evaluate** – Students learn to evaluate information and make judgements. (Appraise, defend, judge, value, critique & weigh)
6) **Create** – Students learn creativity and innovation to design Original work (Design, assemble, construct, develop, formulate, & investigate, author)

4. IMPACT OF TECHNOLOGY ON HANDS ON LEARNING

Technology has had a significant impact on hands-on learning in architecture education. Computer-aided design (CAD) software and other digital tools have made it easier for students to design and visualize their ideas.The use of computer-aided design (CAD) software has become an integral part of architecture education, allowing students to create digital models of their designs. 3D printing and laser cutting technologies have also made it easier for students to create physical models of their designs quickly and accurately. However, the use of these tools has also led to a decrease in the amount of time students spend on physical model-making and other hands-on activities.

While digital tools are important in architecture, they should not replace the value of hands- on learning.

5.CONCLUSION

Having gone through these processes, following statement is derived;

These hands-on activities develop the motor skills, kinetic skills and better understanding; also develop better coordination between mind and hands of the students. The concepts learnt hence stays for longer duration with the learners as they find it relevant and applicable. This can be further achieved easily if the learning outcomes of activities conducted in classes are framed in accordance with the Bloom's Revised Taxonomy.

Also the theory by Maxims can be applied to make the teaching learning process more easy and effective. In order to implement hands-on learning effectively, the faculties should design the studio work that is in accordance with the needs and interests of the students. They should incorporate a range of teaching methods which includes visual, auditory and kinesthetic approaches.

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