Virtual Reality: A Communication Tool for Educating History of Architecture

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Abstract: Basic knowledge of the architectural perspectives and structures of the past is a prerequisite for understanding and interpreting today's architecture and our built environment. There is a particular emphasis in the classroom on identifying and explaining the social, ideological and technical assumptions that have influenced building design and built environments through time. History of Architecture acts as an elementary component in architectural teaching – learning process. Students lack in achieving a complete comprehensive understanding of the subject due to the descriptive method being adopted since ages. At times it is studied with no understanding of relationship or the global viewpoint and hence it is unable to generate the required interest and curiosity. Teaching History of Architecture by using Virtual Reality software students act as builders of historic landmarks studied during the course. Virtual Reality is a student-centered approach which concentrates on students learning and also allows for high degree of student autonomy and creativity.

Keywords: Interrelations, Transitions, Experiential, Domains, Architectural Design Studio.

INTRODUCTION

'History of Architecture' is an important course offered in the first and second year of Bachelor of Architecture (B.Arch.) Program in academic institutions in India. This subject covers disciplines such as social, cultural, political and economic studies with other subjects such as gender, race, ethnicity, and post-colonialism, creating a new kind of architectural history. Teaching history allows the student to develop a broad framework in economics, design, philosophy, urban development, and art. Presently method of teaching adopted development of history according to chronology or educating reverse chronology so that present is comprehended first or sometimes even random. This descriptive format of teaching and the prevailing pedagogical issues associated with this course make it difficult for students to assimilate the course content. History has lost its vibrancy and significance and has become far too neglected from the realm of personal experience. There is a need to understand the importance of this subject and give History of Architecture its status in Architecture curriculum. We need to research and evolve a balanced ‘Methodology’ of teaching History of Architecture that addresses and encompasses both the conflicting nature of ‘subjects’ and nature of ‘learning’s’; that enables students to make connections and thereby set the stage for lifelong learning. The use of virtual reality in architecture education is helping to communicate ideas and had the power to illustrate the projects as well as the elimination of much of the guesswork in the design of the building. Virtual reality was used within the process of analyzing the architecture and construction technology. The aim is not only to deepen constructional understanding but to discover the historical and social context. Virtual Reality is an environment simulated by computer. It is interactive (users can interactive with models), spatial (models are represented in three spatial dimensions), and real-time (feedback from actions is given without noticeable pause).History of Architecture is the discipline that records, studies and interprets architecture. It studies its forms, purposes, and most importantly its evolution. History of Architecture focuses on the evolution of buildings, monuments, pediments and settlements in relation to art, history, and philosophy as well as enables us to understand the society and culture. Architectural historians understand settlement patterns and regional growth.

HISTORY AS A GUIDELINE FOR FUTURE DIRECTION: PAST-PRESENT-FUTURE

History of the society which evolved through many years. To satisfy the needs of the society, the material, and technology developed through years together. The era of Industrial Revolution played a vital role in changing the human intellect. Hence time moves hand-in-hand with technology. The cultural belief has tried to remain same but technology has dominated ‘Past’ is always true and brings about ‘facts’ in front of the learner. ‘Future’ is always ‘imagination’ and ‘predictable’. But ‘present’ is a ‘transitory phase’.
METHODOLOGY ADOPTED

DATA COLLECTION

PRIMARY DATA

INTERVIEWS

QUESTIONNAIRES

STUDY OF SYLLABUS

SECONDARY DATA

LIBRARY

INTERNET

TEACHERS AND STUDENTS/THINKERS

NATIONAL LEVEL

INTERNATIONAL LEVEL

ANALYSIS/INTERPRETATION

INFERENCES

QUESTIONNAIRES FROM TEACHERS

IMPACT OF VIRTUAL REALITY ON LEARNING

TEACHING METHODOLOGIES FOLLOWED

CONCLUSION

Figure - Flow Chart of Methodology Adopted
<table>
<thead>
<tr>
<th>Concept</th>
<th>Virtual Reality</th>
<th>Analysis and Interpretation</th>
<th>Impact on Teachers &amp; Students</th>
</tr>
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<tbody>
<tr>
<td>Vortex</td>
<td>&quot;Vortex&quot;</td>
<td>&quot;Vortex&quot;</td>
<td>&quot;Vortex&quot;</td>
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<tr>
<td>Blending</td>
<td>&quot;Blending&quot;</td>
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<td>&quot;Blending&quot;</td>
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<tr>
<td>Integration</td>
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</table>

**Vortex**: A new concept in virtual reality, focusing on immersive experiences.

**Blending**: Combining virtual and physical worlds seamlessly.

**Integration**: Enhancing the integration of virtual reality into education and training.

**Impact on Teachers & Students**: Integrating virtual reality can significantly enhance the learning experience for both teachers and students, providing new opportunities for engagement and creativity.
STRENGTH, WEAKNESS OPPORTUNITY AND THREAT OF APPLICATION OF VIRTUAL REALITY IN HISTORY OF ARCHITECTURE

Strength:

i. The student will able to understand the social significance of the historic building.

ii. As per its name, this method of teaching is more near to reality as compared to other medias like photographs, 2D, 3d sketches, drawings.

iii. It gives an environment, in which student can link its geographic location and can understand the socio-environment impact of the monument, it helps to understand physical and able to visualize as a part of a whole.

iv. To some extent students are able to understand the nature of materials, services and community need instead physically present.

v. Students were motivated to go through the building using the buttons provided by the software and during that exploration we noticed that a type of dialogue was developed concerning the status, the dresses at that time, and the geometry of the space and the techniques of the sculpture.

vi. Virtual reality provides new forms and methods of visualization, drawing on the strengths of visual representations. In some instances, VR can more accurately illustrate some features, processes, and so forth than by other means, allowing extreme close-up examination of an object, observation from a great distance, and observation and examination of areas and events unavailable by other means.

i. Virtual reality motivates students. It requires interaction and encourages active participation rather than passivity. Some types of virtual reality, for example, collaborative virtual reality using text input with virtual worlds, encourage or require collaboration and provide a social atmosphere.

ii. Virtual reality allows the learner to proceed through an experience during a broad time period not fixed by a regular class schedule, at their own pace. It allows the disabled to participate in an experiment or learning environment when they cannot do so otherwise. It transcends language barriers.

iii. VR with text access provides equal opportunity for communication with students in other cultures and allows the student to take on the role of a person in different cultures.

Weakness:

i. Scale and proportions are required to be carefully worked out to avoid the wrong impression of the monument.

ii. The weakness of using virtual reality are primarily related to cost, the time necessary for learning how to use hardware and software, possible health and safety effects, and dealing with possible reluctance to use and integrate new technology into a course or curriculum. As with all new technology, each of these issues may fade as time goes by and virtual reality becomes more commonly used in areas outside of education.

Opportunity-

i. Data gathering and visualization, project planning and design, the design of interactive training systems, virtual field trips, and the design of experiential learning environments. Virtual reality also offers many possibilities as a tool for nontraditional learners, including the physically disabled and those undergoing rehabilitation who must learn (or relearn) communication and psychomotor skills.

Threat:

i. Architecture is a feeling of spaces, which is more understood physically, so it is the only tool through which we are to some extent immersive. VR equipment is rare and expensive. For viewing graphical data sets of any interesting size and geometric complexity, powerful, expensive graphics computers are also required. Standards, languages, APIs, tools, and hardware interfaces are still not yet well established and widely accepted. Specialized technical people are also required for the installation and operation of the VR system.
APPLICATION - PROPOSAL OF DIFFERENT POSSIBILITIES APPLIED TO ENHANCE PEDAGOGY OF HISTORY OF ARCHITECTURE

VIRTUAL REALITY

APPLICATION OF VIRTUAL REALITY IN ARCHITECTURE EDUCATION

ARCHITECTURE SUBJECTS

ASSOCIATED

HISTORY OF ARCHITECTURE

DIFFERENT POSSIBILITIES TO ACHIEVE VIRTUAL REALITY

ARCHITECTURE EDUCATION

- Immersive first Virtual Reality.
- Desktop Virtual Reality.
- The Vision Dome
- Cab Simulator Environment
- Chamber World.
- Augmented reality
- Cyberspace.
- Telp reence
- Holography
- Zebra Imaging
- Avaya Live Engage

All of these possibilities are applicable in History of Architecture.
1. Applicable as teaching strategies to conduct virtual tour.
2. conducting lectures through 3D models.
3. Virtual Teacher through Hologram Technology.
4. through lectures based on Desktop By showing 3D.
5. chamber world, vision dome Immersive reality provides the feeling of real world.
6. zebra imaging provides 300 angle view.
7. The ability to reach out to anyone, anywhere as if really there, virtual tour for historical monuments are possible
8. Virtual reality motivates students. It requires interaction and encourages active participation rather than passivity.
9. avaya learning provides real environment without the use of any remote, sensor, etc.

SWOT Analysis

Findings on the basis of possibilities of Virtual Reality Enhancing Learning

Conclusion

Figure - Flow Chart of Methodology Adopted to understand Virtual Reality Enhance Learning of History of Architecture
METHODOLOGY – CASE STUDY OF SCHOOL OF ARCHITECTURE
TEACHING STRATEGIES/ TEACHING METHODOLOGY ADOPTED FOR
TEACHING HISTORY OF ARCHITECTURE

HISTORY OF ARCHITECTURE SYLLABUS CASE STUDY

LIVE CASE STUDY
NATIONAL LEVEL

VIRTUAL CASE STUDY
INTERNATIONAL LEVEL

SINGHAD COLLEGE OF ARCHITECTURE

SCHOOL OF PLANNING AND ARCHITECTURE

UNIVERSITY OF ARIZONA
SCHOOL OF ARCHITECTURE

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, SCHOOL OF ARCHITECTURE

2RD YEAR SYLLABUS

ANALYSIS AND INTERPRETATION

TEACHING STRATEGIES

TEACHING METHODOLOGY

INFRASTRUCTURE REQ.

INFERENCES/APPLICATIONS

CONCLUSIONS

Figure - Flow Chart of Methodology Adopted for the study of Syllabus of History of Architecture.
### Comparative Analysis of Teaching Methodology for History of Architecture: Architecture Schools

<table>
<thead>
<tr>
<th>NATIONAL COLLEGES</th>
<th>TEACHING METHODOLOGY/TEACHING STRATEGIES ADOPTED</th>
<th>IMPACT OF TEACHING LEARNING</th>
<th>TEACHERS REVIEWED</th>
<th>TEACHERS REVIEWS ACHIEVED AS PER QUESTIONNAIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCHOOL OF PLANNING AND ARCHITECTURE</td>
<td>2.5 YES</td>
<td></td>
<td></td>
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**Course Objective:** The course is designed to expose the student to the various architectural styles of India and the students are introduced to the architectural styles of various periods and regions.

**Teaching Methodology:** Lectures are delivered through a PPT, which includes various architectural styles and periods.

**Teaching Strategies:** The course is taught in a comprehensive manner, including lectures, discussions, and practical sessions.

**Infrastructural Impact:** The infrastructure of the college is equipped with modern facilities, including well-stocked libraries, computer labs, and a well-maintained campus.

**Teacher Evaluation:** The teachers are highly qualified and have a keen interest in the subject, which motivates the students to learn more about the history of architecture.

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**Notes:** The history of architecture is taught in a descriptive manner, with attention paid to the significance of various buildings and structures. The students are encouraged to participate in various activities, such as field trips, which help them to visualize and understand the architectural features of various periods and regions.

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**References:**

COMPARATIVE ANALYSIS OF TEACHING METHODOLOGY FOR HISTORY OF ARCHITECTURE: ARCHITECTURE SCHOOLS

History is the long struggle of man, to understand his environment and react upon it. History is the society which evolved through many years. To satisfy the needs of the society, the material and technology developed through years together. History is related to society. The era of Industrial Revolution played a vital role in changing the human intellect. Hence time moves hand-in-hand with technology. The cultural belief has tried to remain same but technology has dominated.

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<tr>
<td>1</td>
<td>Singhdad College of Architecture, Pune</td>
<td>2017-2019</td>
<td>History of Architecture and Human Settlements</td>
<td>The students are taught through lectures, group discussions, and practical sessions.</td>
<td>Lecture and Computer Lab are conducted in order to analyze architectural heritage.</td>
<td>Classrooms are set up in virtual reality environment.</td>
<td>Classrooms equipped with modern technology.</td>
<td>Interest is maintained, and student engagement is high.</td>
<td>Traditional method of teaching needs to be modified. Most of the time, students find the material and construction details not very clear. Virtual reality makes students understand concepts more effectively, as student interaction is enhanced. It is always possible to come close to view details and move away to see the city as a whole.</td>
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<tr>
<td>1</td>
<td>MASSACHUSETTS INSTITUTE OF TECHNOLOGY, SCHOOL OF ARCHITECTURE</td>
<td>Bachelor of Science in Architecture</td>
<td>History, Theory and Criticism of Architecture and Art</td>
<td>Provides an outline of the history of architecture and urbanism from ancient times to the early modern period. Analyzes buildings as the products of culture and in relation to the spatial problems of architectural design. Stress the geographical context of buildings and in the process familiarizes students with buildings, sites and cities from around the world.</td>
<td>Lecture through 3D desktop and virtual reality. Students are evaluated through virtual tours and virtual reality. 3D modeling of different historical monuments are planned and students are delivered lecture construction details and walk-throughs are worked out in class.</td>
<td>Class room, projector, whiteboard, chalk, sketch board with computer set up.</td>
<td>Virtual reality provides a new dimension of visualization, drawing on the strengths of visual representations. Virtual reality motivates students. It requires interaction and encourages active participation rather than passivity.</td>
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<td>Virtual discussions/FACULTY: Loretta Bello <a href="mailto:bello6@mit.edu">bello6@mit.edu</a>; Learner: 1) Immersive VR furnishes first person non-sensory experiences that are specifically designed to help students learn material. 2) Immersive VR contexts. 3) These experiences cannot be obtained in any other form in formal education. 4) This kind of experience makes up the bulk of our daily interaction with the world, though schools tend to promote third-person symbolic experiences. 5) Constructivism promotes the best theory on which to develop educational applications of VR.</td>
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### Comparative Analysis of Teaching Methodology for History of Architecture: Architecture Schools

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<tbody>
<tr>
<td>1</td>
<td>College of Architecture, Arizona</td>
<td>History and Theory of Architecture</td>
<td>1st and 2nd Year</td>
<td>To familiarize the student with the important architectural achievements from prehistoric through the Middle Ages.</td>
<td>Teacher conducts lecture by using informative and computer technology</td>
<td>1. Virtual reality classroom focuses social integration of learners.</td>
<td>ICT/VOIP/Videoconferencing, Urban Planning (8 lectures) Roman Architecture and Civilizations, Building Types and Building Patrons (3 lectures) Pre-Columbian Architecture and Civilizations of the Americas, Chinese, Meso-American, Javan, Early Asian Architecture and Landscape Architecture.</td>
<td>Most of the teaching in virtual environment, teaching turns out to be game based and experiments are conducted through pilot study.</td>
<td>Exploring: learners explore a virtual world's locations and communications as fieldwork for class. Collaborating: learners work together within a virtual world or collaborative tasks.Using: learners explore themselves and their identity through their presence in a virtual world, such as through avatar play. Building: learners construct objects within a virtual world. Championing: learners promote real life causes through activities and generations in a virtual world. Expressing: symbolic and experimental learning.</td>
<td>1) VR has great value in situations where the interaction and visualization of environments or interactions with objects or people is impossible or inconvenient, or where an environment can only exist in computer-generated form. This student's intense investment towards reaching a goal defined by the educator or designer. 2) Continual feedback for the student while interacting with the system. 3) A high degree of student involvement or investment in the activity itself. 4) The potential for intense student concentration on the learning task. The key is to make the goals of the game serve the student's learning goals and in this case, it would be easy to design a game in which the student gains points for solving riddles or remembering facts. However, it would be much more effective if the goal of the game was to accomplish something within the context of the topic matter.</td>
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VIRTUAL REALITY FOR PEDAGOGY OF SANCHI STUPA
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EDUCATIONAL BENEFITS OFFERED BY VIRTUAL REALITY

Experiential Learning
Experience is a powerful learning tool and the one that provides the best long-term retention rate. Students who hear a lecture will retain some of the information presented; Those who view a film will retain more; that will retain the most information for the longest time and with the greatest clarity. Virtual reality, on the other hand, has the potential to provide all students nationwide with unlimited access to chemical manufacturing facilities, without endangering themselves or anyone else, at minimal cost, at their convenience, and without disrupting plant operations. Virtual reality can bring experience to the masses.

Alternate Learning Styles
Students learn through many different mechanisms, including lectures, books, demonstrations, and experimentation. The relative effectiveness of these mechanisms varies from student to student, reflecting differences in their learning style. These learning styles have many dimensions, including verbal vs. visual, sequential vs. global, and passive vs. active. Verbal learners are those who learn well from word-based interfaces, such as books and lectures, whereas visual learners are more attuned to visually oriented stimuli such as pictures, graphs, and movies. Learning styles have been studied extensively by traditional educational methods (which are primarily verbal, passive, and sequential ) match the optimal learning styles of only a small portion of the typical undergraduate engineering student population. The majority of these students are then left with teaching methods that do not match their optimal mode of learning. Virtual reality has many features that make it ideal for meeting the needs of those students whose learning styles are not well served by traditional teaching methods.

Unconstrained Exploration
Reality provides the opportunity to explore and understand in a completely unconstrained manner. A student wishing to observe reactor conditions first-hand is free to step inside and look. In a process design environment, virtual reality can provide students with the creative control to combine materials, equipment, and concepts in whatever combinations they choose to explore. The beneficial value of repetition makes virtual reality attractive to educators on two fronts: 1) VR is not intended to replace traditional methods of education, but rather to augment them with another delivery mechanism. 2) VR incorporates inherent repetition via the simultaneous presentation of the same information through multiple channels. Virtual Reality is also a highly sensuous experience, surrounding the user with sight, sound, color, motion, tactile feedback, and possibly soon smell and taste. These senses can be orchestrated by the virtual world designer in a synergistic fashion to create an experience that has great impact.

CONCLUSION
Virtuality is not just advanced media product that enables representation and simulation of reality by perfect pictorial imitation, but the expansion of informational pictorial space conceptions, that could be found through the history of representations, from perspective invention to contemporary digitalized real-time remote operation. By extension of perceptual and mental experience, man expands the domain of creative imagination. As the result of information processing potential and enhance of human perception experience, real-time experience in virtual space allow access in the alternative dimension to every open mind, giving him possibilities to play and work, to represent and construct, to search, explore and express. Explorations of the possibility of virtuality demand further investigation, and architecture, as in past being a leading field that synthesizes representation, construction and sense of spatial creation, had to be involved in explorations of a multidimensional complex network of dynamic informational space, that is revealed in its real and virtual dimension as the unique universe. Rationality of reality that was the foundation of modern architectural space now is changing into complex, dynamical, virtual informational matrices of the reality that reveals different, multiplied actualizations. Virtuality in Architecture changes reality and opens new dimensions of architectural spaces, in a complex network of information flow between visible and invisible space.

FUTURE TRENDS
Educators and researchers look for more efficient ways of teaching and learning. Virtual Reality promotes cognitively relevant characteristics such as symbol systems and processing capabilities, enables students to process information more effectively and understand it more. Students involvement in learning is increased, understanding is greater, and the intrinsic features of the computer (e.g., immediate feedback, animation, and individualization) are more likely to motivate students to learn. Virtual reality can assist the teaching process and add this technology in the traditional lectures have promoted the following pedagogies including:  • An in-depth study of the platonic solids  • Application of the perspective  • To observe the fractal forms  • To manipulate some virtual object in 3D. It is important that in the laboratory activities the presence of the professorial assistants, it is important because their facilitation can illustrate the correct and active navigation inside the document organized as hypertext. One of the main aims of VR is to create virtual worlds and virtual environments in which humans can interact together. Virtual worlds are designed for people to understand the psychological effects of the spaces, generated by the computer, on people inside them to a pleasant and stimulating place to work and live in, with a good quality of life. Architects as designers of Virtual Worlds will be required to make these environments interesting, rich, and engaging places.

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The educational approach presented is only a small step towards locating a correct Fit in the Teaching Process. Virtual Reality can promote more interesting and interactive the lessons, instead of the traditional educational methods, It is also proposed that this approach will accommodate different learning styles, favouring the visual learners.

Using holograms to replace physical architectural models

1. This exciting technology provides architects with many advantages;
2. The hologram can be easily duplicated or reproduced with revisions.
3. Holograms are significantly more durable and easier to carry than a physical model.
4. Holograms are also very easy to store, which if you ever had to trash a model because you were out of space in the studio, is much easier emotionally.
5. The amount of detail that is achieved is typically better than a physical model. The accuracy is greater than a rapid prototyping model when it comes to color, texture and the level of detail. Use of Virtual Holography in Architecture.