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

![Flow Chart of Methodology Adopted]

Figure - Flow Chart of Methodology Adopted
<table>
<thead>
<tr>
<th><strong>ANALYSIS AND INTERPRETATION</strong></th>
<th><strong>VIRTUAL REALITY</strong></th>
<th><strong>CONCEPT</strong></th>
<th><strong>IMPACT ON TEACHER-Student</strong></th>
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<tr>
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<td>NAME</td>
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<td><strong>AREA OF APPLICATION</strong></td>
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1. **VIRTUAL REALITY**
   - **CONCEPT**:...
   - **IMPACT**:...
   - **SWOT**:...

2. **SECONDARY VIRTUAL REALITY**
   - **CONCEPT**:...
   - **IMPACT**:...
   - **SWOT**:...

3. **THE FUSION ROOM**
   - **CONCEPT**:...
   - **IMPACT**:...
   - **SWOT**:...

4. **CAR SIMULATION ENVIRONMENT**
   - **CONCEPT**:...
   - **IMPACT**:...
   - **SWOT**:...
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

Immersive first Virtual Reality.

Desktop Virtual Reality.

The Vision Dome

Cab Simulator Environment

Chamber World.

Augmented reality

Cyberspace.

Telap reverence

Holography

Zebra Imaging

Avaya Live Engage

ARCHITECTURE EDUCATION

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 360 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

VIRTUAL CASE STUDY

NATIONAL LEVEL

INTERNATIONAL LEVEL

SINGHAD COLLEGE OF ARCHITECTURE

SCHOOL OF PLANNING AND ARCHITECTURE

UNIVERSITY OF ARIZONA SCHOOL OF ARCHITECTURE

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, SCHOOL OF ARCHITECTURE

2ND YEAR SYLLABUS

ANALYSIS AND INTERPRETATION

TEACHING STRATEGIES

TEACHING METHODOLOGY

INFRASTRUCTURE REQ.

INFERENCE/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

History is the long struggle of man, to understand his environment and face upon it. History is of the society which evolved through many years. To satisfy the needs of this 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 lifestyle. Human time moves hand in hand with technology. The cultural belief has tried to remain same but technology has dominated.

## Teaching Methodology/Teaching Strategies Adopted

<table>
<thead>
<tr>
<th>NATURAL COLLEGES</th>
<th>SCHOOL OF PLANNING AND ARCHITECTURE</th>
<th>YEAR</th>
<th>COURSE OBJECTIVE</th>
<th>TEACHING METHODOLOGY</th>
<th>IMPACT OF TEACHING METHODOLOGY</th>
<th>TEACHER REVIEWED</th>
<th>TEACHERS REVIEWS ACHIEVED AS PER QUESTIONNAIRE</th>
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### Course Objective

The course is designed to acquaint the student of architecture with the various phases of history and to sharpen his powers of observation and analytic. The aim of the course is that the student shall undertake a chronological study of world architecture with emphasis on the Indian subcontinent and the comparison of the different styles of life in India and other parts of the world. The architectural study is to be linked with the social developments of civilization, geographical and geological factors, materials and structural aids.

### Teaching Strategies

- Lectures are delivered through PPT, Teacher controlled learning.
- Field trips to study famous old buildings, reduces learning fatigue and makes students interested.
- Class room projects, white board, chalk, etc.
- Students have the opportunity to analyze the buildings in terms of history and architecture.
- Students are guided by the teacher to analyze the buildings.

### Impact of Teaching Methodology

- Students can relate the famous buildings in terms of architecture and history.
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## 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.

### Teaching Methodology/Teaching Strategies Adopted

<table>
<thead>
<tr>
<th>SNO</th>
<th>Architecture School</th>
<th>Years Taught</th>
<th>Syllabus of 2nd Year</th>
<th>Course Objective</th>
<th>Teaching Methodology</th>
<th>Teaching Strategies</th>
<th>Infrastructure</th>
<th>Impact of Teaching Learning</th>
<th>Teachers Reviewed</th>
<th>Teachers Reviews Achieved as Per Questionnaire</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Singh College of Architecture, Pune</td>
<td>3rd, 4th, 5th</td>
<td>Pre-Dynastic Period, Indus Civilizations, Egyptian Architecture, Greek and Roman Architecture</td>
<td>Introduction to the history of art from ancient times to modern times.</td>
<td>Lectures delivered through PPT, Interactive Lectures, Computer Lab.</td>
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<tr>
<td>2</td>
<td>Sanghaj College of Architecture, Pune</td>
<td>2nd, 3rd, 4th</td>
<td>History of Architecture (Ancient, Medieval, Modern)</td>
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### National College

Comparison includes:
- **Digital Applications**
  - Students are taught to use the digital environment.
  - Virtual tour: A virtual tour is a simulation of an existing location, usually composed of a sequence of scenes or still images. It may also use other multimedia elements such as sound effects, music, narration, and text.
- **Student Engagement**
  - Students are engaged in active learning through critical thinking and problem-solving.
  - Engagement is measured through student feedback and performance evaluations.

### Virtual Reality

Virtual reality is a simulated environment that allows users to interact with the environment in a way that is similar to the real world. It is used in various fields such as architecture, engineering, and design. Virtual reality can be used to explore historical sites, simulate building designs, and provide immersive experiences for students and educators.

### Traditional Learning

Traditional learning involves the use of traditional teaching methods and materials, such as textbooks, lectures, and classroom discussions. It is a common method of education that has been used for centuries.

### Conclusion

The adoption of technology in teaching methodologies has significantly enhanced the learning experience for students. By integrating digital applications and virtual reality into the curriculum, educators can provide students with a more comprehensive understanding of the subject matter.

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**Note:** The above content is a detailed analysis of teaching methodologies for history of architecture, highlighting the integration of digital applications and virtual reality to enhance student learning. The specifics of each methodology are tailored to different architecture schools, reflecting diverse educational practices and technological advancements.
# COMPARITIVE 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 of 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.

| INTERNATIONAL COLLEGES | MASSACHUSETTS INSTITUTE OF TECHNOLOGY | SCHOOL OF ARCHITECTURE | Bachelor of Science in Architecture (History, Theory and Criticism of Architecture and Art) | Stream in all years | 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 special problems of architectural design. Stresses the geographical context of buildings and allows the process familiarizes students with buildings, sites and cities from around the world. STUDIES THE INTERRELATIONSHIP OF THEORY, HISTORY, AND PRACTICE. LOOKS AT THEORY NOT AS SPECIALIZED DISCIPLINES RELATING ONLY TO ARCHITECTURE, BUT AS WASHING ON MANY ISSUES, WHETHER THEY ARE CULTURAL, AESTHETIC, PHILOSOPHICAL, OR PROFESSIONAL. TOPICS AND CREDITS ARE CHOSEN FROM A WIDE RANGE OF TOPICS, FROM ANARCHICAL ARCHAICITY TO MODERNISM. STUDENTS ANALYZE ALL THROUGH DRAWING, MODELING, READING, AND WRITING. PROVIDES A FRAMEWORK FOR UNDERSTANDING CONTEMPORARY ARCHITECTURAL DESIGN AND TO BUILDING A VISUAL VOCABULARY TO COMMUNICATE EFFECTIVELY ABOUT DESIGN. | Lecture through M desktop virtual reality. | 3 | Students are introduced to the use of virtual reality and virtual reality technology. M modelling of different historical monuments are presented and students are divided into teams. Construction details and walkthroughs are worked out in class. | Lecture, practical, studio, and oral presentation. | Virtual reality provides a new dimension of virtuality, drawing on the strengths of visual representations. Virtual reality motivates students. It requires interaction and encourages active participation rather than passivity. Virtual reality provides a new viewpoint for understanding complex design issues. | Virtual discussions | Lorenz Bello | bello@mit.edu | Lecturer | 1. Virtual reality furnishes first-person non-symbolic experiences that are specifically designed to help students learn material. 2. These experiences cannot be obtained in any other way in formal education. 3. This kind of experience makes up the bulk of our daily interaction with the world, though schools tend to promote third-person symbolic experiences. 4. Constructionism provides the best theory on which to develop educational applications of VR. |
## 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 story of the society which evolved through many years. To satisfy the needs of the society, the material and technology evolved 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.

### Teaching Methodology / Teaching Strategies Adopted

<table>
<thead>
<tr>
<th>S.N.</th>
<th>ARCHITECTURAL SCHOOL</th>
<th>YEARS TAUGHT</th>
<th>SYLLABUS OF 2ND YEAR</th>
<th>COURSE OBJECTIVE</th>
<th>TEACHING METHODOLOGY</th>
<th>TEACHING STRATEGIES</th>
<th>INFRASTRUCTURE</th>
<th>IMPACT OF TEACHING RELATING TO LEARNING</th>
<th>TEACHERS REVIEWED</th>
<th>TEACHERS REVIEWS ACHIEVED AS PER QUESTIONNAIRE</th>
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<tbody>
<tr>
<td>1</td>
<td>COLLEGE OF ARCHITECTURE, ARIZONA</td>
<td>4</td>
<td>Prehistoric Architecture: Earth, Sky, and Structure; Egyptian Architecture: Old Kingdom and New Kingdom; Temples (2 sections); and 4th Year.</td>
<td>1. To familiarize the student with the principal architectural achievements from prehistoric through the Middle Ages. 2. To present a historical understanding of the role of architecture in social and cultural contexts. 3. To help the student acquire and develop a fundamental understanding of critical historical modes of thought and historical interpretation. A descriptive and analytical vocabulary with which to express visual perception verbally. The ability to identify and evaluate different kinds of visual evidence and assess the significance of historical context. 4. To encourage effective oral and written communication through training in argumentation. 5. To teach the student to think critically about the aspirations, constraints, tools, and choices involved in all architectural design, past and present.</td>
<td>Teacher conduct lecture by using INFORMATION AND COMPUTER TECHNOLOGY to deliver lectures and to motivate students.</td>
<td>Collaboration in virtual reality classroom course focuses on social integration of learners. 2. Not possible in reality as possible in virtual reality. Virtual game-based 3. Importance of historic ruins and urban layout. 4. Virtual reality introduces new approach to research. 5. Virtual platforms and handouts are the new tools for inspiring creative learning.</td>
<td>A CAVE is 2-5m. In size and four projected surfaces 3. Three walls and floor, five surfaces, or only enclosed five surface configurations for complete virtual immersion. Variety of input devices, for example, a joystick, mode or more commonly, a laptop device, i.e., data glove</td>
<td>Most of the teaching is virtual environment, teaching turn out to be game based and simulations are conducted through Pilot Study</td>
<td>Exploring: learners explore a virtual world's locations and communities as if they were real. Collaborating: learners work together within a virtual world or collaborative tasks. Using: learners engage themselves and their identity through the experience in a virtual world, such as through role-play. Building: learners construct objects within a virtual world. Challenging: learners promote real life causes through activities and simulations in a virtual world. Expressing: Symbolic and experimental learning.</td>
<td>Internet study</td>
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VIRTUAL REALITY FOR PEDAGOGY OF TUGHLAQABAD TOMB.
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VIRTUAL REALITY FOR PEDAGOGY OF SANCHI STUPA.
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 synthesize 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.
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.