

# Visual Techniques as a New Teaching Approach For Construction Engineering Course in UTHM

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**Abstract:** This study is to provide a new approach in learning and teaching process for BFC 21002 course at the Faculty of Civil Engineering and Built Environment in UTHM. This study was conducted to help lecturers and students to get a better understanding of the concept of the construction process through VR system that meets the requirements of BFC21002 Construction Engineering syllabus. The findings of this study prove that VR systems can help built more interest in learning and teaching process as well as improving student's prestige in doing a stimulation. The learning process is also easier to understand with the help of virtual reality experience which gives an idea of the real situation of how a building were built. Although the use of VR techniques in the learning and teaching process is still unclear for the future, the average VR system users provide positive feedback about this system for training sessions in helping them to improve their individual performance. In the future, technological assistance in education will be a successful learning and teaching platform in the field of education.

**Keywords:** Learning, Teaching, Virtual Reality, Hologram, 3D Videography

## 1. Introduction

The main focus of this literature review is on the needs and growth of one's skills. The learning environment will be more interesting by using multimedia. Multimedia presentations play an important role in our lives especially when we want to learn something. When teaching involving the use of visualization, knowledge remains an average of 25% [1]. The impact and the use of multimedia is widely practiced in various fields such as science and technology, video games, in commerce, and most importantly in learning and teaching [2]. Multimedia is a combination of various types of media such as symbols, images, pictures, audio, video, animation and words such as alphabet or numbers that are usually with the help of technology to increase the comprehension power of memory [2]. Firstly, multimedia and technology support complex information processing. Second of all is multimedia and network technology is a type of communication technology where it uses the internet network as an agent to transmit information and interact [2].

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Research in the field of education always focuses on what specific steps should be taken for students to learn by showing their increased performance, attention and motivation in the classroom. Therefore, the main focus in this study is to compare 3D modeling and animation techniques as well as introduce a new approach in the field of education, especially for the Construction Engineering course at UTHM.

### 1.1 Problem Statement

Multimedia applications with interactive 3D animation as well, with regular 3D animation, actually increased students' interest and make the learning process more interesting[3]. Design and construction subjects such as construction engineering involve students' understanding of how a building is built. Relying on lecturer notes alone is not enough to give understanding to students especially in the field of engineering. For students to understand concepts and work in the field of engineering, students need to be exposed to real situations. Learning through these visual techniques can help students to understand a certain work path more carefully. Therefore, the selection of an effective teaching techniques to expose students to the real experience of how a building is built is very important in the field of engineering and not just rely on notes alone.

### 1.2 Research Objectives

Multimedia applications with interactive 3D animation as well, with regular 3D animation, actually increase student interest and make the material more interesting [3]. Theories about learning with multimedia can be categorized into several levels [3]. Due to the rapid changes in products and production systems, students need to be more quickly introduced to existing and future methods [4]. The first objective of this reviews is to identify the most efficient teaching and learning methods and evaluate visualization and multimedia method compare to tradisional method. By using visualization and multimedia in learning, it is hoped that students will be able to get better understanding on the lessons deliver from the syllabus of the subject.

## 2. Literature Review

This literature review focuses more on learning approaches using multimedia resources from previous studies. Through past research that have been made, learning techniques are compared and the most effective learning techniques will be proposed for subjects involving construction such as Construction Engineering. Initially, data from past research are gathered and studied for VR, Hologram techniques and 3D video animation. References from other filed of study such as science, medication and invention are also be used as a reference in this study. The purpose is to collect as many learning methods that utilizing multimedia approaches in the learning sessions. After comparing the advantages and disadvantages of using those techniques, the most suitable media techniques will be selected to facilitate the learning session.

### 2.1 Virtual Reality (VR)

VR (Virtual Reality) technology is widely practiced in various fields such as entertainment and education [8]. In addition, VR systems are also used in forensic science; science and biology; medical field; field of architecture; programming; designing; the field of geometry learning; and digital industry[7-12].

Mixed reality technology, including virtual reality (Virtual Reality) and augmented reality (Augemented Reality), is considered as a potential tool to ensure the process of teaching and learning science that can cultivate positive emotions, motivate autonomous learning and improve learning outcomes [12]. The focus of the VR system in this study is to simulate microscope operations and related to interactive behavior that allows users to observe and operate 3D model microscope components through natural interaction in in-depth scenarios. The results of using this system is very useful and able to help students to recognize the structure of the microscope and understand the operation required skills by stimulating operations using interactive processes [7-10]. Virtual Reality (VR) is a new technology that offers exciting prospects for teaching and learning, especially for

delivering practical skills. [10]. VR-based practical sessions have the potential to add value to forensic science courses, by offering effective practical experience, the ability to work separately and in a variety of different scenarios[10].

## 2.2 Hologram

There are several previous studies that focus on 3D models in learning a particular field or major such as the use of three-dimensional technology in the field of healthcare [12], traditional manufacturing techniques using holograms [13], previous study aims to explain the use of three-dimensional (3D) technology to support teaching and learning in healthcare education and outcomes related to 3D technology from a teaching and learning perspective. The hologram system enables the visualization of complex 3D models in real dimensional dimensions that allows simultaneous 3D visualization of a model to a group of students [12]. Holographic system enables complex 3D model visualization in real dimensional dimensions that allows simultaneous 3D model visualization to a group of students without restriction from the presence of multiple users simultaneously accessing the same 3D content [13].

## 2.3 The 3D Video Animation Technique

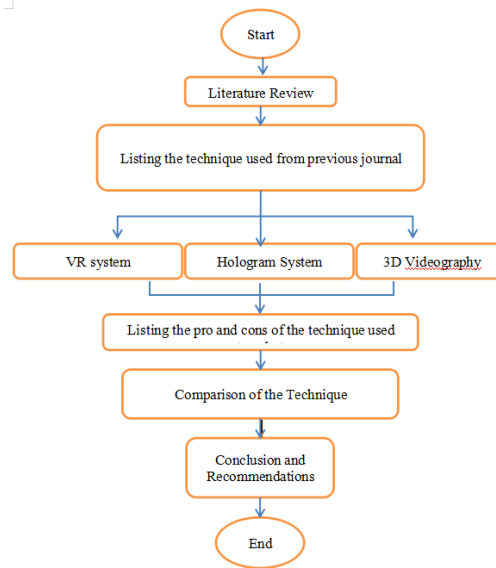
Students' level of understanding through what they see, hear and quality of teaching and learning material is 75% compares to students who only see during teaching, 20% and 40% for those who see and hear during the teaching process [16]. Videos on YouTube is art of learning that have visual, sound and quality of the video contribute to attract students' interest and attention [16]. The four main areas of research of this study for the present and future period are the effectiveness, efficiency, use, and quality of video as teaching and learning materials [22]. Previous study were conducted on how instructors and students gain knowledge using pre-services on good teaching practices through the interactive use of video databases and online discussion forums. From that study, instructors and students shared their instructional videos and receive comments or suggestions from other members of the learning community [20]. Instructional videos can benefit educators and other students who do not participate in this study to learn about teaching[16-18]. While there is a clear need for additional research in this field, the use of video shows promising results, is relevant, and is increasingly being used as a teaching strategy that can improve the quality of clinical skills education [19].

## 2.4 Conclusion

Based on literature review, the results are very convincing that using multimedia systems in learning and teaching sessions can increase students' creativity and design field. Interaction of 3D virtual environment in science contributes more effective effects in the learning process [3]. However, using this multimedia facility requires more experience, and high understanding and imagination to perfect the 3D modeling. In addition, learning with multimedia elements, such as video, has proven to be effective for learning activities [24-25]. Finally, audiovisual education technology enhances the overall features of cognitive processes, enhances learning incentives, makes academic knowledge more attractive and thus plays a key role in achieving the function of teaching development [16].

## 3. Methodology

In this section, the research methodology is discussed. This research involve reviewing process of different topic as shown in Figure 1.



**Figure 1: Research flow chart**

The method used to conduct this study is to review previous research papers related to the topic and simplify it by gathering information in tabular form so that it is easier to understand. By collecting as many journals from previous studies and summarizing them as well as extracting the necessary data that will be used for review in the next chapter. Conclusions will be made based on the review of the study obtained from previous studies. The factors that will be taken into account are the advantages and disadvantages of each media listed and choose a system that is the easiest and simplest and leads to a new approach in this study.

#### 4. Result and discussion

##### 4.1 Summary from Using VR System

This study focuses on students who face difficulties while imagining, illustrating and solving problems such as if they need to design an angle starting from the original it becomes difficult to extend the line from the original and design the angle [26]. In learning mathematics (geometry), many researchers argue that most students are unable to build a network or relationship with an object in 2 dimensional (2D) shape, compared to 3 dimensional (3D) objects where it has made it difficult for students to distinguish shapes an object is either in solid form or flat form [26]. Findings from the study in the field of emergency medicine using VR training can improve performance in simulated scenarios even without previous experience in using VR systems [9]. The contribution of VR systems is still unclear despite the many studies and learning processes that use these VR systems[9]. it was concluded that the use of VR systems ensures the process of teaching and learning science that can cultivate positive emotions, motivate autonomous learning and improve learning outcomes[14].

Based on this research, it was found that this system is very useful and able to help students to recognize the structure of the microscope and understand the operation required skills by stimulating operations using interactive processes[14]. Analysis shows that the experimental results of the AR subsystem have a positive effect on students' understanding of theoretical subjects, and without being limited by the time and space allowed for pre-school or after-school use. Although VR was not been suggested as the replacement to the conventional practical experience, the results of the study found that it is an addition to the Forensic Science education that will improve both student satisfaction and learning outcomes [14].

#### 4.2 Summary from Using Hologram

The purpose of their study is to explore the use of 3D technology to support teaching and learning in healthcare education and outcomes related to 3D technology from a teaching and learning perspective [12-13]. The main benefit of this content delivery mechanism is to show 3D models simultaneously to a group of students who are in the classroom. Outcomes that support learning are grouped into the following categories: user experience (satisfaction with 3D technology), motivation (motivation to learn), attitudes (self-confidence to learn) and emotions (feedback, presence experienced, feelings of interactivity and emotion [12]. In the future, the proposed preparation will be confirmed in a laboratory environment where a group of students who use the hologram system and have several different training sessions with a team of instructors who are in the office or separate from the University campus[13]. However, 3D technology is something new in health medicine education. The scope of research is also limited due to the lack of journal resources related to 3D techniques in medicine. Yet, the use of 3D technology can support teaching and learning in healthcare education if educators want to portray something that is difficult to understand through the imagination [12].

#### 4.3 Summary from using 3D video Animation

Learning through video can help to understand a process being carried out [16]; improve students' understanding of a subject [15]; improving performance in learning in medicine [18]; acquire knowledge using pre-service on good teaching practices through the use of 3D media videos [24]. Hence, this teaching strategy able to improve the quality of clinical skills education [22]. Learning using video guides has been proven able to provide a clearer understanding than verbal learning alone but students are not exposed to the real situation of something happening and are only able to see to imagine how to do it. Teaching source that is the 3D video should come from a valid and authentic source [22]. Furthermore, the quality of the uploaded video should be of high quality so that it is not inconvenient and important details can be clearly seen [22].

#### 4.4 Summary

Several approaches using multimedia have been conducted, tested and recorded significant success. Success stories also vary based on location, target age and purpose of use. After formulating the advantages and disadvantages as well as the suggestions put forward by the author, there is no denying that every method of learning and teaching using a multimedia system brings many advantages over its disadvantages. A significant improvement in user performance can also be seen from each of the results of the study.

### 5. Conclusion

To produce a new approach in the field of education, especially in the field of Engineering for Construction Engineering syllabus at UTHM, it is most appropriate and effective to use VR system for teaching and learning sessions. As discussed in previous chapters, VR systems provide virtual reality experiences and improve performance over time during training period. Not only does it give a 3D view of the surroundings, it can also expose the use of real situations and situations with the presence of special effects that go hand in hand with the VR system such as sound effect.

Although VR system is still unclear to its concept of contribution in other areas, its effectiveness remains clear from what has been discussed. Most importantly, in the field of education is much effective to use this method with some improvement of its performance and VR system is the best option. Indeed, using visual techniques in learning and teaching, student's performance can be improved and attracted to learn.

In conclusion, visual techniques using VR systems has been found able to enhance students' learning power and attract students' interest as well as make it easier for students to understand the learning content by revealing to them the real situation of how something is made and built.

## 6. Recommendation

While it is important to develop a variety of applications for effective teaching and learning delivery. It should be able to suite areas of focus group such as target age, economy value, advantages and disadvantages. Further research on approach of VR applications in experience of economic value for preparation of the facilities and manpower involved should be evaluate also in order to sustain in the future.

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