Realitas Maya

by Bramasta Redy

IMPACT OF SIMPLE VIRTUAL TECHNOLOGY APPLICATION IN ARCHITECTURAL EDUCATION

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ABSTRACT

The development of technology cannot be separated from the development of science, including the learning method. There is an elective course named Virtual Reality Architecture in Architecture Department of Petra Chrisitan University. This course focuses on the process of learning architecture at the stage of presenting and communicating ideas. The virtual technology used as a learning method includes three types of technology, animation, augmented reality and virtual reality. The three technologies are elaborated as a simulation method. The simplicity of its application can be seen in the support for hardware, software, and special devices used by students in their daily lives. This study aims to test the achievement of goals at the final level of learning. Students who have attended this lecture are then interviewed and observed, in relation to proving whether this simple virtual technology can be a supporter in the learning process in the architecture study program.

Keywords: Virtual reality; Augmented Reality; Architectural Presentation.

INTRODUCTION

Architectural design is the process of generating ideas for spatial design and building forms in a particular context. Communicating the results of ideas can be done with presentation techniques. The presentation of architectural designs has evolved from time to time, from manual hand drawings to digital technology. The process of visual presentation, which is closer to reality and more immersive, will make the communication process of architectural ideas more helpful. (Chang & Szalapaj, 2000).

The development of digital virtual visualization technology extends to all fields, including architecture. Design based on visual ideas is considered to be very suitable and can be helped by the use of virtual reality technology (Stonorov, 2018). With the support of increasingly affordable tools, the implementation can reach many layers of users. Architecture students & education is one layer. In the process of architectural education, students cannot be separated from the practice of exploring ideas for the needs of fulfilling the competency of space design skills and building shapes.

In supporting the design process, students can choose an elective course in the Petra Christian University architecture study program, namely Virtual Reality Architecture. A course in which it tries to introduce, give understanding, to the stage of simple technical implementation with the design object they are working on. Students are asked to produce a digital visualization with the help of technology, using software (SketchUp modeling, Twinmotion visualization, and google virtual tour visual viewer) and hardware (laptops, head use visualization devices, smartphones) introduced during the lecture. Of course, this technology needs to be supported by adequate software and hardware. However, this course tries to see a simpler opportunity from the application of this virtual visualization technique. There are at least three design communication virtualizations, as a choice of visualization methods, the first is animation-based, augmented reality, and virtual reality. The simplest technique of virtual reality itself is a stationary panoramic image (Syafril, 2019). The method used is a panoramic image visualization method in the form of a virtual round area. A further technique is to display the panoramic image in real-time. So actually virtual reality itself can be used as a presenter of the final product only, it can also be a tool in the design process. Of course, the tools help the design process directly, requiring more complicated hardware and software support. This is temporarily not accommodated by the Virtual Reality

course. This study aims to see how much impact the implementation of this technology has in its simplest form, on the architectural learning process that is being or has been carried out by students. The big potential is to see and ensure that the relationship of technology in the learning process can have a positive impact.

LITERATURE REVIEW

Several studies and publications related to this topic have been carried out, but not many have correlated them in the teaching and learning process or education. The gap that appears is that the implementation of this technology is mostly supported by very adequate hardware and software. On the occasion of related subject subjects, the technology used is very simple. One of the latest studies shows that the implementation of virtual reality in learning has a positive impact, although it must be supported by the commonality of its supporters, such as hardware and software (Sapto Pamungkas et al., 2018). Our initial hypothesis is that there will be students who will find this simple technique very helpful, but there will also be the possibility of a statement that their implementation has not been maximized or that they have not been fully integrated into the process of designing their daily architecture. The possibility is that some ideal supporting tools are not yet reachable, as well as the limitations of simplicity as previously stated.

ARCHITECTURAL VIRTUAL TECHNOLOGY

Virtual reality is the standard Indonesian term for the term Virtual Reality. Putro said that VR is an application of digital media technology that has many advantages in the visualization of three-dimensional objects. Users can not only have additional visions through this technology but also come to the interaction stage in the digital medium. According to him, three-dimensional physical modeling is a method that can help communicate architectural ideas, especially for ideas that cannot be physically implemented. (Putro et al., 2015).

Virtual reality as a basic concept has at least 4 main keys in its definition (Lavalle, 2017). Experience from the designed space, point of view, artificial sensory stimulation, and awareness of the virtual world created. The limitation of architectural visualization through the manual method, cannot reach most of these keys. In its implementation too, students will design a space that is expected to emerge experience in experiencing the virtual simulation (Figure 1). Virtual reality itself can be fulfilled through 4 basic elements, namely Virtual Environment, Virtual Presence, Sense Response, and Interactivity (Mihelj et al., 2014). These four basic elements are mostly achieved through the three-dimensional modeling support of a spatial plan. So that the hope, through visualization of virtual reality, designers can more easily realize and communicate their imagination in spatial visual language. One thing that Lavalle emphasizes regarding the success of this technology is its demand for high specification hardware and software, and in itself makes this technology seem exclusive and out of reach for everyone. With this fact, it is considered important to review the impact of implementing virtual reality with software and hardware that is simpler, more affordable, and easy to obtain in the architectural education process.
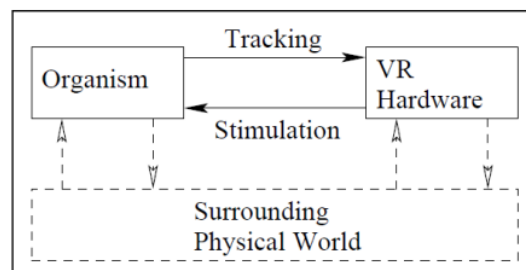

Figure 1 Schematic of how digital space virtualization works
(Lavalle, 2017)

In the research, literature studies will be carried out to ensure the novelty of the implementation of virtual reality technology in various fields about the architectural design process. The various processes referred to include the process of visualization, design simulation, presentation in designing professional architects, researchers, and lecturers-students in the teaching and learning process. (Bashabsheh et al., 2019). This

study is intended to review the inclusiveness of the use of virtual reality technology in the process of professional design and the process of architectural education, especially the implementation of virtual reality using simple tools that are more accessible to many people. Affordability is a very important factor in the process of architectural education because easy access and affordable tools allow all architecture students to take advantage of this technology anywhere without relying on the existence of expensive physical laboratories. Nowadays, simple applications based on 360-degree visualization can be done even on lecture assignments. Its simple nature, and the support of unnecessary tools, make simple implementation easy (Syafril, 2019). The question is whether, with this affordable hardware and software, the four key points of the success of Virtual Reality which correspond to Lavalle's opinion above can be achieved. According to LaValle, we can evaluate the quality of the experience felt in the use of virtual reality technology (Lavalle, 2017). Some of the quality parameters include visual perception (depth, motion, color/texture), visual rendering, motion, tracking, interaction, audio. From this aspect, a set of experiences will be obtained, which can be evaluated including the following aspects: perception, development recommendations, the convenience of use and development, and further experiments.

VIRTUAL ARCHITECTURE SOFTWARE & HARDWARE

The two main components of virtualization are hardware and software. In the context of visualization, hardware functions as a making tool (laptop) and a display device (smartphone or head device). Meanwhile, virtual visualization software can take advantage of several variants of the software. In principle, the software can process three-dimensional views and supports the rendering process. There are at least four main hardware displays for the virtualization design (Figure 2) (Syafril, 2019).

- **Computing hardware**
- This device functions to process data so that it can be compiled and presented in three-dimensional form. If it's just a still image, it can take advantage of simple computing devices. However, if you need a live view, in the context of a design tool, you need more sophisticated computing devices.
- **Display hardware**
- After the image is virtually processed, it needs to be displayed interactively. The least interactive here is that the display device can follow the direction of the user's head movement to be able to display the appropriate direction on the virtual display. The choice is a head device with a viewer using a smartphone or a head device already integrated with the image viewer layer itself.
- **Sound hardware**
- There are at least two senses that are simulated, namely the sense of sight and the sense of hearing. In an architectural context, it is enough that the sense of sight is stimulated. The sound hardware is used to simulate the sounds that may appear in the virtual world, to add a real effect to the user.
- **Controller hardware**
- Controller hardware can take many forms. The simplest are devices with a gyro sensor, which can detect motion. If movement is more active, then additional hardware such as remote control is needed. In the context of design visualization, this is optional.
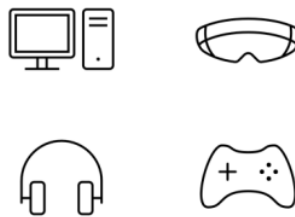

Figure 2 Virtualization support tools
(Souce: Author)

Hardware, of course, needs software support so that it can work as expected (Figure 3). There are at least three categories of software to support the virtual visual communication process of a design, namely design software, display software, and viewer software.

- Design software
- Design software, which is software capable of processing designs in a three-dimensional format. The variety is quite large and is not bound by the capability to present the virtualization of reality. Some examples of software in this category include SketchUp, Rhinoceros, AutoCAD.
- Visualization software

- The three-dimensional design needs to be displayed in a more real way, both in terms of lighting, materials, and simulations of the surrounding environment. This device will support simple reality virtualization if it supports output processing in panoramic format. Panorama can be in the form of still images or moving images or videos. Some examples of software in this category are Twinmotion, Lumion, Enscape, Sketchup.
- Viewer software
- After a virtual image is formed, it needs to be displayed so that it can be consumed by the user. Several platforms support the display of objects, both animated (video), augmented reality, and virtual reality (virtual reality). For video, the platform that can be used in any video platform, because the virtual animation format is video. Some examples include YouTube, Vimeo, Video Player. Meanwhile, for augmented reality support applications, software capable of displaying three-dimensional projection with the help of a camera is needed. This application runs mostly via smartphone devices, for example, UniteAR, Sketchfab, Sketchup Mobile. Meanwhile, virtual reality viewers take the form of panoramas, in the form of digital platforms, including Google Virtual Tour, Kuula, RoundMe, AirPano, Sketchfab, and so on.

Figure 3 Software & Hardware Integration
(Putro et al., 2015)

METHODOLOGY

This research model is generally qualitative lecture evaluation research. Research is designed to provide experience and capture of meaning as created in the research field through interactions between researchers and the object of research, namely students participating in the course. Research is qualitative because research variables cannot be quantified or expressed in numbers, such as understanding, perceptions, opinions, and so on.

The steps of this research are as follows:
- Preparatory phase: consider selecting courses as the scope of research and establishing research arguments. The chosen course is Virtual Reality Architecture (AR4260) which is an elective course. The evaluation research argument is because the topics and learning objects develop dynamically, so it is necessary to map the impact of lecture activities which is one of the bases for the direction of its development.
- Exploration phase: determine the variables that will be sought out through this research, which will be able to help researchers to map the impact of the implementation of design virtualization technology in the teaching and learning process. The variables are then determined in line with the lecture process, from the beginning, the process, the end and after the lecture, both in study and work. From this process, then based on the results of the lecture, the researcher determines the subject of the respondent's subject is interviewed. Subjects are assigned to represent each batch of students, as well as students who get good enough results in these activities.
- Implementation phase: the study was conducted using the online interview method, due to limitations due to pandemic conditions. Interviews were conducted separately between sources. Interviews are focused on interview questions related to research variables.
- Concentration phase: research is processed by narrowing the data, analyzing it, and perceiving findings based on previous data processing.

In general, the scheme of this study will find out four main things (research variables), namely (Figure 4)
1. UNDERSTANDING: The level of understanding of the course participants on the role of applying simple virtual reality technology to the architectural higher education process.
2. MASTERING: The level of mastery of the course participants towards the implementation of simple virtual technology to the architectural higher education process.
3. IMPACT: Knowing the impact of mastery of simple virtual technology implementation in the architectural higher education process.
4. EXPECTANCE: Knowing the vision of implementing simple virtual technology opportunities in the development of the architectural world in the future
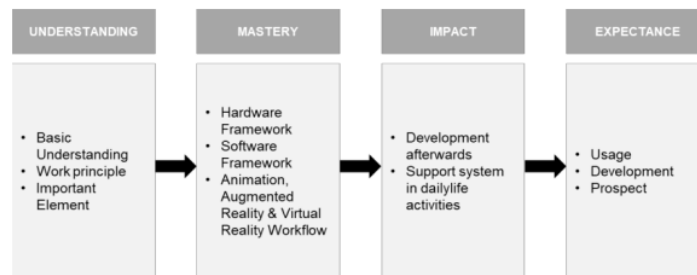
Figure 4 Research Variable Diagram
(Souce : Author)

Research interview schemes that will support the solution to the above problem formulations are arranged according to the course of the learning process:

1. Motivation & background for selecting courses
2. Understanding the concept of design virtualization
3. Experience in implementing design virtualization
4. Use and development of advanced virtualization technology

The Virtual Reality Architecture course has been conducted in two periods. The first period is the regular semester, with 19 students with a mixed composition of 2015 and 2016 class. While the second period is a short semester with 5 students in total with the total composition of the 2017 class. This course is designated as part of the elective courses, with competencies. the end to be achieved is as follows:

- Students understand the meaning and development of digital virtual reality technology in presenting architectural designs (understand)
- Students understand how various virtual reality-based applications work in the process of presenting architectural designs (understand)
- Students can simply implement the concept of digital virtual reality technology in presenting architectural designs (apply)

The learning scheme is divided into two-time sessions, namely the beginning to the middle of the semester, and the middle to the end of the semester. The first half of the semester is in the form of material lectures and discussions. The final half of the semester contains workshops and a simulation assignment for three virtual technologies: animation, augmented reality, and virtual reality. Hardware support in the form of laptops and smartphones and the software used are :

- Computing software
- To support the process of refining the design before it is presented in three dimensions, several applications are used on laptops, namely SketchUp and Rhinoceros. While the visualization application is simulated with Twinmotion and Lumion.
- Viewing software
- The viewing devices are divided into three categories. For the animation category, the platforms used are YouTube and Streamable. Meanwhile, the platform augmentation category used is UniteAR and SketchFab. And finally, for the virtual reality category, the visual panoramic platforms used are Kuula, RoundMe, Google Virtual Tour for still images, and YoutubeVR for videos.

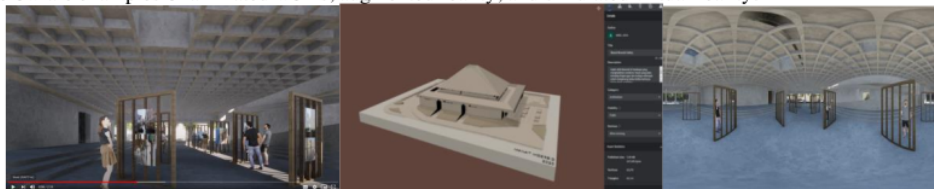Below are examples of animated works, augmented reality, and simulated virtual reality.

Figure 5 Student Works of Virtual Reality Tasks (Animation, Augmented Reality & Virtual Reality)
(Souce : Ariel Jehu – B12170032)

Figure 6 Student Works Showcase in poster format
(Sumber : Sily 22414015 - Celine 22416082 & Satria 22416062 – Desy 22416086)

RESULTS and DISCUSSION

From a total of 24 participants during the two lecture periods, 10 respondents were screened using the following criteria;

- Each of them represents the class of 2015, 2016 and 2017
- Enthusiastic enough in the discussion during the lecture
- Have a fairly good value from the lecture

Interviews were conducted using the online Google Meet Meeting platform in December 2020 - January 2021. The results of the interviews were recorded in the google form and google online table. The interview design is structured to achieve a mapping of the variables of understanding, mastery, impact, and expectation. The interview questions are divided into five-question sections.

1. Motivation and background to attend lectures
2. Conception and understanding of animation, augmented reality, and virtual reality
3. Quality of virtual simulations performed
4. Technical implementation and usage experience
5. Use and continued development

From the data process from the interview results above, the following can be interpreted

Section 01 Background & Motivation

Of the 10 interview respondents, all of them answered that none of their motivation to take the course was compulsive. All with their awareness, whether at first, they don't know, to those who already understand and want to develop their abilities. From this fact, the data from 10 interview respondents in our opinion can be used as valid data.

Section 02 & 03 Concept of Understanding & Visualization Quality (Variables Of Understanding)

Even though they communicate with their understanding, according to the characteristics of each participant, all of them were able to retell the concept of understanding well. Starting from an understanding of digital animation, augmented reality, and virtual reality, the essence of understanding can be conveyed well. Some respondents have graduated from college for a long time, but it can be seen that understanding is not just memorization, but understands it completely. For the aspects that influence, although the choices vary, from the descriptions presented, it is clear that they understand the working principles and role of implementing this technology, namely increasing the opportunity for understanding in communicating ideas or design designs.

Section 04 Implementation And Experience (VARIABLES OF MASTERY)

From a variety of technologies, applications, and complexity, the selection of animation, augmented reality, and virtual reality only within the scope of presenting ideas, can be said to be quite appropriate. This means that by not including the design process, only the presentation of the design, the tools needed do not need to be too complicated. Each of the respondents can operate, access independently both hardware and supporting software. This is because they are making enough use of what they already have themselves.

Section 05 Implementation and Development (Variables Of Impact And Expectations)
Most of the respondents were able to see the opportunity to take advantage of this visual virtualization technology in various activities. This is of course a positive indicator, which shows that this ability does not stop at lectures, but extends to jobs, competitions, and so on. The use of technology has been able to understand its role, namely that they place this virtual visualization for the aspects of communication and design presentation. In the end, they also said, from 10 respondents, all of them stated that this technology was very promising. This is supported by the digital era which increasingly demands the role of technology to be more intense, to facilitate the design process.

From the interpretation of the results and interview data, the answers to the research questions are as follows:
- Can the course participants understand the role of implementing simple virtual technology in the architectural higher education process?
- They can understand that this virtual visualization technology is intended to facilitate the process of presenting and conveying ideas, especially to laypeople. This is because this technology helps make digital simulations closer to reality, a condition that ordinary people can understand. This condition approaching reality is achieved because the understanding of space becomes more complete, not cut into pieces, and visual qualities such as light and materials can be simulated as real as possible.
- Can the course participants master the implementation of simple virtual technology in the architectural higher education process?
- They consciously answer this simple implementation they can master without too hard effort or big capital. The tools used are tools, most of which are daily design tools. Even for additional tools, it can be accessed from the cheapest version to the most expensive version. For example, a VR headset can be replaced with an inexpensive device such as a VR Cardboard with the same basic functions. For supporting software, the average software can be used easily because developers present their applications very friendly to users. Complex matters have been simplified in the form of simple icons and buttons. There was no answer to the interview questions that they had difficulty, both in accessing the hardware and operating the software. And the next stage is to present their work virtually.
- Does mastery of implementing simple virtual technologies have an impact on the architectural higher education process?
- Most of them feel very helped by this technology. This can be indicated from its implementation outside of compulsory lecture assignments. Some consciously add this product as part of a design product even though they are not asked for it. On other occasions, they are quite observant about using this technology assistance in competition activities and even working in the office. So it can be said that the impact that appears is positive, that is, they get additional abilities in processing and presenting their design work, to then be communicated to clients or design targets interactively and attractively.
- What are the expectations of the opportunities for implementing simple virtual reality technology in the development of the architectural world in the future?
- All respondents answered that the opportunities in the future are getting bigger. This is evidenced by their very optimistic answers. Not only that, but the increasing trend of technology's contribution in life also supports the above statement. But it does not stop at this point, of course, in line with the development of this virtual visualization technology, we must develop ourselves as well, both in the context of hardware, as well as the ability to utilize an increasingly varied variety of software.

In addition to the above conclusions, we found the following specific points:
- Special & Specific Simulation
- Resource person Gregorius Christian said that one of the advantages of using virtual reality simulation is that it can simulate a special condition that is difficult to do without virtual or digital media. In the opportunity to work in an architectural studio in Japan, a design needs to simulate the interaction of buildings with rainfall. If the simulation is carried out in real terms, then the model mockup will try to combine it with a certain water flow, so that the studio gets wet, or needs a special room. Meanwhile, through digital simulations, this is easy to do, without the need for a special physical room

- Understanding of the common people
- Resource person Billy Kianda said that one of the most obvious advantages related to the use of virtual visual technology is that it makes it easier for ordinary people to get an atmosphere simulation exactly as expected by the designer. From this, we can draw an understanding that architects should understand the client's condition or that the target design is people who cannot understand space. With the help of digital tools or technology, ideas can be conveyed easily, because experiences are simulated closer to reality. Architects as designers certainly have a good understanding of shadow space, but this is not the case with most laymen who are the design targets and potential users of the design space.
- Forming a complete atmosphere
- Resource person Billy Kianda revealed that in fact, one of the messages to be conveyed through design other than spatial configuration is the ambiance. This can be strengthened by feeling the space as a whole, not just a partial part, with a visualization that approaches the concept of design (aspects of light, materials, etc.). With the help of virtual technology, completeness is easily achieved because the viewer can feel a complete 360-degree space without being divided into certain angles like normal visualizations.
- Opportunities for development
- Resource person Billy Kianda also mentioned technology is related to tool support. Tools that are easy to get and cheap, make the use of technology cheaper. In the implementation questioning session, Billy mentioned that one of the things that spurred the ease of using this virtual technology was because most of the supporting tools were what they already had. Additional tools, too, can be accessed with various versions. For example, headsets, some only have folding cartons, up to expensive devices. The point is that affordability and ease of use can be factors for the sustainability of further developments. For a more advanced stage, the use of more sophisticated tools is certainly possible, but the possibility of daily implementation with a wider range of users becomes more limited.

CONCLUSION

From the results of the above discussion, it can be concluded that:
- Understanding of the concept and application of virtual visualization technology, be it animation, augmented reality and virtual reality, can be mastered by most of the lecturers well
- There is an awareness that this technology has a positive role in the aspect of presenting ideas or communicating architectural designs to the common people. This happens because, through this media, ideas and designs in the form of simulations can be presented attractively and variedly, approaching real conditions that are easily understood by most people.
- Most agreed that these additional skills support the architectural learning process. This is evidenced by the intensity of the use outside of the mandatory things they have to do, but as additional design products that are very helpful in communicating design ideas.
- Future developments tend to be bright, must remain optimistic and adaptive, keep abreast of various similar technological developments, so that they can continue to be helped and are not burdened because they cannot operate. Good technology is a technology that can make life easier, not what makes us dependent.

From the above conclusions, it is advisable to:
- For study programs and teaching lecturers: to be able to continue to develop and integrate science with technological advances, so that learning can continue to be relevant to the progress of the times.
- For prospective students: to be aware of their interests and talents, and with full awareness, either independently or in a structured manner, develop abilities in all aspects that support work professionalism.
- For graduates/alumni participating in this course: to be able to continue to develop themselves, in whatever field they are currently studying. The learning process does not stop when you have graduated, but there is a need for awareness to continue to develop yourself and be relevant to the times.

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