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# LEVEL OF APPLICATION OF 3D ARCHITECTURAL SOFTWARE BY ARCHITECTURE STUDENTS IN ARCHITECTURAL PRESENTATIONS

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## ABSTRACT

The application of 3 Dimensional Software (3D) in architectural practice has become a necessity in the late 21st century and beyond. Digitalization of documents, presentations in the architecture profession has increased the need for faster, reliable, and accurate 3d modeling and productions. Therefore, in most architectural faculty and schools, the introduction of 3d modeling and production is a must nowadays. The introduction of many 3d software and applications in the architectural study has also tremendously allowed for the users (architects) to choose the best software for their practice.

In this research, the data of each architectural students performance in FABE, IUKL in diploma in architecture program has been collected since 2020 till 2021 has been analyzed and discussed in the research to find out the usability of architecture students after they have learned how to use the 3d software for their advantages in an architectural presentation in their studios and following. The results will be beneficial to educators on how students accept 3d software and apply them in their works other than manual presentation in their early years of study. It will also help educators on how to deliver 3D teaching and learning to the extent the students are able to use the platform for their future careers in the field of architecture.

The first most important discovery in this paper is the trend and effectiveness of 3d architectural usability by students heavily relies upon the delivery method used by the course by the lecturer and the type of software used. Then the second most important discovery is that the students discover their own style of the method of delivery of the 3d software to ensure their 'marketability in the era of digitalization and globalization. It is hoped that the finding of this research will improve the teaching and learning in the architecture field and career.

**Keywords:**
*Architecture, Education, 3D Visualization, Modelling, Animation, Statistic*

## INTRODUCTION

Architecture education has been discussed and improved throughout time by educators and practitioners all around the globe. Due to the NATIONAL POLICY ON INDUSTRY 4.0, announced by the government in 2018, it is crucial that by 2030 all young graduates are capable of fulfilling the needs of skilled workers to boost the country's economy. A lot of 3D software has been launched by software developers in line with the development of hardware advancement and digital collaboration among industry players. This has become a need for architectural education institutions to revamp and update their skills in teaching so that when the students go outside to practice, they are fit to the needs of industry.

The goal of this study is to improve the delivery system of 3D architectural courses skill by institutions so that the students are ready for their careers in the future. A lots of 3D architectural animation by firms attracts a lot of attention and increases the value of their design an ideas.

Therefore, it is important for educators to master the updated skills of the industry to make the students' education in line with the current industry needs. Fast-paced and productive services are needed for each practitioner when they deliver their product and design as the current technology in computer hardware is also evolving and improving each time. This study by lecturers of IUKL in architecture faculty is to discover the improvement needed for methods of teaching delivery, softwares and hardwares needed in order to deliver the best education for future architects. It is important to know that this study only involves those architecture students in IUKL and no other institution that offers the same product.

## LITERATURE REVIEW

Designing a building and space is one of the traits of an architect. In architectural studies, 3d modeling and visualization play an important role in delivering a high impact, impressive rendering, and visualization of both static 3d imagery and animation. Students intent to put their interest first to the visual marvel and beauty of 3d rendering and animation. However, lack of structural knowledge, Building Information Modelling (BIM), and other architectural services in the building has 'crippled' student's relevancy in their design (K. Khoshelham a, and L. Díaz Vilariño b, 2014).

The increment of the high-pixel density (HD) index in the latest digital display also encourages designers to increase their abilities to produce high quality and high definition 3d rendering and presentation (W.C. Park; K.W. Lee; I.S. Kim; T.D. Han; S.B. Yang, 2003). This shows how important computer rendering plays its role in 3d architectural visualizations. It does not only improve the 'high-stakes' of the users but also their assets in securing a job for their later prospects in the industry.

Non Photorealistic rendering (NPR) is capable of broadening everyone's ability to communicate thoughts, emotions, and feeling through computers (A Lake, C Marshall, M Harris, M Blackstein, 2000). This is proven when architects utilized the advancement of computer technology to analyze the surface to be colored to designated color or texture that creates shapes and patterns that every human can understand and explore in the design. For example, a rendered 3d image of a building helps viewers to understand its massing, volume of the space, and its physical aesthetic. This is the means for any architectural student to impress their audiences with their skills in computer rendering hence, elevate their design for higher marks and grades for the course. The rendering then will be also compiled as their portfolio when applying for jobs after they graduated.

The use of Graphics Processing Units (GPU) has also improved the immersion of 3d modeling and rendering by architecture students in their works (Wei-Hao Huang, Wei-Jia Huang, Kai-Che Liu, and Ludovic Angot, 2010). The advancement of hardware and software in computer engineering has excelled very drastically in line with the needs for better, powerful, and faster processing pc and gaming platforms. This can be seen in the launch of new generation gaming consoles such as Playstation 5, Xbox One, and gaming computer platforms that offer stunning graphics and visual effects that also can be used in architectural rendering. For example, Lumion uses the GPU same as the gaming rendering engine in Fallout games to be used in real-time rendering by the software users to create their computer rendering immersively like computer games. This factor has improved architecture students towards using 3d rendering in their presentation.

The use of 3d rendering or manual drawing in an architectural presentation by FABE architecture students is optional as 3d study and rendering are only allowed for 2nd-year students in both Diploma in Architecture (DAR) and Bachelor of Science Architecture (BSAR). Therefore, the choice by students whether they use 3d rendering 100% in their works or combine is analyzed. This will also show their understanding and master in using any typical 3d rendering or not.

This paper will highlight the percentage (%) and the ratio of architecture students in FABE that used their skills acquired in their 3d course in their design studio presentation and also for those who are using manual drawings for their architectural presentation.

## METHODOLOGY

A digital compilation of architectural students' presentations ranging from semester 5 (2nd year) onwards is done to analyze each presentation on their use of 3d rendering software since the beginning of Movement Control Order (MCO) on the 18th March 2020. Each student's presentations are logged

into Statistical Program for Social Science (SPSS) format and get their percentage and ratio versus manual drawing by each student in their works.

The results will then be analyzed and discussed in the paper and to be discussed among 3d course lecturers in FABE on how to improve the deliveries of their teaching in the course and Course Development Program (CDP) meeting. This is also in line with the requirement by Malaysian Quality and Assurance (MQA) on delivering quality and updated courses to meet the industry's requirements.

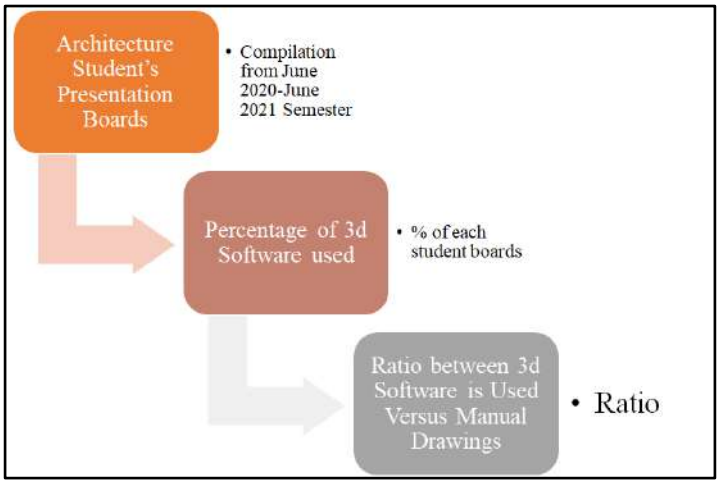


Figure 1.0 Diagram of Research Methodology

**FINDINGS**

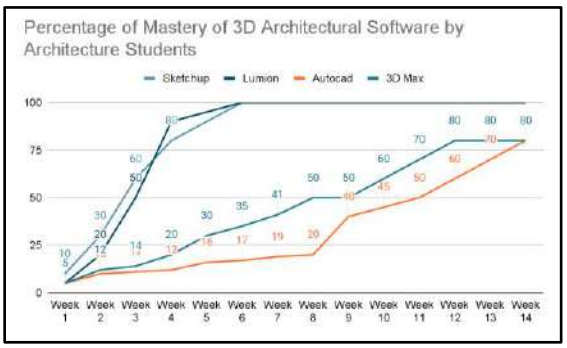


Figure 2.0 Mastery of 3D Architectural software by Architecture Students

The above figure shows the learning curve of students to various 3D architectural software based on questionnaires after each semester ends where they take the 3D software course in FABE, IUKL. It shows that both Lumion and Sketchup software have a faster rate of a learning curve than AutoCAD and 3D Max. The use of GPU technology has greatly increased the immersion of model making and is fun to learn thus, increasing the percentage of skills learned in a short period of time. The capability of the current hardware to impose the 'real-time' modelling and animation has proven increasing the immersion and understanding of the design at the same time of the process of designing in 3D. It also improves the pleasure and satisfaction by students when they use the software since all the processes of 3D modelling are live in front of them when they use it.

The percentage of usability by architecture students in their works after they had mastered their skills in 3d rendering in their presentation is more than 50%. This is because the use of 3d

rendering in studio works by architecture students depends also on their confidence level whether it will benefit their chances to get a better grade if they used it. In Figure 3.0, the table shows the amount percentage in 3d rendering versus manual is consistent among semesters batches which is at 60%.

| No | Semester | Total Number of Students Presentations | Percentage using 3d Software | Percentage using Manual Drawing | Ratio using 3d Software Vs Manual |
|---|---|---|---|---|---|
| 1 | June 2020 | 44 | 61.5% | 38.5% | 27:17 |
| 2 | September 2020 | 25 | 55.7% | 44.3% | 14:11 |
| 3 | June 2021 | 18 | 66.3% | 33.7% | 2:1 |
| TOTAL | | 87 | 100% | 100% | 2:1 |

Figure 3.0 Percentage and Ratio of 3D Rendering in their presentation boards.

The ratio between 3d and manual is also consistent within the whole 3 semesters, which is relatively 2:1. This shows that even though 3d rendering is a faster and cleaner way to do their 3d perspectives in architectural presentations, manual drawings are still an important aspect in getting better marks by students. This is also because of the fact that manual drawing in 40% did promote the efforts spent on the design apart from 3d rendering.

Student's performance in design studio through presentations do improve with the level of application of 3D rendering and modelling in their product thus increasing the number of students encouraged to use it in their presentations. This can be seen through the number of students in the same batch that use the software in their presentations. Peer learning is affecting the numbers and level of 3D software used by students.

Apart from that, the availability of a good performance personal computer or laptop also contributes to the better performance in 3d rendering and therefore, affects these numbers (Figure 4.0). Within each number of samples (a total of 87 for all 3 semesters) shows that these are also affected by the percentage of 3d rendering usability by students. It's shown that the more the numbers for each semester students taking design studio within the semester, the more the number of students using 3d rendering in their advantages and therefore influence others who use manual drawings.

More digital submission by students in both their minor and major course classes. The availability and affordability of computer hardware and software have proven to speed up the production process of presentation documents and presentations. This can also be seen in the quality of students' work from September 2020 semester versus June 2021 semester. Although several students in the same course had different backgrounds in the exposure of the 3d rendering software, some students did perform very well in delivering the required product in their presentations. Good delivery of 3d architectural teaching and technique leads to a better understanding of the software and therefore, more applications in future studies. Some of the examples of this are that educators must have proper hardware and software, teaching materials, and a consistent channel of communication to the targeted students. This has also involved proper infrastructure and Information Technology (IT) providers as well. Without it, the teaching and learning of 3D would not be effective to encourage students to use it when it is needed.

## CONCLUSION

As education has been evolving quite rapidly in recent years with the addition of more digitalization during the pandemic since 2020, students are starting to adapt more to the needs of receiving and delivering what has been taught in class. 3D architectural visualization has proven its market value when most of the students learn their understanding in the course and apply it in their architectural studio and thus their future career after graduation.

The current delivery of 3D courses by the syllabus provided does improve students' readiness when they apply for their job after graduation. It provides students with basic knowledge of 3D architectural visualization to begin with and lets them explore more on the same method in delivering what they intended to through their design. Therefore it is crucial to maintain 3D courses in this field and improve them according to the rapid improvement of both hardware and software.

A better technique and deliveries during the Computer-Aided Design (CAD) courses will ensure a better production by architecture students in their presentations by choosing the right updated software and method in 3D modelling and rendering. Neglecting the needs of 3D architectural presentations will result in less value and appreciation of the presentations and therefore its marketability. Therefore, current education in software learning and hardware is essential to the survival of students in their careers for the future.

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