

Research Article

# Low-Cost 3D Scanner for 3D Design Courses

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**Abstract:** Today 3-D scanning technology is widely used in various field such as industrial design, engineering and construction, education, architecture and landscape, health and medical, product and manufacturing. By capturing required data, this 3-D scanning technology can reduce time management such as re-production (etc), quickly and accurately based on the raw data that showed shapes and appearance of the object in different angles. However, in creating a good three-dimensional (3D) artwork such as product, sculpture, diorama, or motion art (animation/montage) for any 3-D design courses, students seem facing difficulty specially with affordable budget and time-consuming during fieldwork studies in order to understand 360-degree views on selected subject/object. By introducing a low-cost 3D scanner, students can create a good 3-D design, with acceptable references of selected subject/object and will be a satisfactory as part in exploring and collecting data such as image, shape or appearance. It also helps student to generate different types of idea in developing their own design. Which can also save up their time limit (deadline) for last date assessment/submission. This project used an approach that can be easily adapted, shared, and adopted by others that using low-cost 3D scanning technology where the user is able to address these issues specially among educators. Lecturers or teachers can encourage their students and create a good working environment practically during discussion, captious or crit session. Other than low-cost and time consuming, the design of this technology (tools) also minimalizespatial area and easy to remote specially for average transportation. Moreover, with medium size, this tool not only safe to install and dismantle but also can captured a large-scale object (<100kg) with user friendly interface.

**Keywords:** 3-D scanner, low-cost budget, time-consuming, education technology, 3-D courses, sculpture, motion graphic, 3D animation/montage design, spatial arrangement, medium size technology, user friendly technology.



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## 1. INTRODUCTION

3-Dimensional (3D) scanning technology is widely used in industrial design, engineering, education, and manufacturing because it can capture the required data quickly and accurately (Dusan, 2019). 3D scanning involves capturing the shape of a physical object and reproducing or redesigning (stylization) it as a 3D model/artwork. This is done using a 3D scanner and also capture 3D objects to create 2-dimensional movies and create 3D models in different scale at the same time (Straub et al, 2014). In other words, 3-D scanning technology helps in capturing raw data based on the shape and

appearance of the object. The area of expertise that was covered are education technology, 3-dimensional scanner technology and industrial based oriented development. However, for educational purpose, this tool can help student learning activities among educators with the progress of teaching tools development specially in accessing 3D user friendly apps/software such as 3D Max, Blender, AutoCAD, Sketchup etc.

In this low-cost technology, innovation approached by the researches are by supplying an affordable everyday life material in installing a medium space of area. Although the size was about 4 feet height with 2.5 feet diameters turn able standing equipment, it is more practical compare to other 3-D scanner that was already available in the factories (industry) or in the market (online purchase), which suitable for educators to apply in their own classes that used by variable type of students with different types of small-medium objects (man-made or nature). Moreover, it is affordable budget for educators compare to other available 3D scanners (small scale) and easier to install or dismantle remotely. While in time arrangement, educators can assist their students to further their studies and develop their own 3D design model in a short time. This can encourage educator-student's working schedule in discussion, ideas and producing a good mock-up before finalising an artwork(s) for final assessment with proper presentation such as sketches, drawings or designs. Moreover, it makes simpler for educators in keeping student's artworks (3D) virtually and also for department's own collections for future references, which would also save a lot of space.

## **2. PROBLEM STATEMENT**

Based on observation, students in various department from College of Creative Arts (KPSK) have difficulties in conducting specific research and collecting data on particular subject/object matters such as images or detail shapes. This takes hold on to the students in developing their own idea (stylization) to create a good 3-Dimensional artwork(s) such as 3D animation, products, sculptures, dioramas or in any 3D design courses. While the images are usually stored digitally from cameras, the image captured or recorded are in 2-Dimensional views. This method, however, takes time for the students even among the educators to understand acceptable subject/object matter's characters and propositions, especially during denaturalization and stylization process. In contrast, the images of 2D objects are always unsatisfactory because they would only appear on one side of the artwork although it was already taken 360-degree views. It would be best to display the artwork in 3-Dimensional views as this is how people appreciate the 3D shapes which enhance student's creativity in sketching or designing a 3-Dimensional work of arts. Plus, it can reduce student's work schedule in producing a 3D mock-up in order to clarify a better image of their 3D model specially for final project assessment.

## **3. PROJECT OBJECTIVE**

The objective of the study is to create a low cost 3-D scanner with time consuming especially for 3-D design courses such as modelling, animation etc. This low cost 3-D technology then use practically for student in 3-D projects.

## **4. METHODOLOGY**

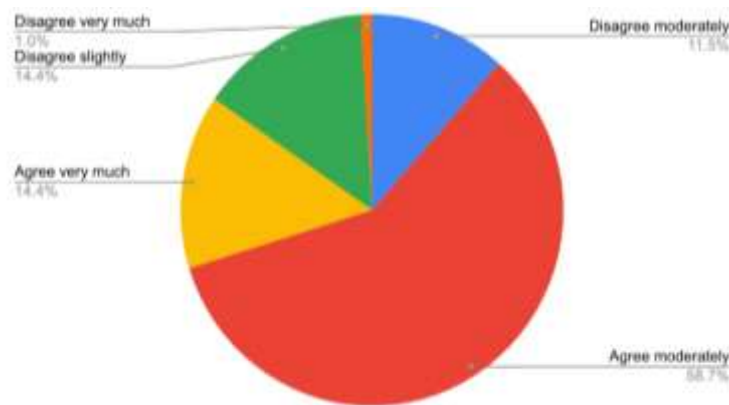
After a series of observation, the data for this study was collected through questionnaire which was distributed to 100 respondents who were students of UiTM Kelantan and UiTM Shah Alam

campus. The questionnaire that was distributed only for students that had registered 3-D design courses as their subjects (3Ds Max software) which was offered to diploma and degree (foundation) in their study plan. The questionnaire was developed using Google Form app to ease the data analysis process once they utilising 3D Scanner practically during classes. The findings of this study are discussed in the next section.

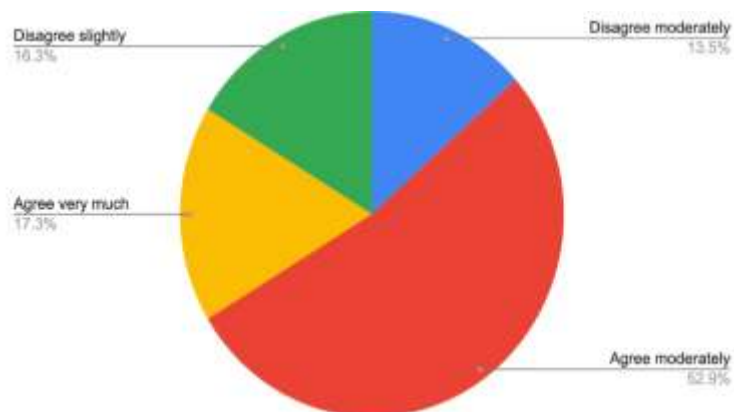
## 5. FINDINGS & DISCUSSION

In this research, a total of 100 students from the Universiti Teknologi MARA (UiTM) Kelantan campus, including students from Shah Alam, were actively involved. The analysis involves evaluating two key aspects. Firstly, the researchers are assessing the practicality of using low-cost 3D scanning technology. Secondly, the researchers are examining the user experience and the ease of integrating low-cost 3D scanning into 3D design courses.

### 5.1 Analysis on the Usefulness of Low – Cost 3D scanning



**Figure 1.** Low-cost 3D scanning is useful for improving design skills.

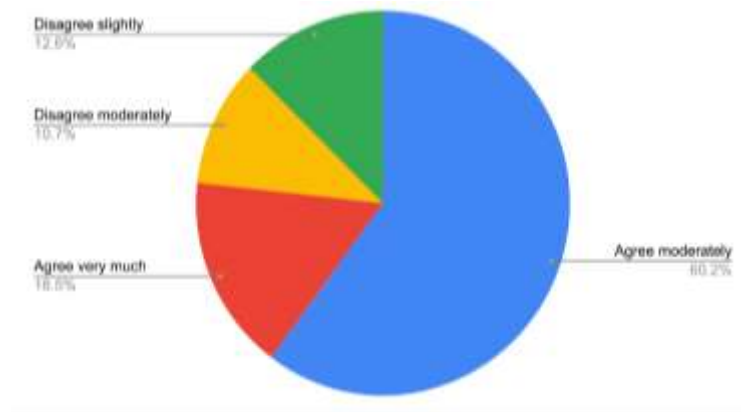


**Figure 2.** Low-cost 3D scanning is useful in the learning design course.

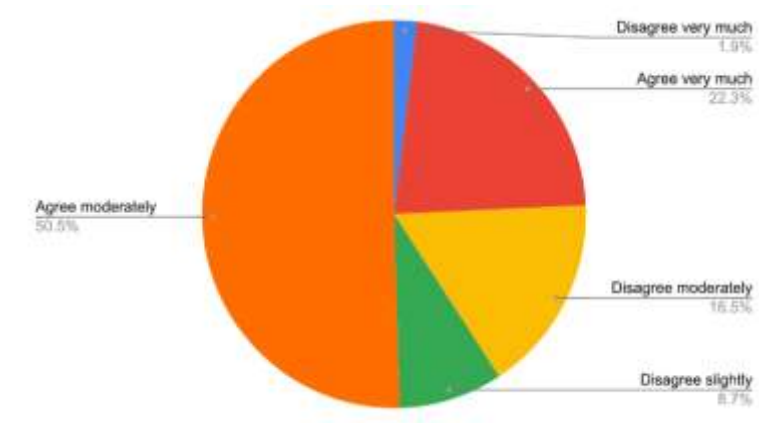
Figure 1 shows the results of a survey on the use of low-cost 3D scanning to improve design skills among students. 14.4% strongly agree that low-cost 3D scanning is beneficial for enhancing design skills. Following this, 58.7% of the respondents moderately agreed. In contrast, only 11.5% disagreed moderately, while 14.4% slightly disagreed, about the usefulness of low-cost 3D scanning. Only 1.0% strongly disagree that low-cost 3D scanning is beneficial for improving design skills.

Figure 2 displays the results of a survey on the use of low-cost 3D scanning in a learning design course. A total of 17.3 % agree very much that the use of low-cost 3D scanning is useful in learning design courses. There are 52.9% of students who moderately agree, while 13.5% moderately disagree that low-cost 3D scanning is useful in the learning design course. Only 16.3% of students slightly disagree that low-cost 3D scanning is useful in the learning design course.

### 5.2 Analysis of Ease of Use of Low – Cost 3D scanning



**Figure 3.** Low-cost 3D scanning platforms are user friendly.



**Figure 4.** Low-cost 3D scanning can be time-consuming.

Figure 3 display the result of the ease of using low-cost 3D scanning. A significant proportion of students, specifically 16.5%, have expressed a high level of promise regarding the ease of use of low-cost 3D scanning technology. Following this, a substantial 60.2% of students have indicated a moderate level of agreement with this statement. In contrast, 12.6% slightly disagree and 10.7% moderately disagree that low-cost 3D scanners are user-friendly.

The research findings indicate that 22.3% of respondents strongly agree that low-cost scanning can be time-consuming. In contrast, 16.5% expressed a moderate level of disagreement, while 8.7% of students slightly disagreed that low-cost scanning is time-consuming.

## 6. CONCLUSION

Encouraging the use of low-cost 3D scanners among students enrolled in 3D courses can greatly enhance their ability to create innovative design in product and artworks with a suitable scale and time consuming to have a better preparation for their final assessment. This technology not only fosters creativity but also provides practical skills that are increasingly valuable in various industries.

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