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Design and Development of Mould Design Teaching Tool Application Using Augmented Reality

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ABSTRACT

Augmented Reality refers to the concept of the real world with the virtual world. This technology can transform the learning environment by incorporating the real environment into virtual information in various multimedia formats such as graphics, video and audio. This project is based on observations made last semester related to CLO and PLO for the DJC50083 course, Mould Design. The objective of this project is to develop an application of teaching aids for Mould Design using Augmented reality to facilitate students' understanding section in standard mould parts. This application can help lecturers as a teaching aid, applied on the type of android smartphone that can be used in QR codes and production of AR Marker display containing brief notes, video and visuals of each part of the mold. The project is based on the problems found in the last semester that is from data that has been collected through CLO evaluation that is CLO2 for 2 classes for the last semester which are DMK5A and DMK5B, the average percentage obtained is 74% while the target set by lecturers for specific this is as much as 80%. Based on the study that has been conducted Arleta Application is the most suitable for this project. While for the application development process, its start from downloading Arleta App until QR code development. Finally, the results of the analysis and discussion that have been conducted can be summarized that the application of Mould Design teaching aids using Augmented reality has achieved the set objectives.

Keywords: Augmented reality, mould design, teaching & learning

INTRODUCTION

Outcomes based education (OBE) is a method of student-centered learning and teaching that is now beginning to be widely used. The system has gradually replaced existing study methods for the purpose of improving the effectiveness of learning outcomes measured based on students' knowledge and abilities. OBE is also the best approach to see student achievement in applying learning knowledge and also facilitate teaching staff. Thus, transforming passive students into active and creative students in the classroom. OBE focuses on 4 main elements in the implementation throughout the academic program, namely planning, implementation, monitoring and evaluation. To implement OBE, lecturers need to emphasize Program Learning Outcomes (PLO) and Course Learning Outcomes (CLO). PLO can be measured from the practical work that will be carried out by students while CLO is about the theory related to the function of a component such as quiz 1 [1]. At Malaysian polytechnics, every Diploma in Mechanical Engineering students must take PLO and CLO in determining student's level of understanding. Among the courses that need to be taken by semester 5 students is specifically DJC50083 which is Mold Design. In this subject, students are exposed to the knowledge of each part of the plastic injection machine, one of which is the mold base part. Mold bases are the parts that contain cavities for injection molds. Mold base consists of several parts including ejector plate, support plate and fixed clamp plate, these parts require a high level of understanding to avoid any mistakes that will be made by students during the process of operating the injection molding

machine. To increase the level of students' understanding of the mold base, simulation teaching methods need to be applied. The simulation method is an effective teaching method by enabling the lecturers to achieve the learning objectives [2]. Among the simulation methods are situations that exist with real situations for example providing learning materials by having examples of components that can be held by hand. In conclusion, the production of teaching aids application for mold base refers to Continuous Quality Improvement (CQI) can facilitate the teaching and learning process. The objective of this innovation is to develop a teaching aid application for Mold Design using Augmented reality to facilitate student understanding.

EXPERIMENTAL

Augmented reality is a technology that combines two-dimensional and three-dimensional virtual objects into the real environment around us. It is a new technology for adding computer-generated content into the real world at a predetermined location. Interactive in real time where users can interact with virtual and physical objects simultaneously. On the other hand, This technique, which combines virtual reality and reality, uses an interesting display technique because it features 3D objects, animations, audio and video by simply scanning the smartphone camera towards a specific image that has been designed [3, 4]. Project design is very important in implementing a project. This is because it simplifies the reference process for the work steps that will be carried out on the application development. Figure 1 below is a flow chart of the design process for the application of mold base teaching tool.
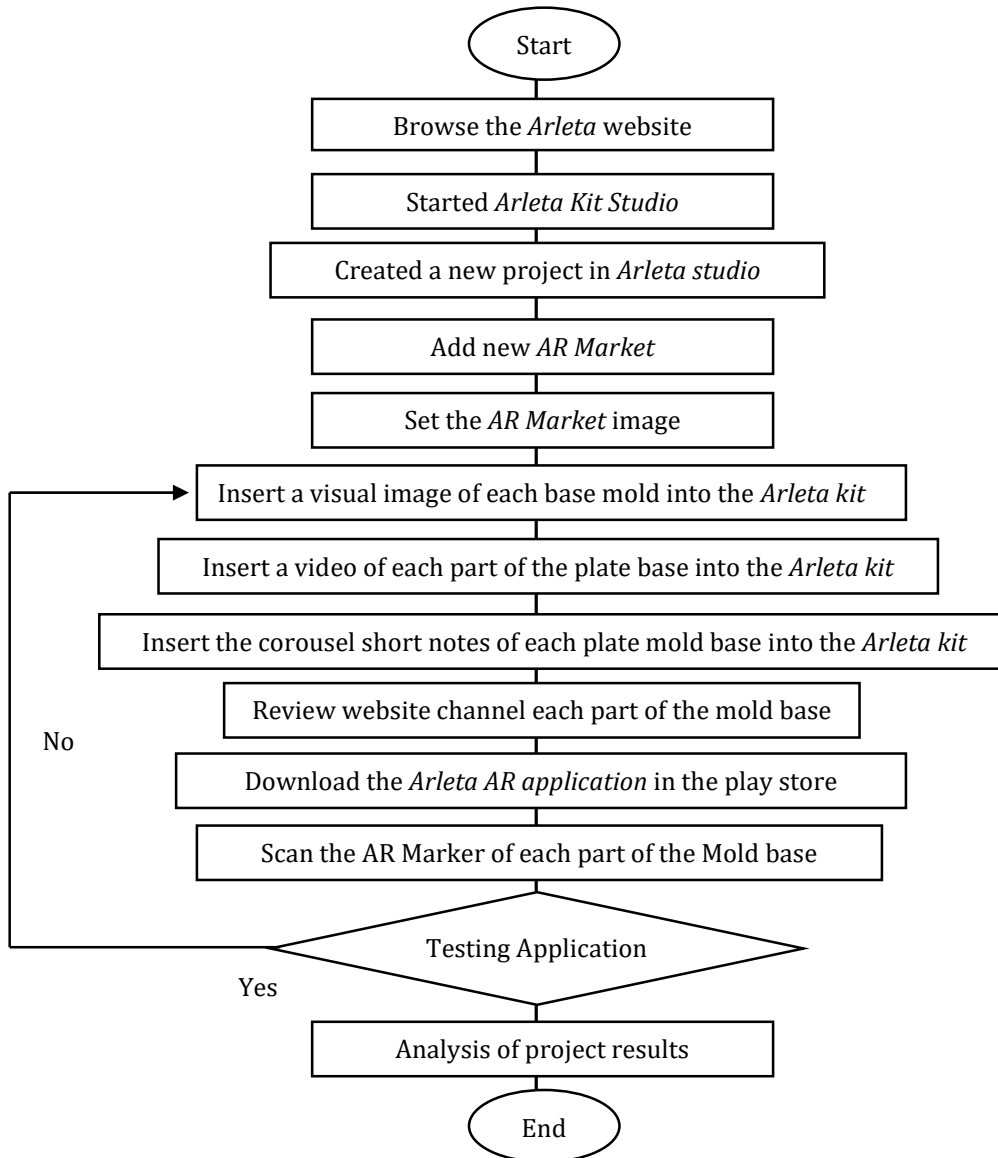
Figure 1. Project design process flowchart.

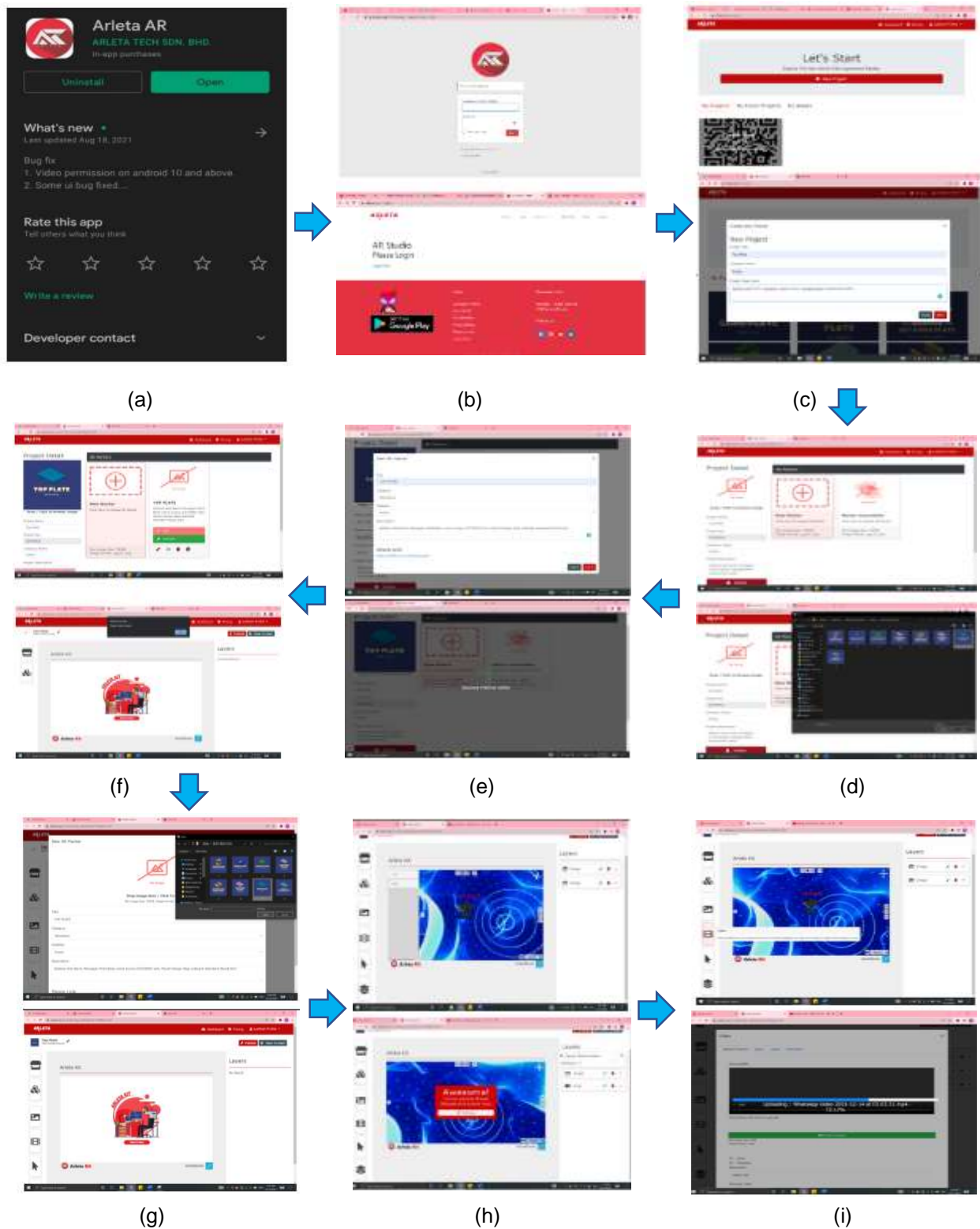**Arleta AR Marker Development Work Procedure**

Figure 2. Procedures for generating innovation.

Figure 2 shown the procedures for Arleta AR Marker, the steps are follow by; Download the Arleta app on smartphones via google play. Browse the Augmented Reality website, Arleta https://arleta.my/ar-studio/. Sign in Arleta & Arleta studio. Click the New Project button; Creating a Top Plate; In the Project Details, add a top plate image that has been edited; Add an AR Marker and click the positive symbol on the New Marker. Fill in the Ar marker for the top plate and press the save button. Next, click the edit button on the newly created top plate folder. Select Marker for top plate; Select the appropriate image to be the Marker Top Plate and click save. Click to start Arleta kit; The Arleta kit provides several facilities for creating AR 21. The first step is to click the image to add it to the layers section. Click edit to insert the images and save the images that have been included in the Arleta kit. Tips to get the best three -dimensional picture is to 22 place the images in a position between 30° to 45. Apply and reload to save the image result. If you do not save the position of the images top plate will return to the original position (Default). The second step is inserting the video in the layers section [5, 6]. Edit the video and add the top plate video in the Arleta kit. Edit the video on the Arleta section of the kit and position the learning video according to the position next to the images top plate. Apply and Reload to save the edited video.

QR Code Development Work Procedure

Figure 3 shown the QR code development work procedure. Browse the QR code website which is https://www.qrcode-monkey.com. Then enter the Top plate link in the section provided, which is enter content. Next set the color on the code to be created. Insert a Top plate image on the QR code. They created a form of QR code. Create a QR code and download the result of the QR code top plate image. Result QR Code top plate. Repeat each of the above steps on each other part of the mold base, namely: a. Cavity plate; b. Core plate; c. Spacer block, d. Ejector retainer plate, e. Ejector plate, f. Bottom plate.
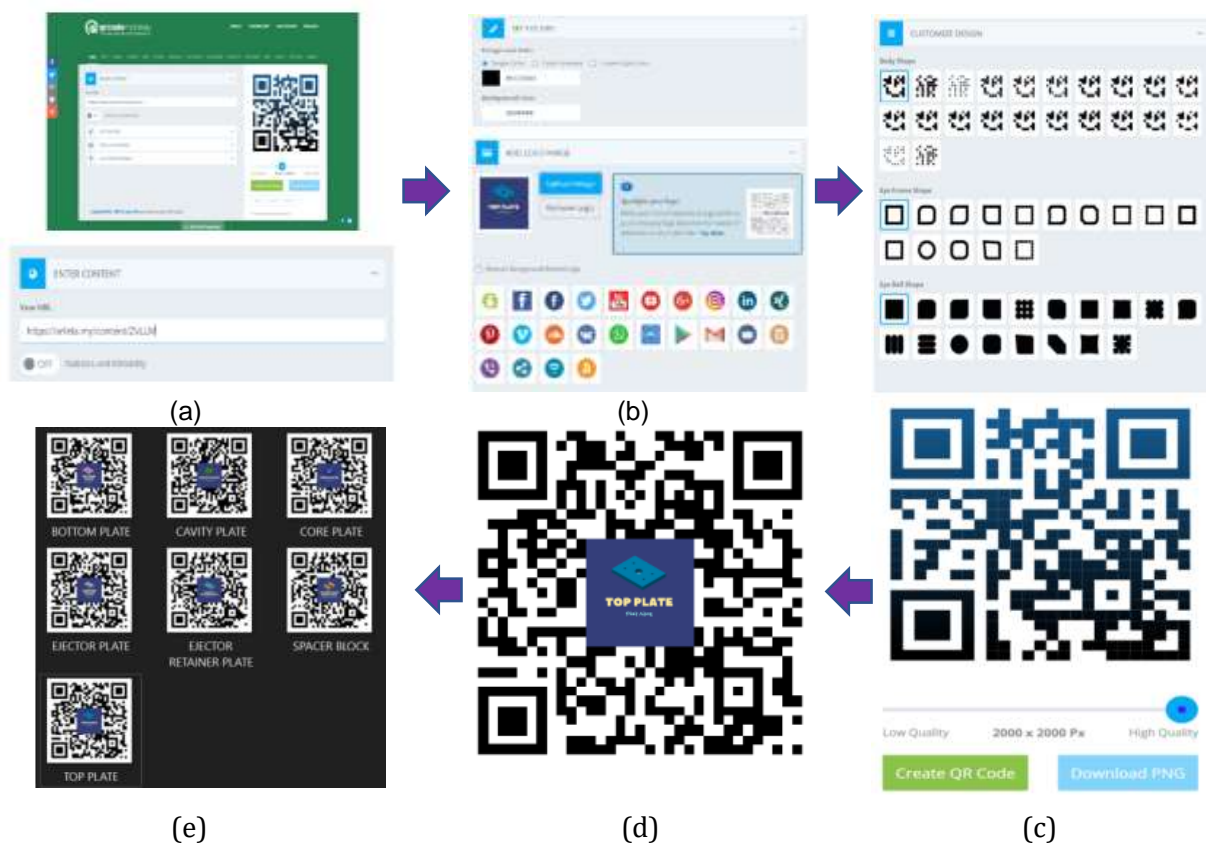

(a)   (b)

(e)   (d)   (c)

Figure 3. QR code development work procedure.

RESULTS AND DISCUSSION

The results of data collection and analysis include evaluations related to projects that have been developed including advantages, disadvantages or problems in the process of development of teaching tool (ABM) mold base. Testing carried out on the product that has been produced along with testing methods and equipment. Design testing criteria is an evaluation conducted on the product produced to obtain feedback on the product produced whether it meets the criteria that have been set or unsatisfactory. Table 1 shows the design testing criteria and the findings from the evaluation results.

Table 1 Application Testing Criteria for Mould Design Teaching Tool

No.	Design Testing Criteria	Evualution Scale				
		1	2	3	4	5
1	Safety				√	
2	Understanding				√	
3	Mold Base Teaching Aids Application System				√	
4	Function				√	
5	Type of software				√	
6	Type of testing: The type of testing is parameter testing. A description field of each criterion for testing the Mold Base Teaching Tool Application.				√	

Criterion	Description
User	• The application of this mold base teaching tool is for students who take DJC50083 specifically, the Mould Design Subject. • This mould base teaching aid application is for lecturers who want to use this application as a teaching tool
Function	• The function of this application is to scan the picture of the mould base through the application of mould base teaching tool
Aesthetics	• This Mould Base Teaching Aids application is to attract students to learn the topic of standard mould part. • Facilitate students to understand and memorize each of the components of the mould base with a three-dimensional picture.
Materials/Software	• Using the Arleta kit studio website. • Using the Canva Website.

Source: (Mohd *et al.*, 2017)

Figure 4. Comparison between (a) current and (b) previous innovation.

Figure 4 (a) shows the DJC50083 course lecturer conducting a teaching and learning process (PdP) using a prototype teaching aid (ABM) mold base. Meanwhile, Figure 4 (b) shows that DMK5A and DMK5B class students are testing on Mould Design teaching aids. The testing method was also implemented using a Questionnaire Form. Green technology in the ICT sector includes practices and studies in the use of computers and communication tools [7]. These practices and studies focus on the manufacture, design, use and disposal of computer tools. The approach that can be taken in adopting green ICT is to reduce the use of hazardous materials [4,8]. The project that will be produced is a type of application development of mold base teaching aids. Elements of sustainability that is digital content is used such as the use of smartphones to scan the mold base components and then a 3D image will be displayed.

Testing the Functionality of the QR Code Scanning Process

An interactive aspect is needed so that the material is more easily absorbed and understood as well as avoiding boredom. Interaction occurs when students do not act as passive recipients of information, but engage in learning by providing actions that will be answered by the subject. Based on the evidence in the data analysis that has been conducted, the development of Mold Design teaching aids application using Augmented reality is very accurate because this idea can attract interest and facilitate students to understand the standard subtopic mold parts. help teach like this. The results of the analysis of findings found that Dmk5A students and Dmk5B students are more likely to use this Arleta application as a mold base teaching aid. In this era of globalization, the use of ICT is very widespread, especially to students who use smartphones as reference material. The selection of Augmented reality application that is Arleta is very suitable because the construction level of Ar Marker is easy to understand and if there is an error it is not complicated to correct it [9]. Furthermore, this Arleta Application is an application published by Malaysia.

The Augmented Reality teaching aid application using the Arleta application will help students improve their skills and understanding of the DJC 50083 Course which is Mold Design. By using this app ,students can view Mold Design subject notes at any time on a smartphone. This environment allows students to engage and experience a variety of learning contexts as well as to develop their own learning styles [10]. As such, the Arleta application environment introduced

in teaching and learning will benefit both educators and students in terms of face-to-face learning process and no face-to-face learning process. The application of teaching aids using the Arleta Application has limitations. The limitation is that this app is not able to zoom in and zoom out to get brief notes, photos and videos of each part of the mold base [11]. Furthermore, this application can only be used on Android smartphones only. In the future, it is hoped that the teaching aid application using Arleta's Augmented reality can be upgraded with the addition of the existing limitations.

CONCLUSION

In this study, Augmented Reality technology mould design was used. An augmented reality environment for basic design and Mould Flow converters to explore the impacts of using this technology was developed. The experimental results indicated a positive effect on the students compared to the traditional teaching approach; therefore, the possibility of designing the entire course with AR tools in the future is appropriate. From the results of the analysis found the need for improvement for items in terms of design, technical and multimedia. This is because there are three items that get the same or more than 30 percent. The items will be studied and improvements made to improve the quality and quality of e-Modules in line with the TVET education system today.

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