

**Designing and developing an augmented reality book: A sample Malayu subject****Nurulhusna Abdullatif\* and Suaida Buenae***Department of Information Technology, Faculty of Science and Technology, Fatoni University, Pattani 94160, Thailand*

\*nurulhusna@ftu.ac.th

**Abstract**

This research was aimed to develop an Augmented Reality Book on the topic of Malayu Alphabets for primary students. It studies the students' satisfaction towards augmented reality 3D book. The samples were 23 primary students. The research instruments were augmented reality 3D book on the topic Malayu alphabets and the satisfaction questionnaire of students towards the augmented reality 3D book.

**Keywords:** Augmented reality, Application, Interactive book, Malayu subject

**Introduction**

Thai public education system in the southernmost provinces, which includes Yala, Pattani, Narathiwat and Songkhla, integrates academic subjects with Islamic subjects. This Islamic education system is offered in private Islamic schools at a secondary level equivalent to grade 7 - 12. The Islamic education system offers twelve levels. The first six levels are called Ibtidaiyah (Basic). The next three levels are called Mutawassitah (Intermediate). The last three levels are called Sanawiyah (Advance). The common subjects include Malay language, Fikh, Hadith, Aqidah, Arabic, Nahu, Faraid, Akhlaq, Tafsir, Tajweed, and Tarikh.

The schools divide the class sessions for academic and Islamic subjects into two; morning session for academic subjects and afternoon session for Islamic subjects. While using creative instructional media as teaching aids is proven to enhance classroom teaching and learning, Islamic subjects offered at these schools have yet provided students with this kind of learning complements. Islamic subject teachers are still using only books as teaching materials due to lack of other teaching instruments while academic subjects are supported by many existing learning media tools. The media being used in teaching and learning academic subjects includes videos, slide presentation, interactive media, and an Augmented reality (AR) books. Using of media will enhance teaching and learning complements traditional approaches to learning. Effective instruction builds bridges between students' knowledge and the learning objectives of the course. Using media engages students, aids student retention of knowledge, motivates interest in the subject matter, and illustrates the relevance of many concepts (Salomon, 1979). Instructional media to enhance teaching and learning for students consist of video, animation, music, powerpoint, cartoon, picture, augmented reality interactive books and etc. Using media is the key to moving students to higher-level thinking such as the augmented reality interactive books that explore the depths of the dinosaur's era while learning about each dinosaur. Interacting with augmented models allows students to see, hear and touch in the environment unlock the additional augmented reality mode (Ruangsiripivakul, 2015). Augmented reality technology is a new dimension in educational media. It stimulates students' curiosity and hence makes them interested in learning new things. It creates new experience and increases participation in learning, which allows them to create meaningful learning outputs. This way the classroom interaction is made by creating experience that combines real situations with the virtual reality (Meesuwan, 2012). Therefore, in the above mentioned, it is necessary to develop instructional media to aid the teaching

and learning of Islamic subject classes that covers all the 13 core subjects. A questionnaire survey on the difficulties in teaching and learning Islamic subjects is then conducted online.

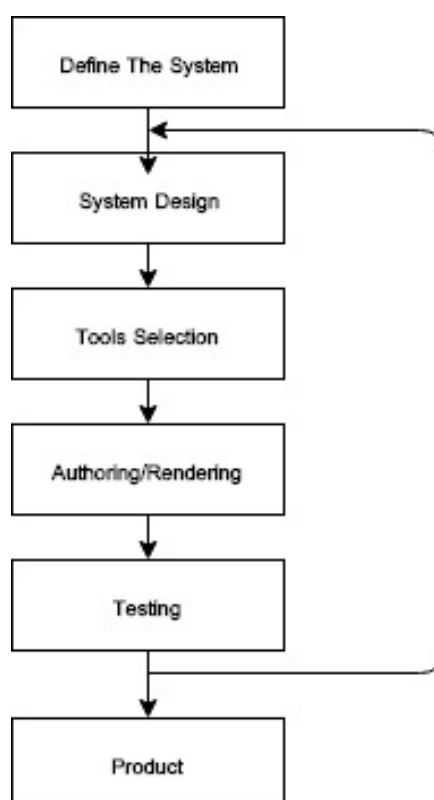
This survey targeted both students and teachers. There are 60 students and 25 teachers participated in this survey. The results showed that the three most difficult subjects reported by the teachers are Aqidah, Malayu, and Fiqh, with average difficulty values of 6.00, 5.00, and 4.00 accordingly. On the other hand, the students' response showed the three subjects with the highest scores for the need to have instructional media are Malayu with average scores 9.33, Arabic with average scores 8.67, and Fiqh with average scores 8.33. Malayu is the subject that is seen to be the subject that requires instructional media the most.

### Objective

This study aims at developing an Augmented Reality book for Malayu subject for primary school students. It is hoped to promote listening and memorizing habits to the children in alphabets lessons. In addition, this Augmented Reality book also provides entertainment and makes learning more interesting at the same time. Moreover, audio and graphics are better for children's understanding than reading the lengthy words on a book in the traditional way itself. Paper questionnaire was prepared to evaluate the level students' satisfaction toward the use of this Malayu augmented reality book.

### Materials and methods

Multimedia development life cycle method was used in this study. This method consists of 5 steps, which are defining the system, system design, tools selection, authoring/rendering, and testing, as shown in **Figure 1**.

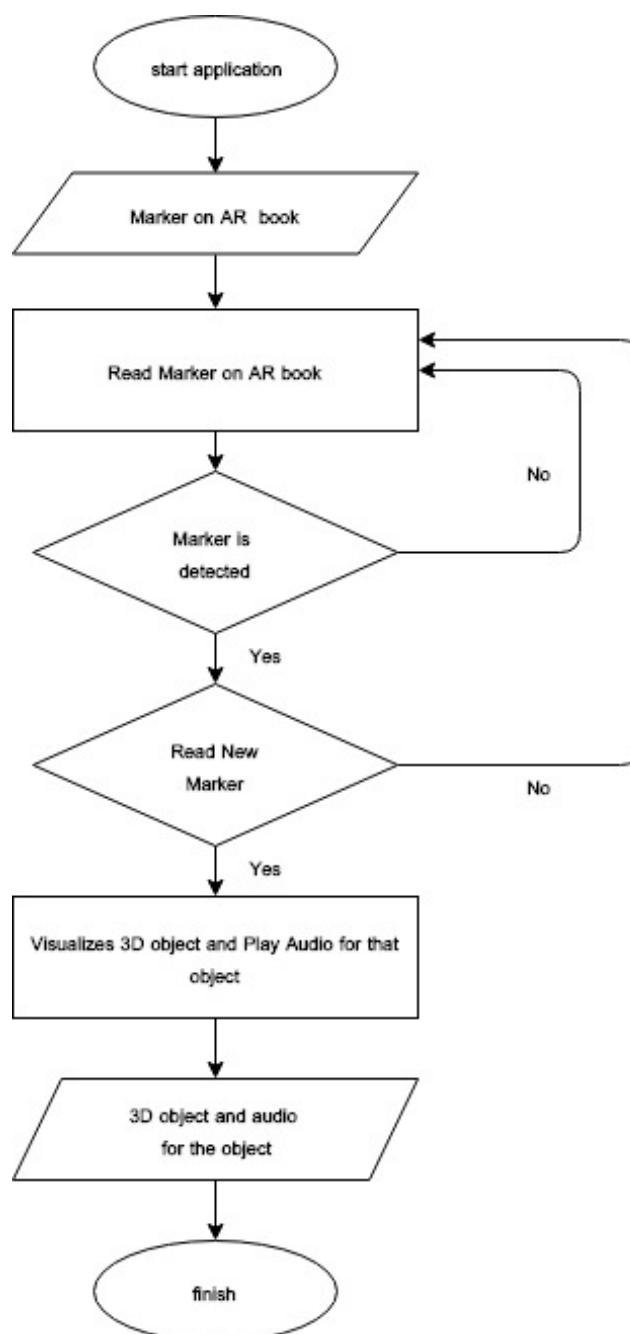


**Figure 1** Life cycle for multimedia product development (Rasel, 2014).

### Defining the system phase

To develop a multimedia presentation or program, it is valuable to understand precisely who the user is. To compose a multimedia program the developer should consider the following:

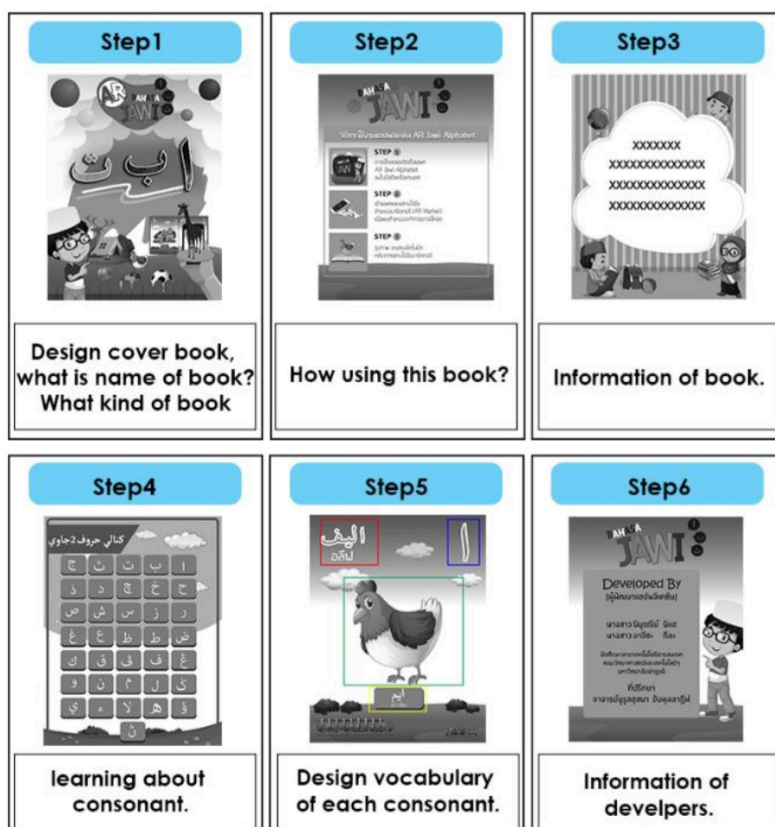
1. Idea and function: interactive augmented reality Malayu book is design and develops to be a choice for first students in primary school. It is name augmented reality (AR) Malayu book.
2. Propose: This project proposes designs and develops Jawi alphabet augmented reality application, it is instruction media for Malayu subject.
3. Target audios: augmented reality Malayu book is design and developed to be an instruction media for Malayu subject in first primary school.



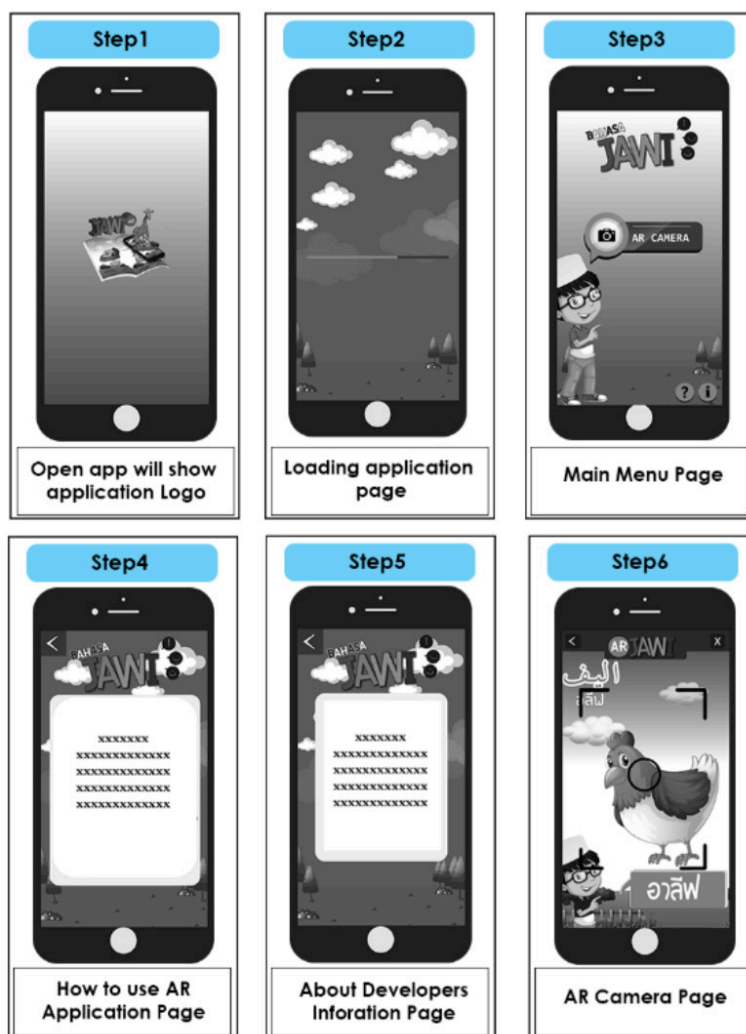
**Figure 2** Augmented reality application flow chat.

Most common way to start design is by composing an outline of the sequences and locks of information that will on the screen. The content of AR Melayu book is presentation of thirty alphabets of Bahasa Jawi. It presents ts with three dimensions. The flow chart diagram is shown in **Figure 2**.

In step of designing phase, the most important is preparing and designing storyboard. This storyboard is explained both for book pages and application. As shown in **Figures 3** and **4** below.



**Figure 3** Book storyboard.



**Figure 4** Application storyboard.

### Tool selection phase

The tool selection phase is about tool is used to developed the AR Malayu book. The tools were used Adobe Photoshop CC and Adobe Illustrator CC program both of this software used for designing the user interface, background, marker and book pages and using unity program for creating marker and develop AR. Adobe Illustrator is an effective program used to decoration of graphics and vector image, developer use Adobe Illustrator as tools for preparing and designing user interfaces characters, and button as show in figure below.



Figure 5 Designing user interface in adobe illustrator cc.

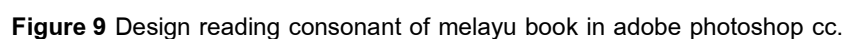


Figure 6 Designing button in adobe illustrator cc.

Adobe Photoshop is the predominant photo editing and manipulation software on the market. Its uses range from the full-featured editing of large batches of photos to creating intricate digital paintings and drawings that mimic those done by hand.



Figure 7 Design vocabulary icon of melayu book in adobe photoshop cc.



The screenshot displays the Unity 5.6.0f3 development environment. The top-left panel shows the 'Game' view with two 2D sprites: a house and an egg. The top-right panel shows the 'Console' window with the 'Assets' tab selected, displaying a tree view of '3D object' containing '3-Telur' and '11-Rumah'. The bottom-left panel shows the 'Hierarchy' window with a tree view of '3D object' containing '3-Telur' and '11-Rumah'. The bottom-right panel shows the 'Project' window with a tree view of '3D object' containing '3-Telur' and '11-Rumah'. The central 3D scene shows a 3D egg and a 3D house on a grid floor.

**Figure 10** set object to marker in unity.



Maya is 3D computer animation software with powerful modeling, rendering, simulation, texturing, and animation tools for artists, modelers, and animators. Maya should interest anybody who wants to easily create 3D model and for AR melayu book, it uses Autodesk Maya as a tool to create 3D object on this AR melayu book. The result of designed the 3D model in AR Application such as chicken, ball, egg, home, grape fruit, and so on as **Figure 11** below.



**Figure 11** Creating model in Maya.

I.

## II. Authoring phase

After creation of all the contents, it is required to put them all together. This authoring phase is steps of importing marker to unity and importing 3D objects to set in each marker.



**Figure 12** Marker designed.



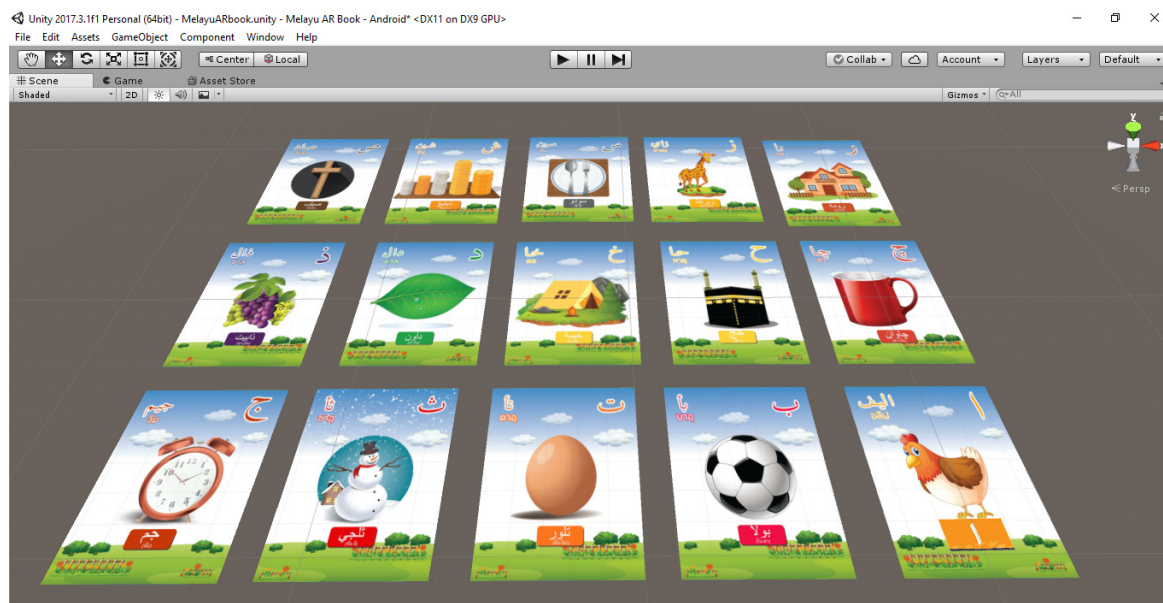


Figure 13 image target.

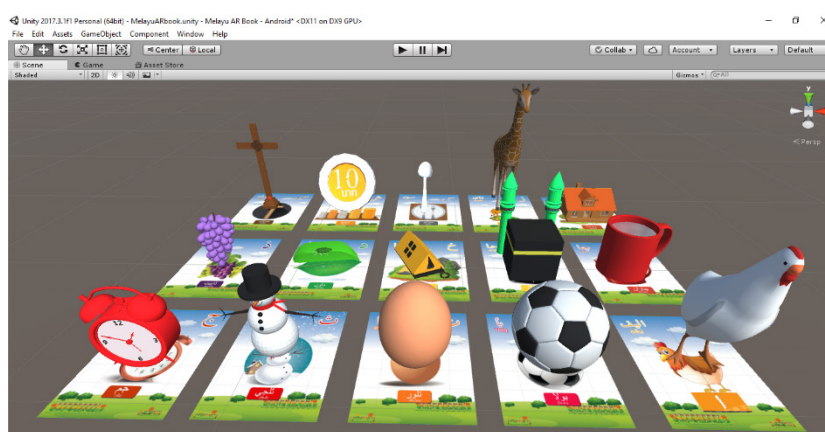


Figure 14 Import 3D model to image target.

### Testing phase

User satisfaction (US) is often used as a surrogate measure of information system effectiveness. From evaluation results form of instruction media using AR application Melayu on mobile for student in primary school. In user satisfaction there are 5 evolution levels, number five, it means most satisfied, number four, it means very satisfied, number three, it means moderately satisfied, number two, it means least satisfied and the last is lowest satisfied as **Table 1** below.

**Table 1** User satisfaction for an augmented reality application.

Contents	1	2	3	4	5	x	S.D
AR books are interesting and beautiful.	0.00	0.00	0.00	13.04	86.96	4.87	0.34
Color and font size used can be read, easy to understand	0.00	0.00	0.00	39.13	60.87	4.61	0.50
Have enough content	0.00	0.00	4.35	56.52	39.13	4.35	0.57
Ease of use application	0.00	0.00	8.70	34.78	56.52	4.48	0.67
Presentation of augmented reality jawi application as an instruction media for mobile are interesting	0.00	0.00	0.00	43.48	56.52	4.57	0.51
Using of augmented reality jawi application, it is convenient and easy to use	0.00	0.00	0.00	47.83	52.17	4.52	0.51
Designing color and the illustrations are beautiful	0.00	0.00	0.00	39.13	60.87	4.61	0.50
The font size used in this application can be read and understand by students	0.00	0.00	0.00	39.13	60.87	4.61	0.50
Learning of augmented reality jawi application on mobile makes it fun to learn, not boring	0.00	0.00	4.35	30.43	65.22	4.61	0.58
Using of three-dimensional illustration can give students more interested in the content	0.00	0.00	0.00	43.48	56.52	4.57	0.51
Using of three dimensional illustration can give students more understanding in the contents	0.00	0.00	4.35	39.13	56.52	4.52	0.59
Learning of Augmented reality jawi application on mobile can be learn manually	0.00	0.00	8.70	30.43	60.87	4.52	0.67
AR application on mobile as a jawi instruction media have interesting picture and sound	0.00	0.00	4.35	43.48	52.17	4.48	0.59
Learning of AR jawi application on mobile can make the atmosphere is not tense to study	0.00	0.00	0.00	52.17	47.83	4.48	0.51
Learning of augmented reality can help students active to learn	0.00	0.00	0.00	30.43	69.57	4.70	0.47
Average						4.57	0.53

The performance of the learning media was studied by the AR Jawi alphabet book and users 'satisfaction using a questionnaire collected from 23 students from Tadika Darul Akhlaq. The findings indicated that the index of AR Jawi alphabet book was average of students 'satisfaction was 4.57 (in total 5.00) from **Table 1**.

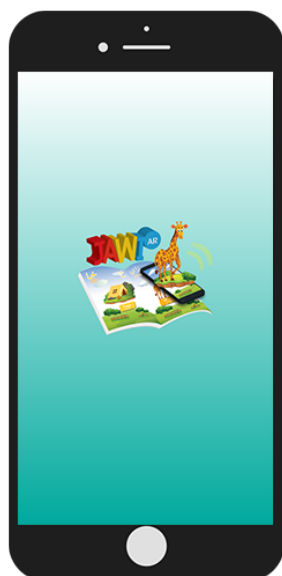


**Figure15** Simple group testing.

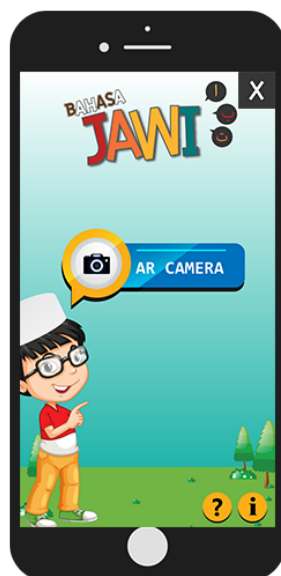
## Results and discussion

The findings of this research as shown in **Figures 16** and **17** indicate the result of AR application include both of an augmented reality application and book. This application consists of 4 pages, which are main menu page, camera page, help page, and about page. In camera page, it is used together with AR book. When camera captures the book page, 3D objects will display, and users are able to scale and rotate the object. The application will then give the sound of this object.

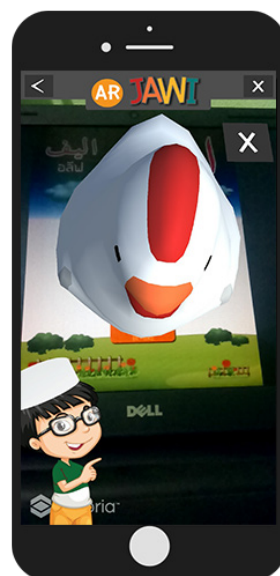
The statistic depicts the level of user satisfaction toward AR application in Primary school. According to the survey, 'AR book are interested in used and beautiful in designing' had the highest user satisfaction level scoring 4.87 on a one-to-five scale, 'Learning of AR Malayu alphabets application on mobile can help students more active' scores at 4.70, and 'Learning of AR Malayu alphabets on mobile makes it fun to learn, it is not boring' scores at 4.61.



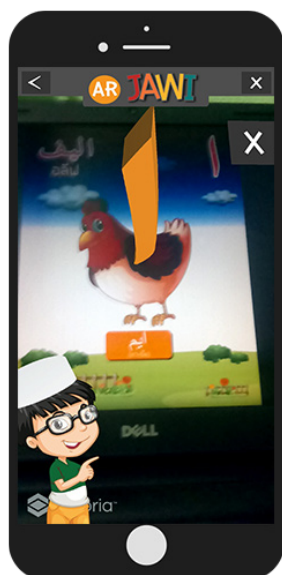
Starting page



Main Menu Page



AR Camera Page.



3D model of Vocabulary



The component of target AR  
Malayu book



Help Page

**Figure 16** Malayu AR applications.



Figure 17 An augmented reality book page.

## Conclusions

This research was designed and developed of an interactive augmented reality (AR) for Malayu subject. The purpose of this research was to develop as instruction media for Malayu subject. The content of AR Malayu book presents the contents of Bahasa Jawi alphabets. It presents alphabets in three dimensions, also meaning of each alphabet is display in 3D picture. Moreover, the alphabets sound is available to user. Student's satisfaction toward the use of this Malayu augmented reality book were 4.45, most of students were satisfy on this instruction media. It can be concluded that the overall performance of developed media is high level. The learning media could help students to funny in learning. Make students active in learning and no boring in class.

## Recommendation

Given the findings of this study, we offer the following recommendations to learn Initiative for future development of AR technology in order to maximize the learning potential:

- The application should provide quiz or test for evaluating the level of user memorizing. The most important is the ease of use of application.
- Make sure the technology works smoothly and accurately so that technical problems do not interfere with students' ability to learn from the application.
- Ensure hints and other scaffolding in the application are sufficient for students to use application without having to ask an adult for help.
- Verify that time, equipment, and space requirements are appropriate for classroom implementation and accessible to teachers. In particular, understand the concerns teachers have with access to and maintenance of technology and either design around them (e.g., by creating Augmented Reality Book that can be played with the device laid flat on the table or held in a stand) or provide suggestions for mitigating them (e.g., recommendations for protective cases).
- Use the AR in a way such that it is clearly advantageous over traditional paper-and-pencil or purely computer-based instruction.
- Add more interactive of image target for example when click on target then make a sound.
- Adding more the effect and interact of 3D model with user.

This study aims at developing an Augmented Reality book for Malayu subject for primary school students. It is hoped to promote listening and memorizing habits to the children in alphabets lessons. In addition, this Augmented Reality book also provides entertainment and makes learning more interesting at the same time. Moreover, audio and graphics are better for children's understanding than reading the lengthy words on a book in the traditional way itself. Paper questionnaire was prepared to evaluate the level students' satisfaction toward the use of this Malayu Augmented Reality book.

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