Utilization of Augmented Reality-Based Application to Promote Digital Citizenship

1st Andre Kurniawan Pamudji
Department of Information System
Faculty of Computer Science
Soegijapranata Catholic University
Semarang, Indonesia
andre.kurniawan@unika.ac.id

2nd Cecilia Titiek Murniati
Department of English
Faculty of Language and Arts
Soegijapranata Catholic University
Semarang, Indonesia
c_murniati@unika.ac.id

3rd Heny Hartono
Department of English
Faculty of Language and Arts
Soegijapranata Catholic University
Semarang, Indonesia
heny@unika.ac.id

4th Angelika Riyandari
Department of English
Faculty of Language and Arts
Soegijapranata Catholic University
Semarang, Indonesia
a.riyandari@unika.ac.id

5th Rikarda Ratih Saptaastuti
Library
Soegijapranata Catholic University
Semarang, Indonesia
ratih@unika.ac.id

***Abstract*— The purpose of this paper is to describe the process of creating an Android-based application with Augmented Reality feature as well as the user's evaluation of the application. The application was created to equip students with some knowledge on digital citizenship. As the users of digital technologies, college students have to have the ability to peruse technology and participate in online activities in a responsible, safe, and legal manner. The augmented reality-based application was designed to teach students the nine elements of digital citizenship. This paper also explains the feedback from the users of the application to further improve the functionalities of the application for future use.**

Keywords*— *Augmented Reality, Gamification, Digital Citizenship

I. Introduction

The Internet and advanced technologies have connected people anytime anywhere. The online world brings many benefits and shortcomings. Fast information and knowledge transfers, communication, and global trade are some of the advantages of the online world. However, the Internet has opened many opportunities for people to act inappropriately and illegally such as cyberbullying, cybercrimes, and hacking. People, including college students, as the users of digital technology, have to possess the ability to read, write, interact with diverse online communities as well as the ability to think and act critically, analytically, and responsibly in online environments [1].

Digital citizenship can be defined as "the norms of behavior for technology use" [2]. It consists of nine elements; they are digital access, commerce, communication, literacy, etiquette, law, rights and responsibilities, health and wellness, and security [3]. Ribble (2004) suggested that teachers should promote the awareness of digital citizenship and include digital citizenship into the curriculum. The inclusion of digital citizenship into the curriculum is particularly relevant and needed in current situations where students are exposed to a virtual environment longer. Teachers should be at the forefront to equip students with the required skills to interact with other people in a responsible and civil manner. Buchholz, DeHart & Moorman (2020) furthermore suggested that digital citizenship requires "the enactment of identities and dialogue online as citizens who collectively work for equity and change" (p. 11) [1]. In their 2020 study of Digital Civility, Microsoft reported that Indonesia is the lowest on the Digital Civility Index among countries in Southeast Asia [4]. The results of the study indicated that young adults who are 18+ are those who contributed the most to the lower status of digital civility in Indonesia.

As the members of online communities, college students have to be equipped with knowledge of legal, appropriate, and responsible online behavior. This paper describes the creation of an Augmented Reality (AR) application dedicated to educating students on safe and responsible online behavior. This paper will elaborate on the process of creating the application. It consists of the nine (9) elements of digital citizenship. They are Digital Access, Digital Commerce, Digital Communication, Digital Etiquette, Digital Well-being and Health, Digital Literacy, Digital Law, Digital Rights and Responsibility, and Digital Security.

The purpose of the application is to introduce the elements of digital citizenship and to introduce students to the university's campus landmarks. Augmented Reality (AR) itself is a technology that combines real reality with virtual reality or 2D or 3D computer objects [5]. AR concept creates a real-time direct or indirect view of the real world and is enhanced by virtual computer-generated objects so that we can feel a new sensation in seeing the world when using AR technology [6].

The AR aspect of the application was designed to attract students' attention when using the application to learn more about the nine elements of digital citizenship.

According to Deepti, augmented reality is one way to get more attention in terms of student motivation [7]. The result of previous research indicated that students were highly satisfied with the use of AR Environment for interactive learning. Because the concept of augmented reality provides interesting new images, especially for students in carrying out learning activities.

II. Application Creation Process

The application was named Digital Citizenship AR. It was an Android-based application that used AR technology. The application was developed using Unity3D software with the help of the Vuforia plugin for its AR technology. Unity3D software was selected as the software which could assist the process of making game applications with 2D and 3D graphics and it was also also supported by the Vuforia plugin for AR technology.

Seven phases be should be followed in developing a mobile application: identifications there were identification, design, prototyping, development, testing, deployment, and maintenance [8].

In this study, the identification process was carried out by identifying the needs of the nine pillars of digital citizenship. This process was followed by the design process for making characters, stories, UI for assets in the game. Following this process was the development process, and after the development process was complete, the system was tested before it was finally implemented.

A. Asset Creation

The asset creation starts by making marker icons because the AR for this application is AR using markers. There are nine types of icon markers, conforming to the nine elements of digital citizenship.

Fig 1. Asset marker

After the assets were created, we designed the characters. In this application, there were two characters named Gia and Prana. The two characters represented students who had conversations in the application and discussed with each other about aspects of digital society. Character creation was made with various styles and expressions to provide variations in the game.

Fig 2. Gia and Prana 2D character assets

In addition to two-dimensional characters, three-dimensional character assets were also created to add varieties to this application.

Fig 3. Prana and Gia 3D character assets

After creating characters and markers, assets were created for the User Interface (UI). UI is a visual display of a system that can be used to interact with the menus in the application [9].

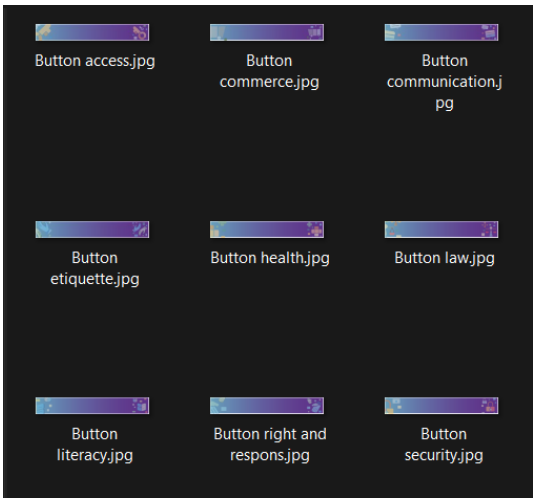

Fig 4. Asset UI button

B. Story Creation

Upon the completion of all assets, we wrote the dialogues that would appear at each level. These dialogues were written in an Excel table consisting of the character names and answers to each question. There were nine sets of dialogue that were composed for this application.

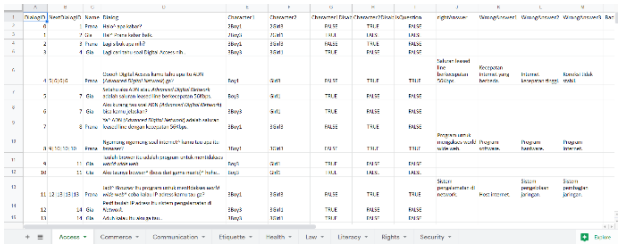

Fig 5. Story assets in Excel

C. Application Development

Once all the images and story assets were completed, the next item to be created was system development. To develop AR aspect of the game, Unity 3D software with Vuforia plugin was used.

Fig 6. Application Development Process

The game itself was designed to include 10 main scenes. One scene had three buttons, namely Starting the Game, Total Points, and also Game Instructions. The other nine scenes were allocated for the nine elements of the digital citizenship.

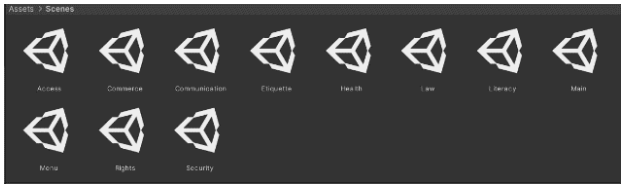

Fig 7. Game scene

In each scene, the game player would be able to watch the conversation between Gia and Prana discussing aspects of digital citizenship and in each conversation, there were questions that the application users had to answer. If the answer was correct, they received a score. The scores that the users collected in each scene were recorded on the leaderboard.

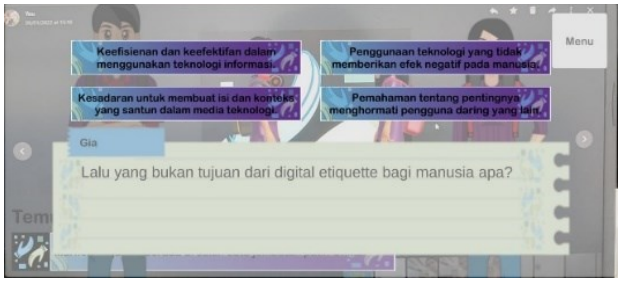

Fig 8. Digital Citizenship game

D. *Publication*

After the application creation process was completed, the results were saved in the form of files in .aab format or Android Bundle and those files were uploaded on Google Playstore.

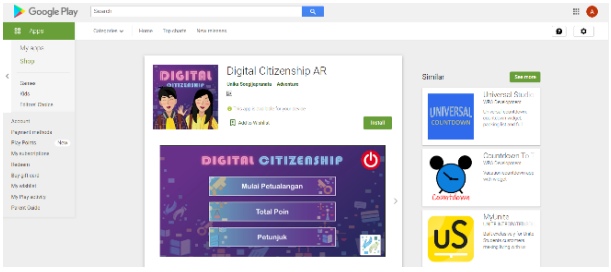

Fig 9. Google Play publication

III. THE GAMIFICATION OF THE DIGITAL CITIZENSHIP AR

Gamification is a learning approach using the concept of video games to increase student interest in the learning process [10].

The Digital Citizenship AR application was developed using the concept of gamification complete with the scoring system and leaderboard features. There were questions with scores on each level. The application users were required to answer questions. If their responses were correct, they would receive one score. After they played the whole set of the game (nine sets), the scores they received were recorded on the leaderboard.

Fig 10. Gamification on application

IV. IMPLEMENTATION

After the application development was completed, we held a workshop to test the game. The trial was carried out in the Soegijapranata Catholic University, Bendan Dhuwur Campus Semarang.

Thirty-one participants were present in the workshop. They followed strict health protocols to prevent COVID-19 transmission. The Trials were carried out in groups of 2 or 3 students, so that each group could apply a collaborative approach.

At the time of the trial, the markers used for AR applications were posted in various places in the campus areas. The most eye-catching areas were selected to make students familiar with campus landmarks. In each location, a picture of its surrounding area was taken as a clue for the workshop participants to find the exact locations of the markers. Many of the students were new students who had never been to campus due to the pandemic.

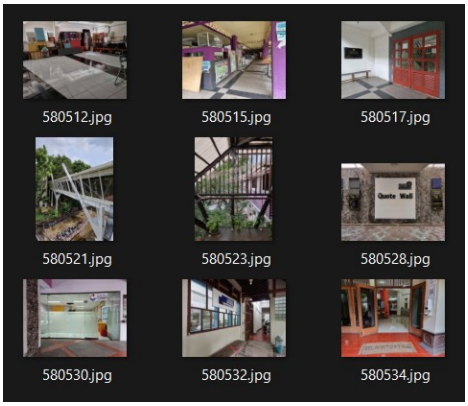

Fig 11. Marker location instructions

Before the event started, participants were divided into groups and asked to do a pre-test first on the nine elements of the digital citizenship. Then we presented the materials

covering those nine elements so that students can understand the issues of digital citizenship better.

Once the presentations concluded, the participants tried out the game in groups. Their tasks were to complete the game by answering all the questions in groups. To increase students' motivation and encourage students' sense of competitiveness, we provided rewards for those who could finish answering the questions the fastest and got the most correct answers. Given that students had to go to each landmark to get the QR code and the questions, the process of completing the game took approximately one hour. When playing the game, students needed to answer many questions, and after the game finished they received a total score that indicated the value they had from the learning process.

Once they finished the game, they were also required to fill out a questionnaire (open-ended and close-ended) to evaluate the game.

Fig 12. Students scanning the QR code in one of the landmarks

V. STUDENTS' EVALUATION OF THE APPLICATION

The evaluations were intended to give feedback to the application designers for future improvement. We asked the participants about the workshop in general, the modules, the most informative elements of digital citizenship, the difficulties in operating the application, their suggestions for future development of the application, and the weakness and the strengths of the workshop and the application.

The first question we asked is their general impression of the workshop. The figure below shows the responses. Around three fourths of the participants selected the Very Good option for the question "What is your general impression of the workshop?". Eight participants selected Good (25.8%) and twenty-three selected Very Good (74.2%), as we can see that mostly participants felt that the activity was fun.

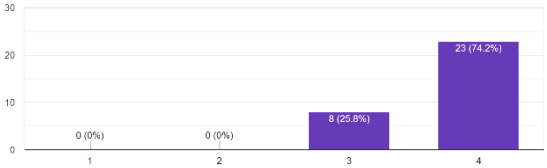

Fig 13. Students' evaluation about the workshop

The second question concerned with the modules we presented. We asked, "How useful are the modules for you as a user of the Internet and gadgets?". From the responses, it is evident that most students (74.2%) viewed the modules as very beneficial and useful for them. Eight students chose Useful.

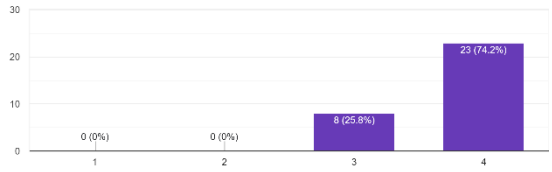

Fig 14. Students' evaluation of modules

The third question in the evaluation deals with the most informative elements of the digital citizenship. The figure below presents students' choices. Out of the nine elements of the digital citizenship, Digital Commerce, Digital Law, and Digital Access were the topics that students were not familiar with. Therefore, they chose those three as the most informative during the workshop.

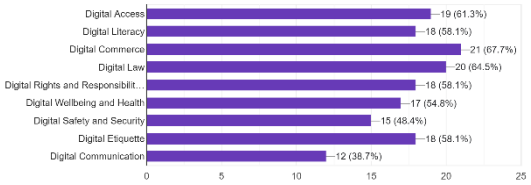

Fig 15. Students' evaluation of the most informative module

Question 4 was related to students' perceived ease of use of the application. More than half of the respondents said that the application was very easy to use. Nine respondents thought the game was easy to use, while two students viewed the game as not easy. The rest of the students (two students) said the application was not easy to use.

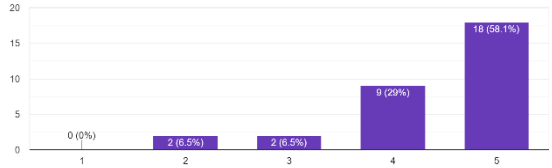

Fig 16. Students' evaluation about the ease of application

The next question was an open-ended question asking students their general impression of the workshop. From the responses, many of them said the workshop was useful to increase their knowledge of digital citizenship. The only complaint was related to the time. Many said that there should be more time allocated for the workshop, especially for the presentation.

Question 6 asked about what the respondents liked the most from the workshop. Many students mentioned the fact that they learned something new about online behavior. They also liked the application because it was new for many of them. The competitive nature of the game was also mentioned. Another aspect they liked was the chance to explore the campus while learning new knowledge.

When asked what they disliked the most from the implementation, they mentioned that the activity made them tired. One hour of running around across the campus was not an easy task for many of them.

The next question concerns specifically with what students liked about the application. They said the AR aspect of the application was new for them. Thus, they felt the application was refreshing. In addition, it was generally easy to use. The character designs were good.

When asked about what they disliked about the application, most students said they would prefer to have the application on iOS platform. Some students had iPhones, yet the application was an android-based application. Another aspect of the application they would like us to improve was the character designs. They suggested that we made more character types and designs.

As for the general impression of the application and the workshop, most students mentioned they learned a lot about digital citizenship. Many materials were eye-opening for them. The application was useful and entertaining, yet there were many ways to expand or improve the game.

VI. Conclusion and Suggestions

The process of creating an augmented reality-based application and the implementation of the application for some college students show that several elements of digital citizenship are novel. Even though the participants are avid technology users, they are not sometimes not aware of how they need to behave in the online world. Many digital applications or games such as the one created in this project can be utilized to equip students with knowledge of digital citizenship as well as to encourage them to act responsibly, safely, and legally in the online world. Furthermore, the use of the concept of gamification and AR can be interesting for students in the learning process.

For future use, the application we designed must be improved. From the feedback, the most important application development is the need to have the application created on different platforms so that all students can experience the game using their respective gadgets.

Acknowledgment

This project is funded by a grant from the United Board WPE Digital Content Development.

References

[1] Beth A. Buchholz, Jason DeHart, and Gary Moorman, “Digital citizenship during a global pandemic: moving beyond digital literacy,” *Journal of Adolescent & Adult Literacy, 64*, vol. 64, no. 1, pp. 11–17, Jul. 2020, doi: https://doi.org/10.1002/jaal.1076.

[2] Mike Ribble, “Digital Citizenship for Educational Change,” *Kappa Delta Pi Record*, vol. 48, no. 4, pp. 148–151, 2012, Accessed: Aug. 28, 2022. [Online]. Available: https://eric.ed.gov/?id=EJ993448

[3] Mike S. Ribble, Gerald D. Bailey, and Tweed W. Ross, “Digital Citizenship: Addressing Appropriate Technology Behavior,” *Learning & Leading with Technology*, vol. 32, no. 1, pp. 6–9, 2004, Accessed: Aug. 28, 2022. [Online]. Available: https://eric.ed.gov/?id=EJ695788

[4] E. Mazrieva, “Indeks keberadaban digital: Indonesia terburuk se-Asia Tenggara [Digital Civility Index: Indonesia the worst among Southeast Asian countries],” *VOA*, Feb. 2021. Accessed: Aug. 28, 2022. [Online]. Available: https://www.voaindonesia.com/a/indeks-keberadaban-digital-indonesia-terburuk-se-asia-tenggara/5794123.html

[5] A. K. Pamudji, M. Setiyowati, and R. Sanjaya, *Mudah Membuat Game Augmented Reality (AR) dan Virtual Reality (VR) dengan Unity 3D*. Elex Media, 2017.

[6] Julie Carmigniani, *Augmented Reality: An Overview*. 2011.

[7] Deepti Prit Kaur, Archana Mantri, and ben Horan, “Enhancing Student Motivation with use of Augmented Reality for Interactive Learning in Engineering Education,” in *Procedia Computer Science*, 2020, pp. 881–885.

[8] Tejas Vithani, “Modeling the Mobile Application Development Lifecycle,” 2014.

[9] Muhyidin M. Agus, Sulhan Muhammad Afif, and Sevtiana Agus, “Perancangan UI/UX Aplikasi My CIC Layanan Informasi Akademik Mahasiswa Menggunakan Aplikasi Figma,” *DIGIT*, vol. 10, no. 2, Nov. 2020.

[10] Jusuf Heni, “Penggunaan Gamifikasi dalam Proses Pembelajaran,” *TICOM*, vol. 5, no. 1, Sep. 2016.