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20-21 April 2020

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Preface

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Preface

The 5th Annual Applied Science and Engineering Conference (AASEC) 2020 is hosted by Technical and Vocational Education study program, School of Postgraduate Studies, Universitas Pendidikan Indonesia (UPI), UPI Publication Center, in collaboration with other co-hosting institutions such as Universitas Negeri Jakarta, UIN Sunan Gunung Djati Bandung, Universitas Trisakti, Politeknik Enjinering Indorama, Universitas Warmadewa, Sampoerna University, Universitas Negeri Surabaya, Sekolah Tinggi Teknologi Garut, Universitas Trilogi, Institut Pendidikan Indonesia, Universitas Serang Raya, Universitas Mataram, Universitas Kanjuruhan Malang, Politeknik Negeri Malang, Universitas Negeri Gorontalo, UIN Sulthan Thaha Saifuddin Jambi, and Universitas Muhammadiyah Sidoarjo.

Unlike the previous conference whose all speakers were scientists, this year's AASEC made an attempt to attract more participation from a wider community by inviting an Indonesian public figure who is also an environmentalist, Hamish Daud Wyllie, along with the other scientists such as Fitri Khoerunnisa from Universitas Pendidikan Indonesia, Indonesia; Muhammad Aziz from Tokyo University, Japan; and Yulfian Aminanda from Universiti Teknologi Brunei, Brunei Darussalam to give a talk based on their expertise under the theme "Green Technologies for Sustainable Environmental Development". The conference was set to be carried out on 21-22 April 2020; however, due to the outbreak of COVID-19, changes arose starting from the postponement of the conference to turning it out into a virtual seminar. To this extent, the parallel presenters were required to send their presentation videos to the organizing committee to be uploaded to AASEC official Instagram account (@aasec_). The presentations proceeded based on each scope determined by the organizing committee as follows: 01 June 2020: Chemical Engineering, 02 – 08 June 2020: Civil Engineering, 15-19 June 2020: Computer and Communication Engineering, 20 June – 01 July 2020: Computer Science, 02 – 07 July 2020: Electrical Engineering, 08 – 10 July 2020: Electronics Engineering, 11 – 20 July 2020: Environmental Engineering, 21-24 July 2020: Information Engineering, 30 July – 02 August 2020: Material Engineering, 03 – 05 August 2020: Material Science and 06 -09 August 2020: Mechanical Engineering.

Despite the pandemic, AASEC 2020 still received a huge attention from the participants. There are 577 papers to be submitted to be published in the proceedings of the 5th AASEC 2020. All the papers have been through a series of rigorous review process to meet the requirements and standards of international publication.

We would like to express our deepest gratitude to the international advisory members, scientific committee, and organizing committee of AASEC 2020 for their commitment and hard work amidst this difficult time. We would also like to thank all the co-hosting institutions for their cooperation on the conference turnouts, particularly on the paper selection submitted to the committee. A huge appreciation also goes to the vice rector for research, international affairs, business, and partnership of Universitas Pendidikan Indonesia for giving constant support to the conference and other conferences held by the university. Last but not least, we thank you all presenters and participants of AASEC 2020 for the most significant contribution at the conference. We hope to see you in the 6th AASEC 2021.

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Mixed reality updatable content for learning supportive tools

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Abstract. Mixed reality technology is a combination of Augmented Reality (AR) and Virtual Reality (VR) technologies. Augmented reality and virtual reality are often used for various fields in terms of education, media campaigns, even used as a game to be more interesting, creative and innovative. The success of Mixed Reality implementation as learning supportive tools are laid on the content richness. As similar to web content, the use of mixed reality as a learning resource will become less efficient when it doesn't have dynamic content. This paper presents the early-stage development of the web-based application as the data source for mixed reality to enable dynamic content when using mixed reality as learning supportive tools. As the results, 112 feedback has been gathered along with acceptance rate more than 86 % stated that the dynamic content is more interesting than having mixed reality with only static content.

1. Introduction

While the Covid-19 pandemic in Indonesia, a social distance and self-quarantine force the academic process for doing distance learning [1,2]. On the other hand, with recent technology, it is possible for students to interact with 3D objects directly and receive information in real-time [3,4]. Using Mixed Reality technology, users can access an information entity without the need to visit the physical source of the information entity. For example, users can use Mixed Reality technology to visit rooms on campus virtually. This model interaction will help information distribution to students while the Covid-19 pandemic. Mixed Reality is a combination of Augmented Reality technology with Virtual Reality. It is a merge between the real world and the virtual world to create a new environment where objects can appear and interact physically and digitally at the same time. However, the creation of Mixed Reality content is very complex [5]. Because it combines designing 3D models, computer-human interfaces, and building into a mobile platform. Therefore, it needs to integrate Mixed Reality with other technologies that enable rich and updatable content. In this paper, we proposed the web-based application as the data source for mixed reality to enable dynamic content when using mixed reality as an alternative distance learning while Covid-19 pandemic.

2. Mixed reality

Combining Augmented Reality technology with Virtual Reality offers a captivating experience through the head-mounted display [6]. In these sections, we briefly describe the differences of Augmented and Virtual Reality.

2.1. Augmented reality

Augmented Reality (AR) is a term for an environment that combines the real world and the virtual world generated by computers [7,8]. Augmented Reality as a system had the following characteristics:

- Combining real and virtual environments
- Run interactively in real-time
- Integration in three dimensions (3D)

Shortly, AR is a real environment that has been added to a virtual object. The interaction with virtual objects is enabled through certain input devices. Instead, AR allows users to see the real environment, with virtual objects added or merged with the real environment. Therefore, AR simply adds or complements the real environment. The main purpose of AR is to create a new environment by combining the interactivity of real and virtual environments so that users feel that the created environment is real. In other words, users feel there is no perceived difference between AR and what they see/feel in the real environment. With the help of AR technology (such as computational vision and object recognition) the real environment around us will be able to interact in digital (virtual) form. Information about objects and the environment around us can be added to the AR system and then the information is displayed above the real world layer in real-time using a digital display. The information displayed by virtual objects expected to gain more attention rather than accessed as a conventional way. AR is widely used in fields such as health, military, manufacturing industry and has also been applied to hand-carry devices, such as mobile phones.

2.2. Virtual reality

Virtual reality (VR) is a technology that will make users feel inside the virtual world by providing the user a visual experience with a head-mounted device [9–11] . The use of virtual reality is to simulate the user interaction with the real environment. The 3D model that supports VR was imitated as possible to study the human behaviour that needs to adapt in the real environment.

3. Proposed methods

The goal of the system development is to enable created Virtual environments, such as existing 3D Virtual Classrooms, to have some sections as a place for image presentation that can update by lecturers as part of learning content. For testing purposes, we used our previous supportive tool development as a data source of the learning materials [9]. The development stage of the proposed system shown in the following diagram.

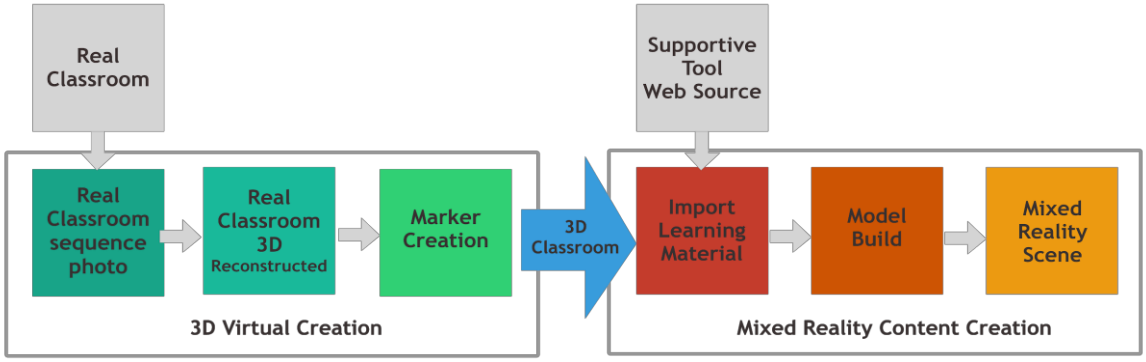

Figure 1. Development stage for the proposed method.

First stage was to develop the virtual classroom. The virtual classroom development shown in the following figures 2. As a results, the 3D classroom was shown on Figures 3.

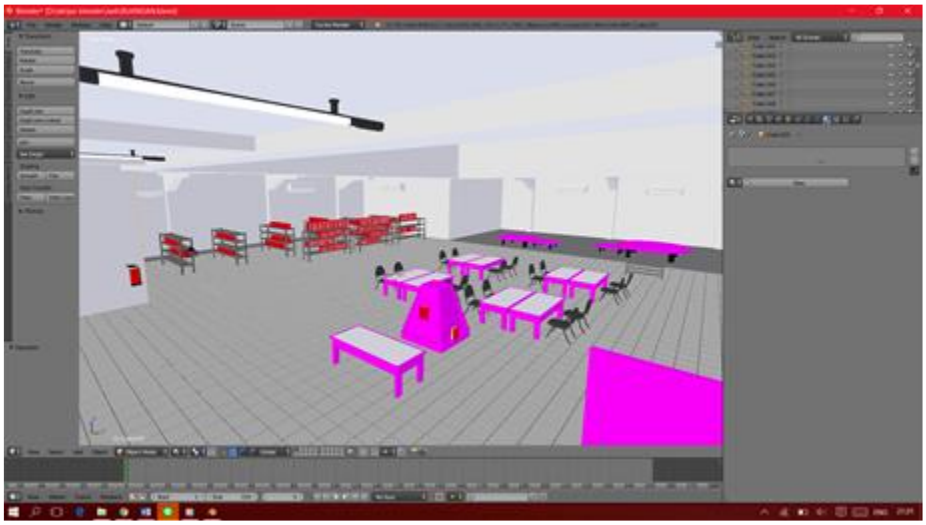

Figure 2. Virtual classroom 3D modelling.

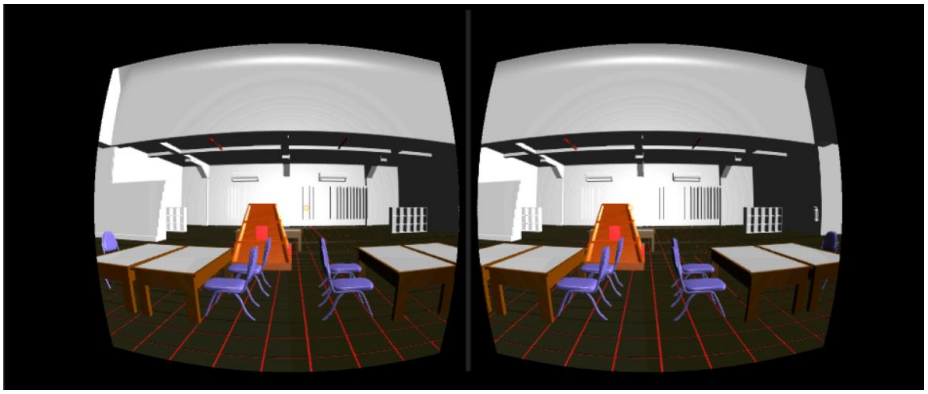

Figure 3. Virtual classroom at VR scene.

For the sake of interactive experience, it needs to provide a resource in the virtual world with content from our previous developed supportive tools [9,10]. The developed supportive tool is a web based application that is used by students to manage their portfolio. One of the assignments is to create some posters that represent their final projects. We use an existing student poster as learning materials illustrations. Also, we use generated QR Code from the supportive tools as the marker. To create markers, we use Vuforia services [11]. The uploaded QR code to Vuforia services are shown on Figure 4.

Next, it needs to import the students' posters from our previous research that act as the learning materials. The example display for the web based supportive tool shown as follows (Figure 5).

Final step, it needs to connect and build the created marker into augmented form with Unity 3D development platform to develop augmented scenes [12]. The developed scenes are shown of figure 6.

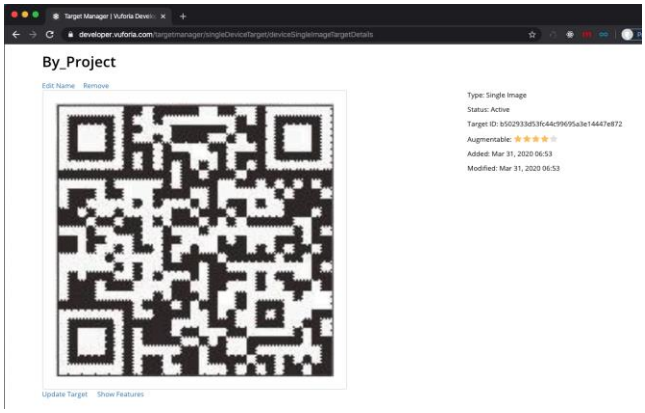

Figure 4. Marker creation using Vuforia services.

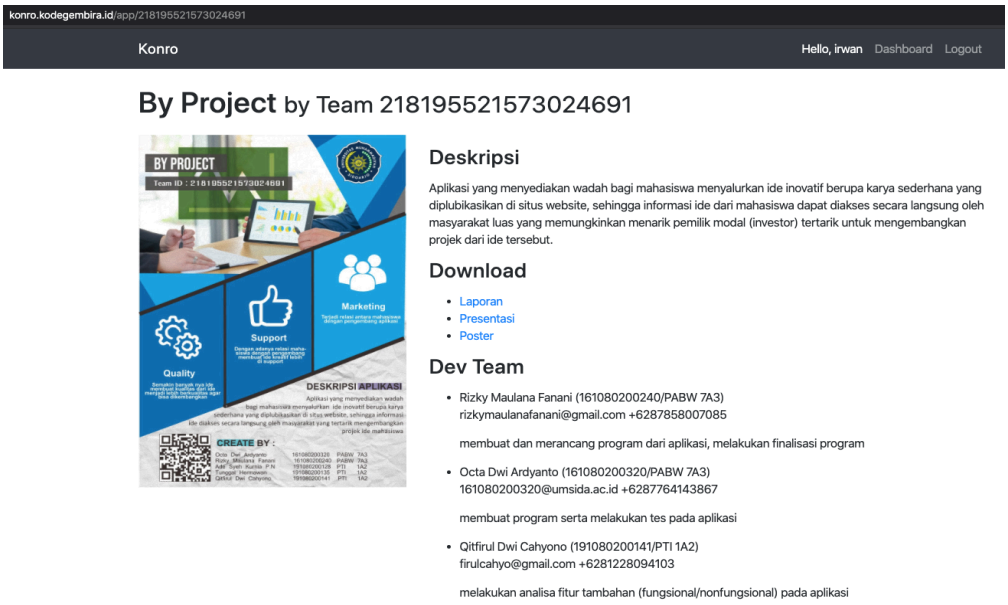

Figure 5. Web based supportive tool as learning materials.

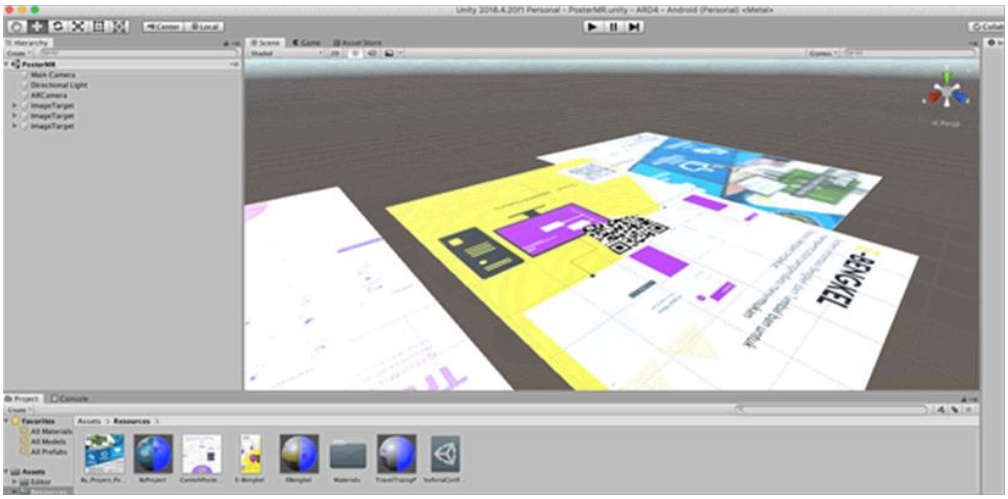

Figure 6. Augmented scene development.

4. Results and discussions

After finishing the augmented scene development, it needs to build the augmented scene to a mobile device ready. In this paper we build into APK files for an augmented scene implemented in an Android based smartphone (as shown on Figure 7).

We implemented mixed reality and showcased the augmented content using learning material from our previous development eportfolio web based applications. This was our preliminary steps to combining the use of mixed reality as learning supportive tools. With dynamic contents, it will help to gain more students' attentions.

We conduct user acceptance tests about the proposed methods on several classrooms that consist of 112 students as participants. The aim of the test was: #1) to determine the effectiveness of the proposed method to enhance students participation, and #2) to evaluate our current development mixed reality experience. The students as participants vary from 1st, 2nd, 3rd and 4th year students at bachelor degree. Figure 8 showed one of our participants using the current development mixed reality.

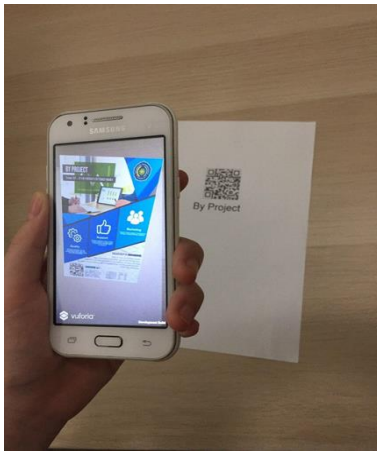

Figure 7. Developed an augmented scene with markers.

Figure 8. One of the user participation for testing the developed mixed reality.

4.1. Results

After experiencing our developed mixed reality, all participants have been requested to fill the designated questionnaire. Table 2 shows the questions for the questionnaire.

Table 1. Questionnaire for participants.

Questions	Response and Percentage (%)
Do students ever conduct elearning?	Yes (92), No(8)
Are students familiar with mixed reality?	Yes (12), No(88)
Have students having mixed reality experience before?	Yes (10) , No(90)
How likely is it that students would implement mixed reality in other classrooms?	Very Likely (98), General Feeling (2), Not Likely (0)
Would students recommend this mixed reality experience to a friend or colleague?	Yes (98), No (2)

Also, we had adapt Likert scale to measure the perception from all participants about the interaction with the proposed method with following formulas [13,14]:

$$P = \frac{N\ x\ R}{I} x\ 100\%$$

Where:
P = The percentage value each questions
N = The value of each answer at each instruments
R = Answered Value Frequency
I = The highest answered value multiplied with number of participant (5 x 112 = 560)

The early stage of our current development mixed reality shown in Table 2.

Table 2. Beta testing of the proposed method.

Questions	Percentage (%)
Is the proposed method easy to use?	91.1
Is markers working correctly?	96.4
Is the learning materials delivered are way more understandable?	89.3
Would students like to use mixed reality experience at existing elearning?	87.5
Is the Instruction given easy to follow?	75.9
Does it have immersive experiences?	78.6
Average Percentage	86.5

4.2. Discussions
From the interaction aspect, studies had shown that learning style with evolved physical body movement is way more effective than observatory style learning [15,16]. This means 2D user experience while using elearning (such as LMS) is less effective when it compares with 3D user experiences [17,18]. From this perspective, mixed reality is more promising to enhance the learning process through its interactions. From Table 1, even though most participants are familiar with elearning, but likely not much to experience with the mixed reality. After experiencing the mixed reality as learning support tools, participants are likely to use the proposed method in future learning processes.

5. Conclusions and future works
Mixed reality has the potential to become an effective tool to enhance conventional pedagogical skill to gain more students' attention. In our previous research, we developed the web based supportive tool that was used by students as their eportfolios. With the proposed method, it increases the value of developed supportive tools as a result of being used as a data source for mobile-based AR. From the questionnaire results, it shows that the implementation of mixed reality with updatable learning materials will bring an immersive and entertaining experience rather than e-learning with static content.

For future works, It needs to study the automation creation of third party services in order to the creation of Augmented scene content with third party API that being provided.

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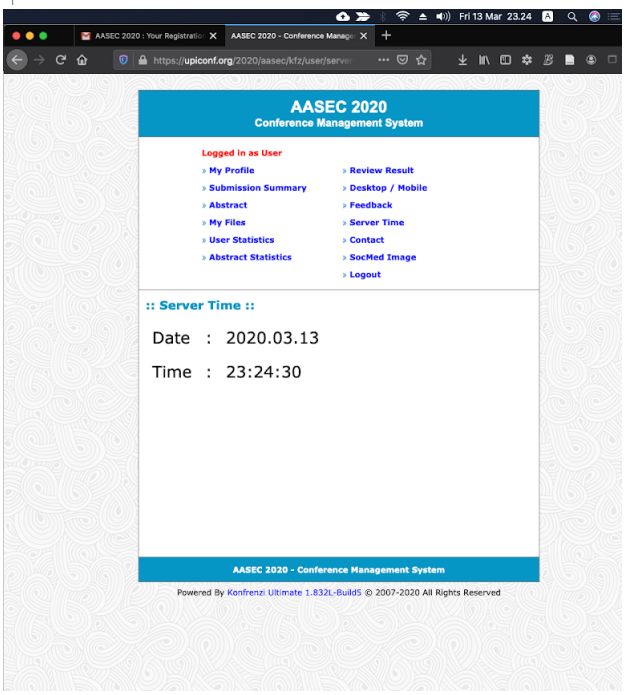

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Dear Authors: Irwan Alnarus Kautsar, Aswin Damardono, Mohammad Suryawinata

We are pleased to inform you that your abstract (ABS-1040, Oral Presentation), entitled:

"Mixed Reality Updatable Content For Learning Support Media"

has been reviewed and accepted to be presented at AASEC 2020 conference to be held on 20-21 April 2020 in Bandung Barat, Indonesia.

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To access the whole part of the manuscripts, please click “next issue” which will end on number 6 or issue 6 for AASEC 2020. On behalf of the committee, we would like to thank you for your participation and apologize for any inconvenience, particularly for the rejected manuscripts. We look forward to seeing you at the next AASEC 2021.

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Mixed reality updatable content for learning supportive tools

I A Kautsar*, A Damardono and M Suryawinata

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Abstract. Mixed reality technology is a combination of Augmented Reality (AR) and Virtual Reality (VR) technologies. Augmented reality and virtual reality are often used for various fields in terms of education, media campaigns, even used as a game to be more interesting, creative and innovative. The success of Mixed Reality implementation as learning supportive tools are laid on the content richness. As similar to web content, the use of mixed reality as a learning resource will become less efficient when it doesn't have dynamic content. This paper presents the early-stage development of the web-based application as the data source for mixed reality to enable dynamic content when using mixed reality as learning supportive tools. As the results, 112 feedback has been gathered along with acceptance rate more than 86 % stated that the dynamic content is more interesting than having mixed reality with only static content.

1. Introduction

While the Covid-19 pandemic in Indonesia, a social distance and self-quarantine force the academic process for doing distance learning [1,2]. On the other hand, with recent technology, it is possible for students to interact with 3D objects directly and receive information in real-time [3,4]. Using Mixed Reality technology, users can access an information entity without the need to visit the physical source of the information entity. For example, users can use Mixed Reality technology to visit rooms on campus virtually. This model interaction will help information distribution to students while the Covid-19 pandemic. Mixed reality is a combination of Augmented Reality technology with Virtual Reality. It is a merge between the real world and the virtual world to create a new environment where objects can appear and interact physically and digitally at the same time. However, the creation of Mixed Reality content is very complex [5]. Because it combines designing 3D models, computer-human interfaces, and building into a mobile platform. Therefore, it needs to integrate Mixed Reality with other technologies that enable rich and updatable content. In this paper, we proposed the web-based application as the data source for mixed reality to enable dynamic content when using mixed reality as an alternative distance learning while Covid-19 pandemic.

2. Mixed reality

Combining Augmented Reality technology with Virtual Reality offers a captivating experience through the head-mounted display [6]. In these sections, we briefly describe the differences of Augmented and Virtual Reality.

2.1. *Augmented reality*

Augmented Reality (AR) is a term for an environment that combines the real world and the virtual world generated by computers [7,8]. Augmented Reality as a system had the following characteristics:

- Combining real and virtual environments
- Run interactively in real-time
- Integration in three dimensions (3D)

Shortly, AR is a real environment that has been added to a virtual object. The interaction with virtual objects is enabled through certain input devices. Instead, AR allows users to see the real environment, with virtual objects added or merged with the real environment. Therefore, AR simply adds or complements the real environment. The main purpose of AR is to create a new environment by combining the interactivity of real and virtual environments so that users feel that the created environment is real. In other words, users feel there is no perceived difference between AR and what they see/feel in the real environment. With the help of AR technology (such as computational vision and object recognition) the real environment around us will be able to interact in digital (virtual) form. Information about objects and the environment around us can be added to the AR system and then the information is displayed above the real world layer in real-time using a digital display. The information displayed by virtual objects expected to gain more attention rather than accessed as a conventional way. AR is widely used in fields such as health, military, manufacturing industry and has also been applied to hand-carry devices, such as mobile phones.

2.2. *Virtual reality*

Virtual reality (VR) is a technology that will make users feel inside the virtual world by providing the user a visual experience with a head-mounted device [9–11] . The use of virtual reality is to simulate the user interaction with the real environment. The 3D model that supports VR was imitated as possible to study the human behaviour that needs to adapt in the real environment.

3. Proposed methods

The goal of the system development is to enable created Virtual environments, such as existing 3D Virtual Classrooms, to have some sections as a place for image presentation that can update by lecturers as part of learning content. For testing purposes, we used our previous supportive tool development as a data source of the learning materials [9]. The development stage of the proposed system shown in the following diagram.

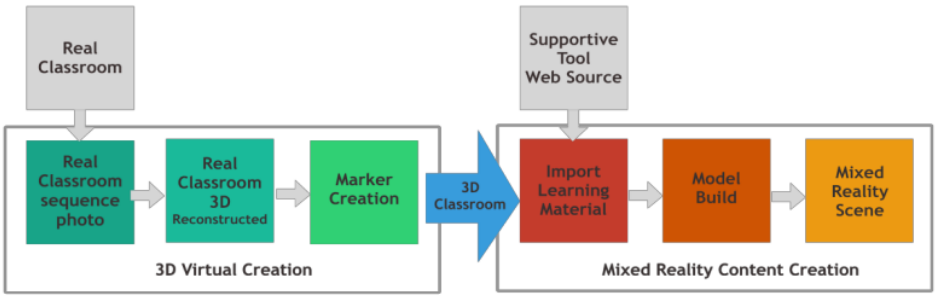

Figure 1. Development stage for the proposed method.

First stage was to develop the virtual classroom. The virtual classroom development shown in the following figures 2. As a results, the 3D classroom was shown on Figures 3.

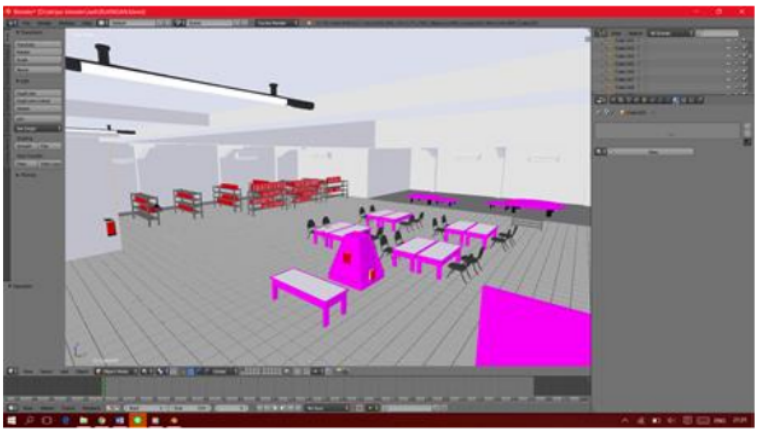

Figure 2. Virtual classroom 3D modelling.

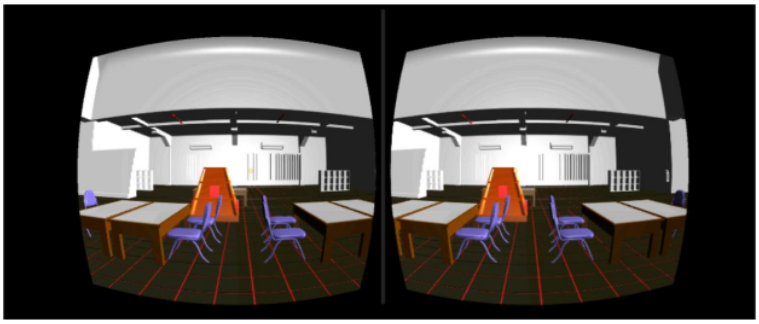

Figure 3. Virtual classroom at VR scene.

For the sake of interactive experience, it needs to provide a resource in the virtual world with content from our previous developed supportive tools [9,10]. The developed supportive tool is a web based application that is used by students to manage their portfolio. One of the assignments is to create some posters that represent their final projects. We use an existing student poster as learning materials illustrations. Also, we use generated QR Code from the supportive tools as the marker. To create markers, we use Vuforia services [11]. The uploaded QR code to Vuforia services are shown on Figure 4.

Next, it needs to import the students' posters from our previous research that act as the learning materials. The example display for the web based supportive tool shown as follows (Figure 5).

Final step, it needs to connect and build the created marker into augmented form with Unity 3D development platform to develop augmented scenes [12]. The developed scenes are shown of figure 6.

Figure 4. Marker creation using Vuforia services.

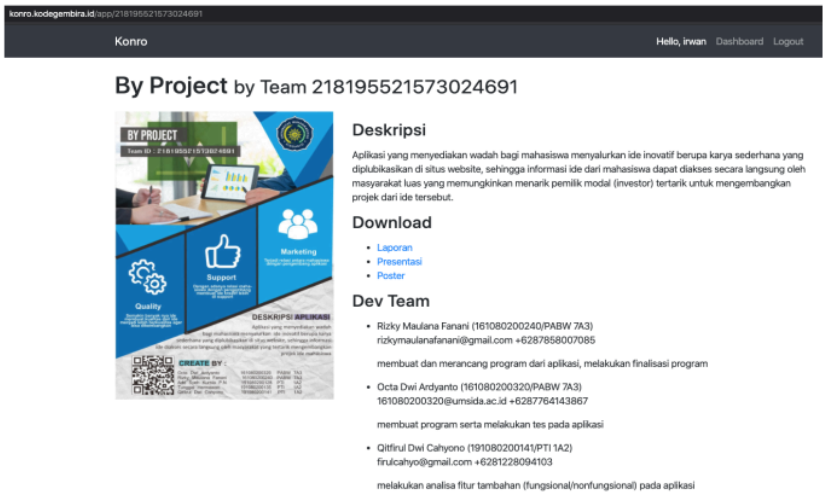

Figure 5. Web based supportive tool as learning materials.

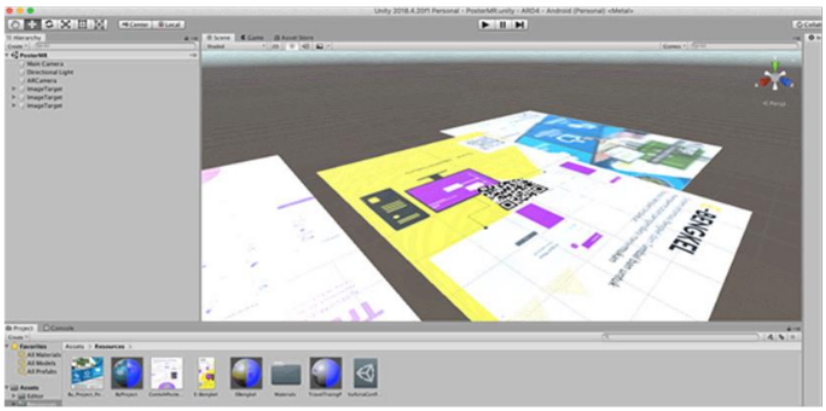

Figure 6. Augmented scene development.

4. Results and discussions

After finishing the augmented scene development, it needs to build the augmented scene to a mobile device ready. In this paper we build into APK files for an augmented scene implemented in an Android based smartphone (as shown on Figure 7).

We implemented mixed reality and showcased the augmented content using learning material from our previous development eportfolio web based applications. This was our preliminary steps to combining the use of mixed reality as learning supportive tools. With dynamic contents, it will help to gain more students' attentions.

We conduct user acceptance tests about the proposed methods on several classrooms that consist of 112 students as participants. The aim of the test was: #1) to determine the effectiveness of the proposed method to enhance students participation, and #2) to evaluate our current development mixed reality experience. The students as participants vary from 1st, 2nd, 3rd and 4th year students at bachelor degree. Figure 8 showed one of our participants using the current development mixed reality.

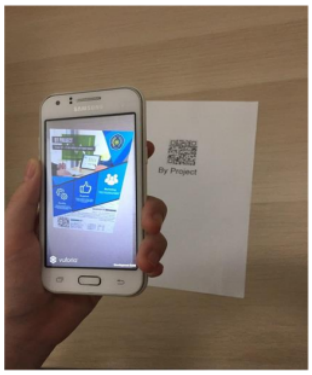

Figure 7. Developed an augmented scene with markers.

Figure 8. One of the user participation for testing the developed mixed reality.

4.1. Results

After experiencing our developed mixed reality, all participants have been requested to fill the designated questionnaire. Table 2 shows the questions for the questionnaire.

Table 1. Questionnaire for participants.

Questions	Response and Percentage (%)
Do students ever conduct elearning?	Yes (92), No(8)
Are students familiar with mixed reality?	Yes (12), No(88)
Have students having mixed reality experience before?	Yes (10) , No(90)
How likely is it that students would implement mixed reality in other classrooms?	Very Likely (98), General Feeling (2), Not Likely (0)
Would students recommend this mixed reality experience to a friend or colleague?	Yes (98), No (2)

Also, we had adapt Likert scale to measure the perception from all participants about the interaction with the proposed method with following formulas [13,14]:

$$P = \frac{N\ x\ R}{I} x\ 100\%$$

Where:
P = The percentage value each questions
N = The value of each answer at each instruments
R = Answered Value Frequency
I = The highest answered value multiplied with number of participant (5 x 112 = 560)

The early stage of our current development mixed reality shown in Table 2.

Table 2. Beta testing of the proposed method.

Questions	Percentage (%)
Is the proposed method easy to use?	91.1
Is markers working correctly?	96.4
Is the learning materials delivered are way more understandable?	89.3
Would students like to use mixed reality experience at existing elearning?	87.5
Is the Instruction given easy to follow?	75.9
Does it have immersive experiences?	78.6
Average Percentage	86.5

4.2. Discussions
From the interaction aspect, studies had shown that learning style with evolved physical body movement is way more effective than observatory style learning [15,16]. This means 2D user experience while using elearning (such as LMS) is less effective when it compares with 3D user experiences [17,18]. From this perspective, mixed reality is more promising to enhance the learning process through its interactions. From Table 1, even though most participants are familiar with elearning, but likely not much to experience with the mixed reality. After experiencing the mixed reality as learning support tools, participants are likely to use the proposed method in future learning processes.

5. Conclusions and future works
Mixed reality has the potential to become an effective tool to enhance conventional pedagogical skill to gain more students' attention. In our previous research, we developed the web based supportive tool that was used by students as their eportfolios. With the proposed method, it increases the value of developed supportive tools as a result of being used as a data source for mobile-based AR. From the questionnaire results, it shows that the implementation of mixed reality with updatable learning materials will bring an immersive and entertaining experience rather than e-learning with static content.

For future works, It needs to study the automation creation of third party services in order to the creation of Augmented scene content with third party API that being provided.

Acknowledgments
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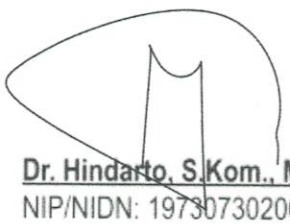

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