Use of Augmented Reality in the Education Setting

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Abstract

The implementation of augmented Reality (AR) in educational settings has become popular due to AR's beneficial effects on the learning process. Because of how readily and successfully conceptual context may be shown as digital components, this technique is one of the most popular learning fads of the present day. In conclusion, this study aims to investigate how augmented reality technology is employed in Malaysian educational institutions from the viewpoints of Malaysian educators. A significant conclusion from the study indicated that teachers were interested in augmented reality technology due to its unique qualities.

Keywords: Augmented Reality, Malaysian Education, Educator Perspective, Pedagogy Enhancement

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1.0 Introduction

The use of technology in educational settings has been seen as a force multiplier to encourage learners to enhance their cognitive capabilities. Also, it can motivate learners to engage directly in the educational lesson, which would also result in an efficient process of learning (Saidin, Abd Halim, & Yahaya, 2015). Shapley et al. (2011) suggest that educational lessons that use educational technology can assist learners in acquiring knowledge more innovatively. Countless sources of knowledge are available in this rapidly evolving setting, so selecting an appropriate strategy and implementing essential knowledge at the proper time and location are crucial in educational settings. One of the most cutting-edge technological advancements in the education sector that is designed for 21st Century learning is augmented reality (AR) technology. According to Brian Mullis (2018), augmented reality technology can convey knowledge more effectively than other technologies already in use. The ability of augmented Reality (AR) as a teaching tool to deliver a blended learning experience by fusing virtual and real-world surroundings or materials in the classroom is another compelling feature (Barrow et al., 2019). Despite the fact that the world is three-dimensional, two-dimensional media are preferred in education because they are more practical, comfortable, adaptable, portable, and affordable (Kesim & Ozarslan, 2012).

Nevertheless, it needs more dynamic content and is stagnant. In order to give its users a realistic experience, augmented Reality (AR) uses spatial space in three-dimensional settings to produce an enhanced version of the real world. This is done by overlaying digital visual components, music, or other sensory stimuli over the real environment in real-time (Zambri & Kamaruzaman, 2020). The teaching and learning processes in education are greatly influenced by the student's prior knowledge and motivation for the studied subject. Under the current pedagogical model, students become passive consumers who merely listen to the courses without contributing anything of their own.

In order to stimulate the senses of sight, hearing, and touch, the current method of learning and instruction, which only goes in one direction, needs to be modified. Researchers in the past believed that augmented reality (AR) technology was a promising tool that may boost student interest and motivation while helping the teaching and learning process in a classroom setting (Mat Bistaman, Syed Idrus, & Abd Rashid, 2018). It is impossible to completely realise the potential of augmented Reality (AR) in education without the participation of teachers, who are the most important resource for communicating the lesson's material to pupils and achieving the desired outcome in education. To pique the interest of students and ensure that they remain focused on the material at hand, teachers need to first acknowledge the value of augmented reality technology as an intervention in the educational process.

There have been very few studies conducted on the opinions of educators on augmented Reality (AR), which is still considered a fresh concept in the field of education. This research was conducted with the intention of delving deeper into the subject of educators' perceptions of augmented reality technology and how it affects the teaching and learning process. Some teachers, while dismissing the benefits of technology's efficacy and

usability in education, continue to retain the view that pupils using technology might lead to the development of digital addictions, which in turn can lead to a decrease in students' self-esteem and confidence (Mat Bistaman, Syed Idrus, & Abd Rashid, 2018). It is crucial to acquire the feedback of educators on how augmented reality technology is employed in the instructional process and whether or not there are any potential concerns before making any particular implementation suggestions.

2.0 Literature Review

Within Extended Reality (XR), Augmented Reality (AR) is one of the many technologies that has emerged as the most fascinating over the previous several years. AR is a technology that overlays an image, video, or animation with a digital or Computer-Generated Image (CGI) in a real-world environment in real-time that the user can interact with. This was stated by Greg Kipper and Joseph Rampola (2012). It allows the user to observe the real environment even when a virtual picture or object is superimposed on top of it. Augmented Reality uses multimedia components, including pictures, animation, audio, and video, to improve the user's perception and allow them to experience something that feels more real to them (Gopalan et al, 2014).

The term "augmented reality" (AR) can be defined in a simple way. The process of enhancing something by providing it with additional capabilities to transform it into something that is superior to what it was in its previous state is referred to as "augmenting" that something. Reality is either the quality or the state of having the quality of being actual. It is understood that the technology known as "Augmented Reality," which is a combination of the two phrases "augmented" and "reality," considerably improves a person's capabilities by superimposing digital representations of virtual elements on environments that exist in the physical world. It provides the viewer with a composite vision that combines the real scene they are looking at with virtually produced scenes created through digital technology. This is an improvement of the real world in a partially unmediated way, and it involves a specific location, space, product, or event as one of the components. According to Figure 1 of Milgram and Kishino's Mixed Reality on the Reality-Virtuality Continuum, Augmented Reality (AR) is much closer to the spectrum that describes the real world. In contrast, Virtual Reality (VR) is much closer to the spectrum that describes the virtual world (1994).

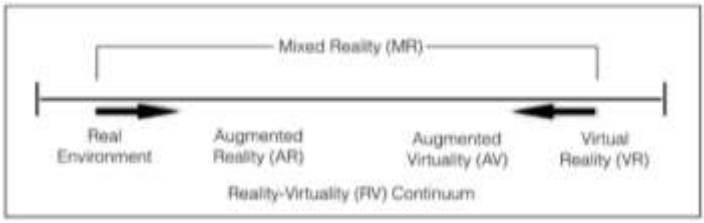

Figure 1: Reality-Virtuality (RV) Continuum (Milgram & Kishino, 1994).

As a result, using technology to enhance teaching and learning procedures and the presentation of learning materials is highly suggested (CC Ng, 2018). Technology multiplies educators' impact by enabling students to access websites, online tutorials, and a wide range of other services in cyberspace rather than relying solely on teachers as a source of knowledge. The education landscape has seen a significant transformation recently, especially in fields where technology is used effectively and with sound pedagogical principles (Zambri & Kamaruzaman, 2020). Using AR technology is one such technology. Because of various technology features that could positively affect students' learning processes, augmented Reality (AR) has attracted a lot of interest in the educational community (Mat Bistaman, Syed Idrus, & Abd Rashid, 2018). This is because it can offer students an engaging learning environment and the brain's route of least resistance for absorbing abstract information while maintaining their attention and curiosity (Zambri & Kamaruzaman, 2022).

Using this technique to create augmented reality textbooks is an intriguing application of the technology (Kessim & Ozarslan, 2012). Regularly, these books are printed, but when a webcam is directed at them, they reveal built-in visualisations and interaction. Downloading specialised computer software, utilising specialised mobile applications, or visiting a website are all viable options for accomplishing this goal. Using this technology, it will be possible to turn any book that has already been published into an augmented-reality version after it has been released. The two separate worlds can be connected in the simplest way possible by making use of media rich in variety and creativity, as well as 3D objects and perspectives, simulations, and a variety of other ways of interaction. The incorporation of augmented Reality onto printed book pages will transform traditional textbooks into interactive sources of knowledge. This makes it possible for people without prior experience using computers to have an incredibly immersive experience.

Figure 2: AR Quake User Interface and Hardware (Thomas & Piekarski,2002)

Thomas and Piekarski (2002) created the first mobile AR outdoor game, ARQuake, in 2000, in which users could fight virtual enemies in the real world, refer to Figure 2. It is an expanded version of the popular game Quake, which was released in 1996 by id Software. An internal half-silvered mirror in a transparent HMD merges the visuals from an LCD with

the user's vision of the world in real time. The prototype is powered by low-cost hardware such as a Toshiba Pentium-233 laptop, a Navigation TCM2-80 orientation sensor, and a Garmin GPS12XL with DGPS for positioning. It is carried in a backpack (Thomas & Piekarski, 2002).

The current state-of-the-art demonstrates many advantages to incorporating AR into the educational system. Thus, there is a need to explore the widespread implementation of augmented Reality (AR) technology in educational organisations in Malaysia. The fact that anyone may now use augmented Reality is a positive development in this field. The advancement of augmented Reality (AR) has achieved a new pinnacle with the assistance of smartphones. This evolution led to the creation of various augmented reality smartphone apps that serve various functions.

3.0 Methodology

This study aims to develop the present pedagogical approach by defining the educational prospects of augmented reality teaching. This study also will replicate the user experience assessment approach by Kamaruzaman et, al 2012. The survey and interview were organised and divided into sections utilising state-of-the-art variables. An in-depth qualitative semi-structured interview was conducted with four teachers from three different schools in the Klang Valley, Malaysia. Teluk Pulai Primary School, Sungai Siput Primary School, and Telok Gadong Primary School are the three schools that cut this investigation. Since the first educator was suggested by an officer from the district education office in Klang, Selangor, Malaysia, the snowball sampling approach was used to select the remaining educators after that initial educator. The next thing that needed to be done was to inquire with the primary instructor about potential new volunteers for the study. Table 1 presents an in-depth look at the demographic information provided by the survey instructors.

Table 1: Educator Respondent's Demographics

	Gender	Schools	Age
Educator A	Female	SK Telok Gadong	42
Educator B	Female	SK Teluk Pulai	45
Educator C	Male	SK Sungai Siput	53
Educator D	Male	SK Telok Gadong	55

In response to the COVID-19 pandemic issue, the Malaysian National Security Council (MKN) has implemented a strict protocol known as the Standard Operating Procedure (SOP) to help minimise the spread of deadly infections. As a direct consequence, one-on-one interviews with each respondent were conducted in a private room according to the same standard operating procedure (SOP). Individuals have the feeling of secrecy because they can freely and openly communicate their thoughts and perceptions without interference from outside sources. Every conversation that took place during the period when the data was being processed was recorded on audio for later transcription. When it

came time to analyse the data, the researcher used theme analysis for the transcribed interview collection.

An augmented reality app was developed as part of the study's data collection process. Using Unity3D, Vuforia, and a "marker-based" approach, we built an augmented reality app. Zambri and Kamaruzaman's idea of an operational Augmented Reality system served as the basis for the construction of the marker-based architecture seen in Figure 2. (2020). The researchers showed the teachers the AR app and gave them a quick rundown of what augmented Reality is and how it works before the semi-interview. In addition, the researcher chose a History textbook aimed at fourth-grade students as the benchmark. After developing the app in Unity3D, the researcher converted it into an Android application by leveraging Vuforia's augmented reality source codes. The resulting software was then packaged as an Android application and made available on Android smartphones. Its user interface is seen in Figure 3 and Figure 4 below.

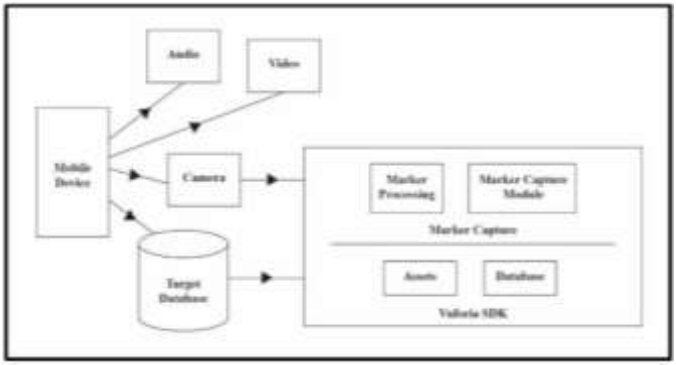

Figure 2: MAR System Model Architecture

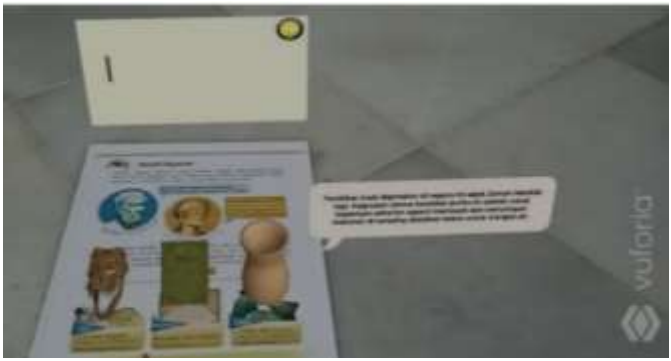

Figure 3: User Interface of AR app

Figure 4: Another user interface in the AR app

4.0 Results

To identify the topics that repeatedly emerged across the dataset, a thematic analysis was carried out. After making multiple appearances in the transcripts, particular words, phrases, and ideas were identified as particularly prevalent. According to the analysis findings, four themes emerged: Encourages Independent Study, Boosts Cognitive Capacity, Contributes to Professional Growth, and Identifies Obstacles and Challenges.

AR enhances the user's sense of immersion in both worlds when combined with real-world environments. All the educators who responded to the survey believed that learners would be more interested in learning if their textbooks had augmented reality elements like these. Please refer to Table 2, Table 3, Table 4, and Table 5.

Table 2: Educators' response on promoting self-study.

	Response / Feedback
Educator A	My students can only concentrate for up to five to ten minutes at a time. Because there is not a lot of description, students could not understand the context, which caused them to question why they should learn this subject. Even if they learn from a book, children's interest in learning will increase thanks to augmented reality technology.
Educator B	AR would give consumers the impression that the graphics they are being shown are real, giving them a more immersive experience. With augmented Reality (AR), it is as if the educational material has been brought to life; students may experience it without having to go to a museum and can learn it anywhere and whenever they wish.
Educator C	Students found that learning was more engaging when they could do it visually, such as studying with pictures. They are being made to learn with the traditional textbook, but if we employ augmented reality technology, they will learn on their own accord and with enthusiasm.
Educator D	Students can receive such information and understand the subject more easily with AR technology because they desire to accomplish things swiftly and effectively. As a result, students will take the initiative to learn even when not in the classroom.

Every single instructor who took part in this study believed that teaching with AR would increase their students' cognitive abilities. In most cases, they were required to develop

innovative strategies to keep the children interested in the teachings, such as organising a trip to a museum or having them create scrapbooks. The usage of AR has the potential to offer a completely new meaning to the concept of education by assisting students in becoming active participants in their education by actively engaging with the material being taught as the instructor discusses the background information.

Table 3: Educators' response on improving cognitive.

	Response / Feedback
Educator A	Studying, especially learning about history, maybe be a monotonous activity. Why, in their view, should they bother to educate themselves about the past? Using this method can provide a clearer explanation of the setting. The students would be ecstatic about it.
Educator B	Students are capable of understanding what it is that we are attempting to educate them, which saves us both time and resources.
Educator C	Pupils benefit greatly from having access to visual content in their education and would be enthusiastic about utilising this technology. They can concentrate more clearly and remember more context when they are exposed to pictures as opposed to when they are taught using more traditional methods.
Educator D	The ability of this technology to visualise the learning context would make it very appealing to students. As a result, kids are able to comprehend the message that the educator is attempting to impart to them without the need for the educator to repeat themselves numerous times, so wasting valuable time.

The educators have claimed that they do not have any worries about introducing AR technology into their instructional procedures and that they are willing to take significant steps, such as enrolling in seminars or classes, to learn how to use the technology effectively. This suggests that the instructors were concerned about the quality of their instruction to achieve the learning goals. In addition to this, they provided evidence that they acknowledge the role that technology plays in the educational process, disproving the widespread belief that teachers are opposed to adopting new technologies and favoring more conventional approaches to education.

Table 4: Educators' response on professional development.

	Response / Feedback
Educator A	Before this, we often held a workshop for anything a new technique linked to IT. If this technology has a workshop or class, this will unquestionably help educators use it in instructing.
Educator B	Using or using this technology in my classroom does not bother me in the least. I cannot speak for other people, but if there is a method that can be used to deal with these issues appropriately, they, too, would welcome the opportunity to make use of it.
Educator C	Hence, one of my goals is to become proficient in its application in the classroom. Since we had previous experience taking online quizzes in the computer lab and Google Classroom, there should be no significant difference here.
Educator D	The technology should be incorporated as speedily as is humanly practicable. There are no barriers to entry for educators when it comes to cutting-edge mastering technology and using it in their lesson plans and student instruction. In most cases, there are workshops or seminars on how to organise it, and the level of engagement (from teachers) is almost never average.

Although all of the educator-respondents admire the augmented reality technology for its originality, one-of-a-kind qualities, and ability to give concrete form to intangible ideas, very few of them are concerned about the technology. They could benefit or suffer from the implementation of this technology. Using technology as a useful teaching tool has always been the primary focus of these educators as they strive to realise their ultimate goal of developing a dynamic and robust educational setting. Yet, students may also utilise the technology for other purposes, which would constitute a deviation from the educational goal. This can be seen in Table 5 below.

Table 5: Educators' response on issues and barriers.

	Response / Feedback
Educator A	In today's world, students have a better understanding of technology than we do, and they also have more general knowledge. On the other hand, I am concerned that they might be engaged in other activities when we are teaching.
Educator B	My concerns are based on the fact that I have witnessed instances in which students, rather than concentrating on the topic at hand, have been "experimenting" with various technological features.
Educator C	I took them to a facility where they could use the computers for educational purposes; instead, they spent most of their time playing games.
Educator D	There is no doubt that technology is amazing; but my issue is that if there are no constraints, students will want to do anything other than learn if they become bored with the course. If there are no limitations, I am concerned that students will want to do something other than learn.

5.0 Discussion

To acquire a better knowledge of and perspective on how adopting augmented Reality (AR) technology in education might improve both the teaching and learning environment. A study was conducted with educators. Educators who responded to the survey were awestruck by the cutting-edge technology demonstrated during the briefing on the created AR app. They were taken aback by its capacity for total immersion and an amplified experience. In addition, the educators who responded to the survey have positive perspectives on AR technology. They believe that it has the potential to revolutionise the way kids learn as well as the way teachers educate. In addition to this, it has the potential to transform a drab classroom setting into a lively and engaging learning session. Students frequently need to be more interested in what they are studying, and teachers, therefore, need to devise strategies to engage their students in what they are doing. Students would not only have the willingness to learn with the assistance of AR technology as a tool for education, but they would also have the capability to understand the notion that the educator is trying to teach them. In addition, according to Ryffel, Mattia, et al. 2017, we have a lot of great content or information ready to be consumed. Still, the flow of knowledge is being impeded either by a lack of time or by the fact that experts have full schedules. As a result, augmented reality technology is an intervention that enables students to continue their

education even when the instructor is not present. However, the development of augmented Reality (AR) technology is not intended to replace teachers; rather, it is intended to improve the educational process while also ensuring that students can learn whenever and wherever they choose. There are, however, a few reservations among the educators that responded. Those educators are scared that their kids would utilise the AR technology for something other than the lesson they are supposed to be concentrating on. Nonetheless, Zambri and Kamaruzaman (2020) said that these problems can be minimised by implementing appropriate rules and policies regarding instructional design. Aside from that, the advantages of utilising AR, as mentioned by the educators who participated in the survey, exceed the disadvantages and difficulties.

6.0 Conclusion

Augmented Reality (AR) has the capabilities of visualising and immersing users, which enables it to make the seemingly impossible feasible. It has been demonstrated that incorporating augmented Reality (AR) technology into educational settings can result in beneficial changes that enhance both the teaching and learning environment. Moreover, Mullins (2018) asserted that augmented Reality is the most effective form of technology for the dissemination of information. In addition to this, the findings demonstrated that, although the myth of educators being afraid of technology having the opposite effects on students and refusing to accept it contained some elements of truth, the findings demonstrated that educators have a positive outlook on the AR technology and do not completely reject the use of it in education. This is despite the fact that the myth contained some elements of truth. Augmented Reality (AR) technology can become a useful educational tool with enormous potential and benefits, provided that appropriate guidelines and policies are followed in its incorporation into the teaching and learning environment. This would contribute to an overall improvement in the standard of education.

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Article Contribution to Related Field of Study

This study has the potential to act as a reference for the Ministry of Education as it works towards incorporating augmented reality technology into the educational system. In addition, this study can be used as an example of the current state of the art by other researchers interested in expanding their scope of inquiry beyond the same topic of study.

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