9

AUGMENTED REALITY (AR) EXPERIENCES: A TOOL TO ENHANCE CONCEPTUAL UNDERSTANDING FOR EDUCATION COUNSELLING STUDENTS

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Augmented Reality (AR) with HP Reveal
Augmented Reality (AR) is a rapidly emerging field that combines the real and virtual world that may appear in the form of 3 dimensional (3D) overlays whereby users could have interaction with these virtual objects using handheld devices such as tablets and smartphones. This human-machine interaction tools offer information in a form of audio, visual, video or any other channel that allow users to explore and experience the real world at the same time as the virtual imagery unlike the immersive virtual reality (VR). One of the common AR application software available is HP Reveal. The affordances of the AR application is that it is very convenient, portable and inexpensive to use as the users only need to have handheld devices such as tablets and smartphones to download the AR application. In addition, there are many educational based AR activities are readily available on AR platforms for instructors to use.

References and links to tutorials (YouTube etc) on use of tool should be included.
Make your Own Augmented Reality: https://www.youtube.com/watch?v=pEVKtPEcgQg&t=23s
How to use HP Reveal Studio - create an aura for beginners: https://www.youtube.com/watch?v=nZKQEAu7HZY

Instructional Strategies for using Augmented Reality (AR)

Instructors may use AR application to assist students in learning abstract concepts and difficult content through visual models which is hard to understand through books, visualization in the classroom, via computer devices and the human mind. When using AR application instructors can design learning task with digital content- Aura in a form of (animation, video, audio, images) that will be displayed on the screen when the camera is able to track the real object.

Another instructional strategy for using AR is for student-develop AR generated content that allow students to work collaboratively by creating new knowledge rather than learning become just transmission of knowledge

References and links to best practices on use of tool can be included.
AR with Dr Dorothy: https://www.youtube.com/watch?v=ZABzL4vbzac

Implementing Augmented Reality in the Classroom:
https://journals.uair.arizona.edu/index.php/itet/article/view/18601/18526

1. Introduction

It was noticed that first semester undergraduate students still struggling to understand facts, concepts on topic such as Cybercrime and to apply it to solve the real-world problem. Even though, there are empirical evidence that shows traditional teaching method via memorization and recitation techniques yield successful results for many centuries, students are still not acquiring knowledge and skills for in-depth

learning, problem solving and collaboration skills. Therefore, when the students face challenges in understanding the fact and concepts, it led to misconceptions about topic learned.

As understanding the basic facts and concepts seems to be an issue, one way to address this problem is for instructors to identify the appropriate pedagogy to help minimize students' misconceptions because learning factual knowledge and concepts referred to basic information that students must master pertaining to a subject which includes terminologies and definitions of a topic. Then, after mastering the basic concepts, students will be able to proceed to next stage of learning principles, rules, discrimination and problem solving (Endo, Yasuda, Mouri, Urata, & Tian, 2014; Yen, Tsai, & Wu, 2013). Hence, as a solution to this problem to learn factual knowledge and concepts is through visualization that allow the students to explore the images. Instructors can design a learning task incorporate technologies that support visualization such as augmented reality (AR). By learning with AR application, many students able to relate with the content taught in the class when the traditional learning task activities such as practice and drill seems to very boring and dull that leads to students having short attention span and lack of motivation towards learning.

What is Augmented Reality (AR) in Higher Education?

Teaching and learning in twenty-first century can be more successful with innovative pedagogy because teaching in higher education is more than just delivering knowledge as content and facts (Dewitt, Alias, & Siraj, 2015). Due to that, the focus on teaching and learning should be on acquiring skills for interacting, applying, evaluating and creating new knowledge as well as problem solving (Martin, 2006; Ronen & Pasher, 2011). In order to achieve that, higher education institutions are moving away from didactic and traditional pedagogies such as direct instruction (lecture) and focusing more on improving student's learning experience by developing their thinking skills through the use of emerging technology such as AR to meet the demands of learning among the new generation of students (Wang, Callaghan, Bernhardt, White, & Peña-Rios, 2018).

AR is a human-machine interaction tool that combines the real and virtual world that may appear in the form of 3 dimensional (3D) overlays. With AR users could have interaction with these virtual objects using handheld devices such as tablets and smartphones

(Elmy Mat-Jizat, Osman, Abidin, Yahaya, & Samsudin, 2016; Majid, Mohammed, & Sulaiman, 2015; Ng, Oon, Lee, & Teoh, 2016). This rapidly emerging field of AR allow instructors to design and develop educational content in a form of audio, visual, video or any other channel that allow users to explore and experience the real world at the same time as the virtual imagery unlike the immersive virtual reality (VR) (Manuri & Sanna, 2016; Martín-Gutiérrez, Fabiani, Benesova, Meneses, & Mora, 2015).

With content created with AR application, allows the students to move around the 3D virtual image like the real object form any point of view and the students also are able to integrate new knowledge learned from the virtual objects to perform the real-world tasks. This is because, learning abstract concepts and difficult content through visual models can be very difficult and frustrating to understand through books, visualization in the classroom, via computer devices and the human mind. Due to that AR offers a new educational approach in assisting students to learn difficult content in more interesting and effective way beyond static experiences (Kesim & Ozarslan, 2012; Sural, 2018; Yen et al., 2013).

In the end of the day, students are not only going to learn facts and concepts but using AR tool as also create opportunities for students to build content with what they studied or understood (Sural, 2018; Wang et.al, 2018). Studies shows that, students perceive listening to their lecturer talking continuously is very dull and fails to engage them but technology integration such as AR would help in-depth learning process which allow them to develop thinking skills and problem solving. AR also promote the culture of working collaboratively with peers to complete certain task either face-to-face or remotely through the merging of the virtual world and the real world (Kesim & Ozarslan, 2012; Wang et al., 2018).

There are many justifications for using AR technology in this study since AR can be considered as one of the educational technologies for future. First of all, AR application is a very simple and friendly tools that student can explore. Moreover, all the students in this study had not been exposed or used AR before for learning. Hence, students will be more interested and in high enthusiasm to learn via AR. The free software offered by HP Reveal allow the students to download and learn with AR anytime and anywhere also contribute to learning without boundaries among the students.

2. Purpose of the Study

Although there are many researchers worked on the mobile AR that focus on field of medicine, engineering, chemistry, mathematics, physics, biology, astronomy and history but there does not seem to be much research to investigate the learners' experiences using AR application as tool to enhance conceptual understanding in the area of educational counselling. In addition, this research is unique as there does not seem to be any studies incorporating AR among undergraduate counsellors. Hence, in this chapter, an AR application was developed to support undergraduate students in the Faculty of Education learning on an unexciting topic such cybercrimes. The aim of the research was to investigate the students' experiences and perceptions of the AR application integrated in teaching and learning. The following are the research questions:

1. What is the students' perception on the technical usability of the AR application developed for "Cybercrime" topic?
2. Is AR application effective in promoting learning "Cybercrime" topic?

3. Methodology

This is a design-based research in an undergraduate course from the Faculty of Education in a public university. The course participants were enrolled in a Bachelor of Counselling Programme Semester 1, Year 1. Thirty-five students were selected for the study based on voluntary participation who are willing to participate in the survey and interview sessions. The course was selected because the undergraduates are digital natives who are active users of technologies for socialization and entertainment but less using it for learning purposes. At the same time the course included theoretical knowledge that students need to master before moving on to the practical component.

In order to answer the first research question, a usability survey instrument was used for data collection which adapted from (Martín-gutiérrez, Contero, & Alcañiz, 2010). The instruments consist of twenty-three items with four main sections that focus on 1) students' demographic and background information; 2) students' perception on the effectiveness of AR application as a learning tool; 3) students'

perception on the efficiency of AR application as a learning tool and; 4) students' satisfaction using AR application as a learning tool. The instruments used a Likert Scale with five responses options, "Strong Agree, "Agree"," Neither Agree nor Disagree" "Disagree" and "Strongly Disagree and the responses were analysed using SPSS software version 23. Descriptive statistical analysis was carried out to explore students' perception on the technical usability of the AR application developed for "Cybercrime" topic and the findings were described by mean and percentages. For the second research questions, based on the survey feedback seven voluntary students take part in the semi structured interview share their experiences using AR application developed for "Cybercrime" topic.

Development of the AR application for "Cybercrime" Topic

The learning application was designed using the HP Reveal platform which is a free application available for iOS and Android devices allow users to create Aura (3D overlays) and also support multimedia elements such as video and images that will triggered based on an image. There are four main components involved when developing an AR application which are camera to capture the real object (target information), secondly is the real object which contain the target information, thirdly is a handheld device such as tablets and smartphones to store the real object and forth is the Aura or overlay the digital content (animation, video, audio, images) that will be displayed on the screen when the camera is able to track the real object.

First download the HP Reveal application and register for a free account (see Figure 9.1). Secondly, use a handheld device such as tablets and smartphones create the Aura. In this study, the Aura was developed based on the elements of self-recorded video on Cybercrime (see Figure 9.2). Third, after registering for an account, capture the real object. The real object used in this study are infographic posters based on cybercrime (see Figure 9.3). Next, choose the aura or the overlay from the device (tablets and smartphones) (see Figure 9.4). If using existing aura or the overlay from the HP Reveal, step 2 can be skipped. After that position your aura or the overlay accordingly and save the work to the "public channel" (see Figure 9.5). Finally, the aura is ready to be shared with the students to allow them to "follow" in order to access the AR created (see Figure 9.6). Figure 9.7 shows the summary of creating the AR application with HP reveal.

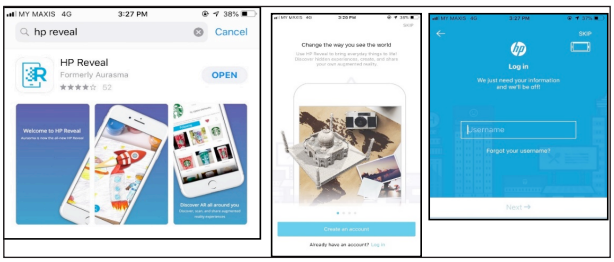

Figure 9.1. Download the HP Reveal Application and Register for a Free Account

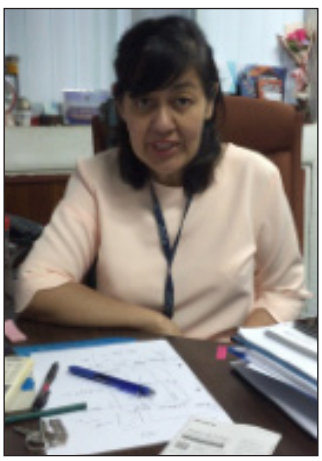

Figure 9.2. Aura was Developed based on the Elements of Self-recorded Video on Cybercrime

Figure 9.3. Capture the Real Object (Infographic Posters based on Cybercrime)

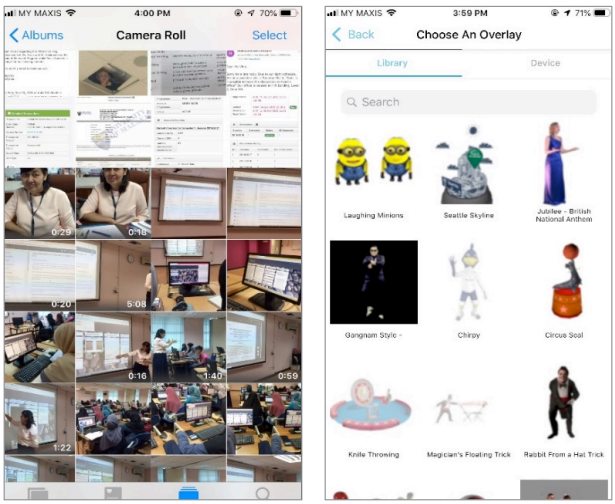

Figure 9.4. Select the Aura or the Overlay from the Device (Left) or Library (HP Reveal)

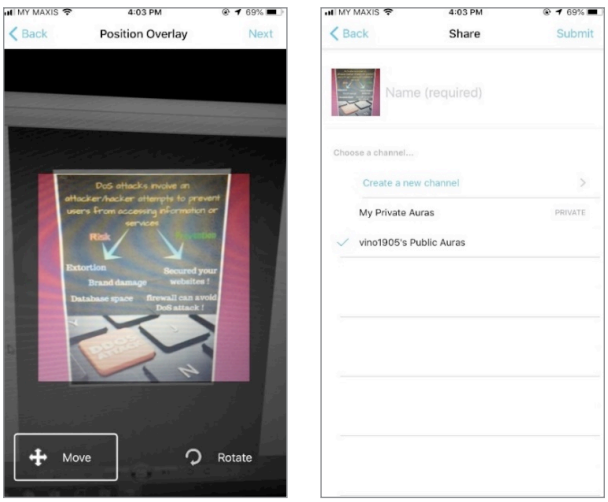

Figure 9.5. Position the Aura or the Overlay Accordingly and Save the Work to the "Public Channel"

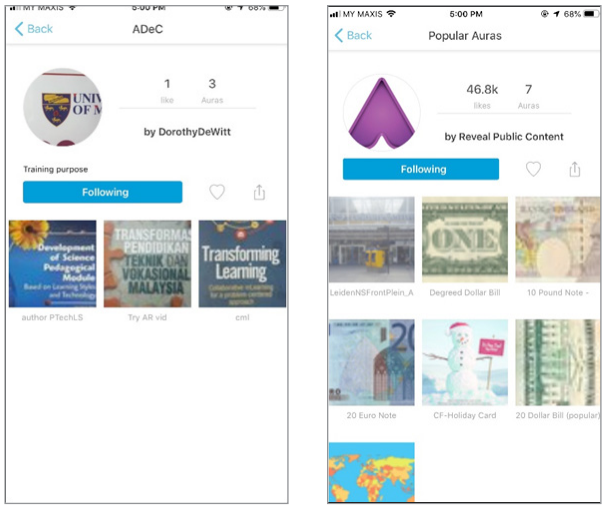

Figure 9.6. Students Must "Follow" The Instructor Account to Access the AR Created

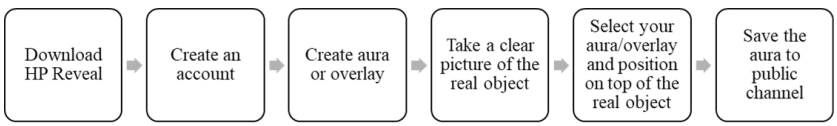

Figure 9.7. Summary of Procedure in Creating AR Application with HP Reveal

Procedure of the Activities

The study was conducted for two weeks in the beginning of the course where students were informed of the final project related to the course which had to be completed by Week 12 of the semester. Throughout the two weeks, the students were exposed to the theoretical component of the course content through different supporting collaborative learning tools such as QR Code, Padlet and Wikis besides AR as the major tool used for teaching and learning. In the learning activities, students were given three tasks to complete. Students completed Task 1 and 2 during the face to face session. However, task 3 was the progress work for final project that was submitted on Week 12.

Task 1:
Students were requested to download a QR code reader, then to scan the QR code posted at the classroom walls to access an interactive wall, Padlet. In order to recall student's prior knowledge and basic understanding on topic they about to explore, they participated in a discussion topic on 'advantages and disadvantages of ICT' by posting their opinion in the brainstorming wall, Padlet.

Task 2:
Students were asked to scan two posters with AR layered on them using HP Reveal application to explore related content. From the poster's students were exposed to basic conceptual related to Cybercrime such as definition, examples and practical application.

Task 3:
Students integrate new knowledge by creating their own Wikis to illustrate their learning by conducting mini research on Cybercrime.

At the end of the second week, the students were participated in the usability survey and selected students was interviewed to determine the impact of AR application on their learning. All the survey data was collected for descriptive analysis and focus group interviews was implemented and recorded for purpose of transcribing for analysis.

4. Findings and Discussion

The findings are reported according to the research questions based on the students' experiences and perceptions of the AR application integrated in teaching and learning.

Students' Perception on the Technical Usability of the AR Application Developed for "Cybercrime" Topic

Descriptive analysis was conducted to provide understanding on the students' perception on the technical usability of the AR application as

a learning tool developed for "Cybercrime" topic based on the mean value and standard deviation, as presented in Table 9.1

Table 9.1: Mean and Standard Deviation of the Sections of the Questionnaire

	Effectiveness of the AR application	**Efficiency the AR application**	**Satisfaction using the AR application**
Mean	4.32	4.64	4.32
Std. Deviation	.55	.59	.56

The usability of the AR application developed was focused by looking at to which extent do the user are able to work effectively, efficiently and with satisfaction using AR in learning. The usability was measured after use of the AR application in week 2.

According to (De Paiva Guimarães & Martins, 2014) the variable effectiveness measure how accurately and the learning goals can be achieved by integrating AR application in learning the topic. The efficiency variable is referred to the good use of time students invest in learning Cybercrime topic using the AR application. Finally, satisfaction measures the degree to which students find AR application meet their expectation and their attitude toward the use of the AR application for learning.

The findings indicate that students strongly agreed that AR application developed for "Cybercrime" topic are usable as a learning tool. The mean value of 4.32 (SD=.55) under the effectiveness show that the AR application is stable as the image and short video are clear with language and easy to understand as the measure of effectiveness has obtained a good result. For the efficiency section, the mean value of 4.64 (SD=.59) shows that the AR application is efficient for learning because they able to complete the subsequent learning task by creating a Wiki pages based on selected topic on Cybercrime after using AR application without difficulty. Under the satisfaction section, the mean of 4.32 (SD=.56) shows that students were satisfied with the use of the AR based application in learning about cybercrime. Overall, it can be concluded that students have high perception of the AR application on the technical usability of the AR application developed for "Cybercrime" topic as learning tool.

Effectiveness of AR Application in Promoting Learning "Cybercrime" Topic

The analysis of students' interview showed that there were several advantages in using AR application to learn "Cybercrime" topic. Students indicated that, AR application very effective in promoting their learning because AR engaged students in learning, increase learning motivation; promote peer collaboration; helps students learn to control their learning and AR leads to longer retention of information. Despite the advantages of using AR application in learning but students perceived some obstacles that become a barrier to the use of this technology due to technical obstacles related to the speed of the Internet and some students were facing technology anxiety while working with AR application.

AR Engaged Students in Learning

The first theme that emerged from the data was the AR application provides different educational experiences to students to learn mundane content as such "Cybercrime". All this while, learning happened via traditional way by instructor providing direct instructors by using a simple presentation slide. By integrating AR, students were given an opportunity to learn in a more interactive way rather than one-way lecture. Students discovered that AR application help them to engage in learning difficult content through visualization models to get better and deeper understanding about the lesson. This also evidenced in the survey responded by S1 and S2 that: AR technology engaging me to learn about lesson topic deeper. During the interview, S1 said, "I found that AR application is interesting because learning is more fun compared to lengthy and tiring lectures". P2 also expressed her happiness that "I didn't know about AR application before. However, after joining this course, I learn new way of learning. I wish more lecturers will use AR to teach us because it's totally fascinating". Students feedback evident that, teaching and learning processes become fun and beneficial to both parties (students and instructors) when instructors able to design learning activities appropriately using technology. Thus, this increased the engagement level among the students to learn.

Increased Learning Motivation

Second theme that emerged shows that students were highly enthusiastic when AR application was implemented in learning the topic. AR application seems motivating the students to continue to discover and learn more about "Cybercrime". In the survey S3 stated that: I believe AR technology has improved my learning motivation. The reason was made clear during the interview, "When I saw the video of my lecturer in the posters, I was amazed. I was thinking and want to discover more on how to use AR in my other subjects". Another participant S4, shared in the interview that, "I'm a visual learner due to that I find AR is very interesting compared to reading slides and textbook that have length information. So, through AR its quite interesting to learn about definition and concept of "Cybercrime" because it provides relevant information quickly". These comments indicated that, student want to re-experience AR application in other subjects and they very satisfied and keen to learn difficult content in a more fun way.

Promote Peer Collaboration

The next theme that emerged was the AR application develop collaborative skills among the students. The collaboration happened among students and peers, students and material as well as between students and the instructors. This was stated by S5 in the survey: AR technology allows me to work collaboratively with others. S5 also expressed in the interview that "AR application create opportunity for students to interact with the virtual objects in non-traditional environment through entertaining way". During the interview S1 shared that, "In a group of four, we already started to design our Wiki page. The AR application allow us to learn the basic before we proceed with the final project". Another participant S3 stated that, "During the AR session, we work individually by collecting as much information and after that we sat as a group to make sense the information we learned before the final project". In addition, S4 also indicated that the instructor was readily available to guide them when students need assistance during the AR activities. This indicated that, AR application allow students to perform task together as well as increase communication among the students and instructors throughout the session.

Helps Students Learn to Control their Learning

Next, from the AR application used in learning, students also found out that they able to take charge of their learning throughout the session. This also evidenced in the survey responded by S6 and S7 that: AR application allow me to take control of my own learning. During the interview, S6 said, "The AR application spurs my creativity and imagination to grasp the facts and concepts because I can start, repeat and stop the application at any point of time. This allow me to learn according to my level of understanding". S7 also shared that, "The session was very amazing because I was able to complete certain task by myself and I only ask clarification from my lecturer if am facing any difficulty. She already gave us some guidelines before the class". From students' feedback, it shows that the lecturer designed the AR learning task so that the students will take responsibility which allow them to make their own decisions and judgement in completing the project at the end of the day.

AR Leads to Longer Retention of Information

The last theme that emerged was AR promote long retention of information among students compared to the learning through traditional way of using slides presentation, books or articles. In the survey S1 stated that: AR allow me to remember information deeply. The reason was made clear during the interview, "I was having difficulty to understand the definition and concepts in "Cybercrime" but through AR, the posters gave me more visualization to remember for longer time so that I don't have to memorize!". These comments show that AR has the high impact on students learning since students able to understand and make sense of information gathered from AR deeply rooted in their memory rather than repetition and memorization.

Technical Issue: Internet Speed

Though AR provides many advantages in this study, one of the challenges imposed by AR technology is the technical problem related to poor internet connection. In the interview, S4 responded, "I was unable to view the aura since the Internet speed (WiFi) in the class very poor". Another participant, S7 shared that, "Since the WiFi is pretty slow, I decided to use my own mobile data so that I will be able

to download the HP Reveal". This shows that, AR application requires a stable internet connection because poor connectivity meant the instructor need to spend lot of time in providing assistance to fix the technical issue. Even though, AR application was an interesting tool for learning, but technical issues need to be taken into consideration before implementing it for teaching and learning.

Technical Issue: Technology Anxiety

Another drawback discovered from this study was, small number of students were battling with technical issues while using AR in the classroom. Even though they are familiar using smartphones, tablet, software for purpose of socialization, they tend to have anxiety incorporating technology for education purpose. Interview with S2 revealed that, "I'm totally unfamiliar with AR so I need more time to learn how to operate the software. But am glad my instructor and classmates are very helpful". Another response from S5 shows that "I got lost in between because I unable to see the Aura even though I scanned the posters many times. Am also having difficulty to follow the instruction because am scared I will do something wrong". This indicated some common sign of anxiety exhibited by the students while using AR application. Hence, working collaboratively with peers and instructors continues guidance will promote and increase confidence level to use new technology for learning, thus AR can be inclusive for all the students.

Figure 9.8. Composite of AR Activities in the Classroom

4. Implications and Conclusion

Based upon the outcomes of the current study indicating that AR application developed for "Cybercrime" topic contribute practical implication for the students as well as the instructors. From the instructor's point of view, this study promotes the culture of innovation pedagogy by designing learning task using emerging technology as such AR rather than the usual direct- instructors to teach facts and concepts to the students. Besides that, this study also provides best practices of integrating AR into content because to integrate AR effectively into instruction, the instructor needs to have a good understanding of how AR can be incorporated together with pedagogy and content. Teaching meaningfully with technology is beyond using a device. This is because appropriate use of technology requires strategic lesson planning to incorporating AR that will encourage students to learn factual knowledge and concepts in a fun was through visualization rather than memorizing and recitation techniques.

Students will benefit AR when instructors design the learning task that will require them to interact with each other, work in a team by applying, creating new knowledge and problem solving since students need to have collaborative skill before they step into working environment. The findings of the study also show that students were satisfied learning the topic since AR application developed is very effective and efficient in learning factual knowledge and concepts an interactive way. Using AR also stimulate students deep understanding through social interactions and cognitive process during learning with AR application. When instructors are moving away from didactic teaching approach towards technology enhanced learning, students will benefit by becoming learners who are responsible for their learning.

This study also has identified certain limitations which are; 1) time limitation, as the study was conducted only for two weeks and its suggested that longer duration can yield better results in measuring students learning outcome; 2) sample limitation, as the study only focuses on one undergraduate course offered in the Faculty of Education. Therefore, the finding of this study only can be generalized to this context and population of this study; 3) spatial limitation, as the study is confined one public higher education institution. However, the finding of this study maybe applicable and pertinent to instructors in higher education institution from various faculties.

Among the drawbacks discussed in this study, nonetheless the benefits outweighed the perceived drawbacks. The findings of this study provide remarkable impact to greater audiences because this AR is not limited to certain field of study and research has shown that the applications of AR have been used in many disciplines for education, such as in Engineering, medical, computer science as well as in social sciences from the aspect of training and teaching. If the instructors are having difficulty in developing AR application, there are many AR activities are readily available on AR platforms for instructors to use. Instructors can also work with the specialists and experts in the field of AR and educational technology to design learning activities for AR. This study will enable other instructors to develop and implement learning designs which can incorporate the use of AR for education.

In summary, AR technology has the potential to engage and motivate students to learning new knowledge and skills in an interactive way the brick-and-mortar classrooms. Information can now be layered on existing objects rather than just enabling students to listen to lectures. However, this is only possible when instructors are well equipped with skills and knowledge of using technology appropriately in providing best learning experience for students because there are possibilities that AR might not constitute an effective teaching and learning strategy for some students.

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