Usability And Acceptance Of Augmented Reality (AR) Applications For SKR 3302 Vehicle Air Conditioning System Maintenance Course At Pasir Salak Community College

Muhamad Asrul Affendi Mat Nor
Pasir Salak Community College, Perak
asrul@staf.kkpsa.edu.my

Farah Waheda Othman
Pasir Salak Community College, Perak
farah@staf.kkpsa.edu.my

Nurhan Ayub
Pasir Salak Community College, Perak
nurhan@staf.kkpsa.edu.my

Abstract

The Augmented Reality (AR) application is a learning application explicitly designed for Servis Kenderaan Ringan certificate students at Community College who take the SKR 3302 Vehicle Air Conditioning System Maintenance course. This learning application combines mobile application methods and Augmented Reality (AR) technology that can be accessed through a smartphone using the AR Edu: My AC Kit application and used with Augmented Reality BlippAR. Even when students are not in class, students can access and download notes anywhere. In addition, students can also access and download Summative and Formative Assessment documents such as Assignments, Practice Sheets and Quizzes through the provided application. The problem identified for students at Pasir Salak Community College is that conventional learning methods, such as printed notes or books as learning guides and references, are found to be less attractive to students studying this course. This study was carried out to evaluate the usability and student acceptance of the AR application for the SKR 3302 course. The objective of this application was built as a medium of reference and self-learning for students. Where four items can be achieved in this application, namely Notes, Videos, Evaluation Documents and games, to attract students to use this application. A total of 32 Semester 3 Light Vehicle Service Certificate Program students were involved in this study. The study uses this descriptive method to evaluate the developed application's usability and acceptance. This study uses a 5-choice Likert scale questionnaire. This study found that students are very satisfied with the developed application. Furthermore, the Min value from the aspect of this application improves user skills towards the Vehicle Air Conditioning System Maintenance course is very high. In conclusion, the construction of this mobile application was successfully developed and potentially implemented in teaching and learning for the Vehicle Air Conditioning System Maintenance Course throughout the Malaysian Community College. In conclusion, the learning concept used in this application aligns with the latest national agenda and technological developments in meeting the challenges of 21st Century Learning and the 4.0 industrial revolution.

Keywords: Application, Augmented Reality, Vehicle Air Conditioning System

1.0 Introduction

Augmented Reality (AR) is a technology that combines real-time computer-generated digital content with the real world. Augmented Reality technology in the learning process can provide a new learning experience and train skills and knowledge in the 21st century. According to Siti Hajar Johar & Nurhanim Saadah Abdullah (2019), education researchers increasingly recognise AR technology. Technology in education makes learning more interactive, interesting, and motivating for students. The availability of AR technology can help students who take the SKR 3302 Vehicle Air Conditioning System Maintenance course at Pasir Salak Community College to improve student's understanding and skills. This study focuses more on technology in education that uses AR technology to produce an AR Edu application: My AC Kit as a teaching aid for lecturers during the Teaching and Learning process in the era of industrial revolution 4.0. According to Nor Najwa Arifah Sapri & Fariza Khalid (2019), interesting and effective alternative learning through AR applications can provide new educational experiences. Therefore, the AR Edu: My AC Kit application is identified as providing benefits to the field of education to produce more meaningful learning for students.

1.1 Problem Statement

Conventional teaching and learning methods such as printed notes (hardcopy) or books as a guide and reference were found to attract less student interest in the SKR 3302 Vehicle Air Conditioning System Maintenance course. This is because there are students who do not master this course as a result of the Assessment of assignments, quizzes, and practical assessments given to students. As a result of the questionnaire before using the AR Edu: My AC Kit application, the student's understanding of the vehicle's air conditioning system is still minimal. According to Nor Najwa Arifah Sapri & Fariza Khalid (2019), traditional teaching methods are not enough to achieve teaching goals because they need to integrate teaching by using information technology as a teaching method to be more directed and achieve the expected goals. Course learning outcomes cannot be achieved 100% if traditional teaching methods require students to read written notes or books and explanations from lecturers. The results of Chen et al.'s study (2020) found that the motivation of students who use this method of approach is higher than students who undergo conventional learning methods. Sampaio and Almeida's study (2018) states that students are highly interested after interacting with AR application prototypes in the teaching and learning process for information technology courses. This application also contributes to a higher motivation increase for students to complete the assignments given by the lecturer. This will cause school or college students to be less motivated and interested in their studies. As a result, the course's learning outcomes and the program's learning outcomes will not be able to achieve the target.

As a result of the lecturer's observations throughout the lecture and practical Teaching and learning implementation process for the Vehicle Air Conditioning System Maintenance course, some problems arise, including

printed notes that do not have interactive features, teaching and learning notes that are often left behind, or lost, practical training sessions that need lecturers who need to make repeated explanations and demonstrations if students do not understand and grading sessions for formative tests using sheets of paper. This causes students' learning motivation to be seen as lacking interest in improving their understanding and skills in this course.

1.2 Objectives

The objective of this study is:

i. Determining the usability of the AR Edu: My AC Kit application for the SKR 3302 Vehicle Air Conditioning System Maintenance course.
ii. Determining the acceptability of the AR Edu: My AC Kit application for the SKR 3302 Vehicle Air Conditioning System Maintenance course.
iii. Identify the ability of the AR Edu: My AC Kit application to improve student knowledge in the SKR 3302 course.

2.0 Literature Review

Augmented Reality (AR) is now widely used in education. According to Roslinda Ramli, Fitri Nurul Ain Nordin & Nor Effendy Ahmad Sokri (2018), AR is a technique of combining virtual reality and reality and features an interesting display of 3D objects, animation, audio and video by scanning the smartphone camera towards a specific image that has been produced. Mobile devices, especially smartphones, have now become one of the methods of delivering education following current technology developments. Because this technique that combines the virtual world with reality using a smartphone will make the Teaching and Learning process more interesting and fun. Ivan Surtherland first developed AR technology in 1960. According to Azrie (2022), AR technology is believed to attract students' interest effectively. Therefore, it is appropriate to implement it in education. This AR technology can increase the interest and motivation of students in the Teaching and Learning session for the SKR 3302 course. Nowadays, mobile devices have become the choice of lecturers for delivery in education because they can attract interest and improve student understanding. The AR Edu: My AC Kit application can attract students to master the automotive field, especially for vehicle air conditioning systems. The usability potential and the impact of its use need to be studied to assess the effectiveness of use in the Teaching and learning process. The construction of mobile applications is developed with the potential to help the smoothness of the Teaching and learning process.

According to Siti Azrehan Aziz, Khodijah Abd Rahman & Haniza Othman (2020), To provide fun and interest students to spend more time reading, AR Technology is suitable to be used as an added value. This AR Edu: My AC Kit application will make the Teaching and learning process for the SKR 3302 course more enjoyable for students to improve their understanding and skills in the vehicle air conditioning system. It can also provide an experience for students to learn with a more interactive simulation method that uses the concept of games for learning. The AR Edu: My AC Kit

application also has a mobile feature where learning can take place regardless of time and place. The experience is different from the conventional methods used before. The Teaching and learning process is not concentrated in the lecture room only. The Teaching and learning process can be carried out anywhere using a smartphone.

3.0 Research Methodology

This study was conducted using a questionnaire instrument, and the study design is descriptive. The study respondents were 32 students from the 3rd semester of the Light Vehicle Service Certificate who took the SKR 3302 Vehicle Air Conditioning System Maintenance course at Pasir Salak Community College. The questionnaire is divided into three study aspects: user-friendliness, layout and design, and usability and suitability. This questionnaire was distributed after respondents used the AR Edu: My AC Kit application in teaching and learning sessions. The scale's reliability was measured using Cronbach's Alpha at a value of 0.81, where all items can be accepted in this study. The accepted value of Cronbach's alpha is 0.7 (Taber, 2018).

4.0 Analysis and Discussion

This set of questionnaires was analysed using the IBM Statistical Package for The Social Science (SPSS) version 26 software to evaluate the usability and acceptance of this application. The questionnaire was modified from the study of Muhammad Razuan Abd Razak et al. (2016). The questionnaire uses a five-point Likert scale which is 1 = Strongly Disagree, 2 = Disagree, 3 = Satisfactory, 4 = Agree, and 5 = Strongly Agree. Data were analysed through descriptive statistics using frequency, percentage, mean and standard deviation. Interpretation of the Mean Score based on (Pallant, 2007) is as in Table 1 below:

Table 1: Mean Score Interpretation Scale

Interpretation level	Min Score
Low	0.00 – 1.66
Simple	1.67 – 3.33
Height	3.34 – 5.00

4.1 Analysis of Study Findings

The Usability Study of the AR Edu: My AC Kit application was carried out on 32 Light Vehicle Service Certificate students who had used the AR Edu: My AC Kit application in the learning session. Respondents need to answer 10 question items. The question is divided into three parts. Three questions were given for the user-friendliness research aspect, three for the design and layout research aspect, and four for the usability and suitability research aspect.

4.1.1 Analysis of Aspects of User-Friendly Studies

Three question items related to the level of user-friendliness of the learning application that has been built. The results of the study are as in table 4.1.

Table 4.1: Mean Analysis for Aspects of User-Friendly Studies

	N	Minimum	Maximum	Mean	Std. Deviation
The application is user friendly	32	3	5	4.72	.523
This application can be used without the help of others	32	3	5	4.28	.634
This application via smartphone is easy to use	32	4	5	4.75	.440

Referring to Table 4.1, the study's findings show that the mean score for each item of questions 1, 2, and 3 is at a high level of 4.28, 4.72 and 4.75. The item for this smartphone application is easy to use, showing the highest mean score of 4.75. This shows that respondents agree that the features of this application are easy to understand and use. Mobile applications are user-friendly and engaging for students. Compared to a traditional lecture-based classroom, students find learning more enjoyable and are more eager to spend time and effort on activities that they find interesting. (Dias, 2022).

4.1.2 Analysis of Aspect Design / Layout Aspects

Three question items are contained in the design and layout aspects of the learning application that has been built. The results of the study are as in table 4.2.

Table 4.2: Mean Analysis for Design and Layout Study Aspects

	N	Minimum	Maximum	Mean	Std. Deviation
Information is presented in a simple and attractive style	32	4	5	4.63	.492
The elements and icons in this application are very interactive	32	3	5	4.41	.615
Access between pages works fine	32	4	5	4.56	.504

Based on Table 4.2, the findings are based on the respondent's evaluation of the design and layout of the application. The overall question for this aspect is high, with mean values of 4.63, 4.56, and 4.41. Items for the

information presented in a simple and attractive style show the highest mean value at 4.63. The multimedia elements used in this application can attract students' interest in using this application. While the element and icon items in this application are very interactive and have the lowest mean value. Icons for applications can be improved to make them more interactive and attractive Ahmad Fkrudin's research (2018) found that users will be satisfied and more motivated when they can use an attractive, simple and creative display.

4.1.3 Analysis of Aspects of Usability and Compatibility

Three test items dealt with factors of usability and compatibility for the created learning application. The results of the study are as in table 4.3.

Table 4.3: Mean Analysis for Usability and Compatibility

	N	Minimum	Maximum	Mean	Std. Deviation
This application is related to your course	32	4	5	4.78	.420
This application provides the necessary knowledge quickly	32	4	5	4.72	.457
This application is suitable for use as a learning material	32	4	5	4.72	.457
This application improves user skills in the Vehicle Air Conditioning System Maintenance course	32	4	5	4.88	.336

Table 4.3 above shows the mean score for aspects of usability and compatibility. Each question item obtained a high mean value. The item with the highest mean score is question item 4, which is at a value of 4.88. This means that respondents agree that this application can improve skills in the Vehicle Air Conditioning System Maintenance course. This shows that this application can improve the user's knowledge of the course. It can also improve user understanding. However, items with a low mean value of 4.72 can still be improved by allowing this application quick and fast access.

Analysis of the full item's data shows that it is at a high level. This shows that the AR Edu: My AC Kit application has achieved user satisfaction for almost all the features produced.

Table 4.4: Pearson correlation test between User Friendly, Design and Layout and Usability and Compatibility

		User Friendly	Design and Layout	Usability and Compatibility
User Friendly	Pearson Correlation	1	.507**	.566**
	Sig. (2-tailed)		.003	.001
	N	32	32	32
Design and Layout	Pearson Correlation	.507**	1	.544**
	Sig. (2-tailed)	.003		.001
	N	32	32	32
Usability and Compatibility	Pearson Correlation	.566**	.544**	1
	Sig. (2-tailed)	.001	.001	
	N	32	32	32

**. Correlation is significant at the 0.01 level (2-tailed).

The Pearson correlation analysis on the independent and dependent variables shows that the User-Friendly variable has a significant relationship with design, layout, usability, and compatibility. This can be seen in the results of the p-value for the element User Friendly (p=0.03), Design and Layout (p = 0.001), and Usability and Suitability (p=0.01), which proved that the p-value is smaller than 0.05. This is in line with Pallan (2016), who states that if the p-value is smaller than 0.05 (p < 0.05), there is a relationship between the two variables and vice versa.

Table 4.5: Rowntree Scale for the correlation coefficient

Value of correlation coefficient (r)	Strength of Relationship
0.9 to 1.0	Very high, very strong
0.7 to 0.89	High, strong
0.4 to 0.69	Medium
0.2 to 0.39	Weak, low
0.0 to 0.19	Very weak

Table 4.5 also shows the value of the analysis to determine the strength of the correlation (r) between User-Friendly, Design and Layout and Usability and Compatibility. The value of the correlation coefficient for the elements in the variable shows a positive value. Therefore, based on the Rowntree Scale (1981), the level of correlation strength for each element can be explained in Table 4.5.

The correlation coefficient value for User-Friendly with Usability and Compatibility is 0.566. This illustrates the moderate strength of the relationship. Meanwhile, the value of the correlation coefficient for Design and Layout with Usability and Compatibility shows a moderate relationship strength with a value of r=0.544. Likewise, the correlation is moderate for User-Friendly and Design and Layout, with a coefficient value of r=0.504. It

can be concluded that the strength of the three variables provides a moderately positive impact. Based on this correlation value, it can be reported that the variables User-Friendly with Usability and Compatibility have a higher correlation than Design and Layout in improving the usability of this AR Edu My AC Kit application. The combination of all three factors contributed to the adoption of the AR Edu My AC Kit application.

4.2 Discussion

The study found that the AR Edu: My AC Kit application positively impacts Pasir Salak Community College students. This application meets the requirements of the Teaching and learning process and is suitable for use in the Vehicle Air Conditioning System Maintenance Course. This AR Edu: My AC Kit application can provide an impact in line with the needs and latest technological developments. This shows that innovation and more interesting activities are needed so that teaching and learning sessions are more interactive. According to Hamida Ab. Rahman et al. (2019), in implementing more effective teaching and learning methods, mobile applications have become very important and appropriate in this era of Industrial Revolution 4.0.

Easy-to-use and user-friendly application features can provide satisfaction to users. Mobile learning applications show high acceptance among users. This is supported by a study from Pebriantika (2021); with mobile learning, lecturers can use multimedia materials like videos and slideshow presentations for students to access anytime and from any location. In addition, Ahmad Fkrudin (2019) also stated that attractive design would increase user motivation.

The findings of this study also show that users are more interested when the display is interesting and interactive in the application used because it can provide satisfaction and motivation to users. The AR Edu: My AC Kit application has a simple, attractive, interactive design and layout. This shows that users will feel satisfied, and the satisfaction obtained by users depends on the content that is easily accessible in the developed application.

In addition, the findings of the study also show that the content of the AR Edu: My AC Kit Application complies with the curriculum contained in the syllabus of the Vehicle Air Conditioning System Maintenance Course. This is because the application development needs to comply with the content of the subject syllabus and the learning outcomes set. Mohamad (2021) states that the curriculum requirements, syllabus, and learning outcomes must be considered when developing the application. This is also supported by Yusoff (2017) to produce a focused and structured teaching and learning process.

5.0 Summary and Suggestions

AR Edu: My AC Kit is an application produced to give exposure to educational technology in teaching and learning sessions. The results of the study show that the potential of the AR Edu: My AC Kit application that supports the use of educational technology can be well received by users. With these findings, it is hoped that AR applications like this can be further expanded in the field of education in applying 21st-century learning. With

that, innovation and strategy become a catalyst for educators to develop educational technology in line with the policy of the Malaysian Education Development Plan 2015-2025 (Higher Education). Therefore, this AR Edu: My AC Kit learning application has the potential to be implemented to support educational learning in learning Vehicle Air Conditioning System Maintenance Courses at Community Colleges and any educational institution. A larger sample size from Community Colleges that provide light vehicle service certificate programmes will be used in future studies.

Reference

Azrie, A. F. H., Rosdi, A. N. H., Hafit, M. I., & Ibrahim, Z. (2022). Aplikasi Realiti Pergerakan (AR) Untuk Standard Subjek Sains Tahun 5 Sekolah Rendah,(AR Jirim). Multidisciplinary Applied Research and Innovation, 3(2), 129-137.

Chen, C. H. (2020). Impacts of augmented reality and a digital game on students' science learning with reflection prompts in multimedia learning. Educational Technology Research and Development, 68(6), 3057-3076.

Dias, L., & Victor, A. (2022). Teaching and learning with mobile devices in the 21st century digital world: Benefits and challenges. European Journal of Multidisciplinary Studies, 7(1), 26-34.

Hamidah Ab. Rahman, F. J. (2019). Kajian Potensi Penggunaan Aplikasi Mudah Alih Classification Of Accounts App Dalam Pendidikan Perakaunan. Journal on Technical and Vocational Education (JTVE), Vol 4 No 3:Special Edition NASCO, 162-169.

Johar, S. H., & Abdullah, N. S. (2019). Pembangunan e-Modul Augmented Reality bagi Subjek Semiconductor Devices untuk Guru TVET. *Online Journal for TVET Practitioners*, *4*(2), 99–104. Retrieved from https://publisher.uthm.edu.my/ojs/index.php/oj-tp/article/view/5098

J.Pallant. (2007). SPSS Survival Manual, 3rd Edition. Crows West, New South Wales.

Khalid, F., Daud, M. Y., & Nasir, M. K. M. (2016, October). Perbandingan penggunaan telefon pintar untuk tujuan umum dan pembelajaran dalam kalangan pelajar universiti. In International Conference on Education and Regional Development (Vol. 31).

Mohamad, A., & Nor, M. (2021). Pembangunan Aplikasi Penilaian Projek Akhir Menggunakan 'Google Sheet'Dan 'Glide Apps'. International Journal of Modern Education.[Online], 3(8).

Muhammad Razuan A.R, Ahmad Zamzuri M.A. (2016). Ujian Kebolehgunaan Serta Kepuasan Pengguna Video Screencast.

Nor Najwa Arifah Sapri & Fariza Khalid (2019). Keberkesanan Teknik Augmented Reality (AR) Dalam MeningkatkanKefahaman Konsep Asas Matematik.Persidangan Kebangsaan Amalan Terbaik Pembelajaran & Pemudahcara (PdC) Dan Inovasi 2019, IPG Kampus,Kota Baharu 14-15 April 2019.eISBN:978-967-10760-9-5.

Pebriantika, L., Wibawa, B., & Paristiowati, M. (2021). Adoption of Mobile Learning: The Influence And Opportunities For Learning During The Covid-19 Pandemic. Int. J. Interact. Mob. Technol., 15(5), 222-230.

Roslinda Ramli, Fitri Nurul'Ain Nordin, Nor Effendy Ahmad Sokri(2018). Teknologi Realiti Luasan: Satu Kajian Lepas.e-Journal Penyelidikan dan Inovasi.Vol.5 No.1(April 2018). Kolej Universiti Islam Antarabangsa Selangor.17-27.

Sampaio, D. & Almeida, P. (2018). Students' Motivation, Concentration and Learning Skills Using Augmented Reality. Proceeding of 4th International Conference on Higher Education Advances (HEAd'18), 1559–66.

Siti Azrehan Aziz, Khodijah Abd Rahman & Haniza Othman (2020). Analisis Rekabentuk Aplikasi "Augmented Reality" bagi pembelajaran Komponen Sistem Unit Komputer. Proceeding of ICITS 2020), 6th International Conference on Information Technology & Society.e-ISSN 2716-6732.Selangor

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. Research in Science Education, 48(6), 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Yusoff, A. F. M. (2017). Pembangunan Perisian Pengajaran dan Pembelajaran Multimedia Interaktif Pengurusan Jenazah Politeknik Malaysia. O-JIE: Online Journal of Islamic Education, 2(2).

Yusoff, A. F. M., Hamat, W. N. W., & Basir, N. K. (2019). Penggunaan aplikasi web 2.0 dalam proses pengajaran dan pembelajaran kursus mata pelajaran umum (MPU) di politeknik. e-BANGI, 16(5), 1-13.

Yusoff, A. F. M., & Romli, A. B. (2018). Kebolehgunaan Aplikasi Mudah Alih (Mobile Apps) Bagi Kursus Sains, Teknologi Dan Kejuruteraan Dalam Islam (M-Istech) Di Politeknik Malaysia. Malaysian Online Journal of Education, 2(1), 18-28.