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A CASE STUDY OF LOCAL UNIVERSITY IN MALAYSIA FOCUSING ON TECHNICAL AND VOCATIONAL STUDENTS' KNOWLEDGE OF AUGMENTED REALITY TECHNOLOGY IN EDUCATION

Nur Haslinda Salikin[1], Awangku Zaini Awang Zainal[1], Azizul Qayyum Basri[1*], Siti Faizzatul Aqmal Mohamad Mohsin [1], Abdul Muqsith bin Ahmad[1], Muhammad Azri Bin Othman [2], Azuan Failani Bin Ariffin[3]

[1]Department of Engineering Technology, Technical and Vocational Faculty, Sultan Idris University of Education, 35900 Tanjong Malim, Perak Darul Ridzuan, Malaysia
[2]Department of Mechanical Engineering, Centre for Diploma Studies, Universiti Tun Hussein Onn Malaysia, Pagoh Education Hub, 84600 Pagoh, Johor, Malaysia
[3]Pusat Latihan Teknologi Tinggi (ADTEC) Jerantut, Km 9, Jalan Jerantut-Temerloh, 27000, Jerantut, Pahang, Malaysia
(Corresponding author: qayyumb@ftv.upsi.edu.my)

Abstract

Augmented reality (AR) technology is increasingly improving education across various disciplines and educational levels. This technology has favorably impacted users in terms of knowledge, experience, and its diverse applications. Therefore, this study focuses on measuring the extent of knowledge among students from Universiti Pendidikan Sultan Idris (UPSI) regarding the use of AR technology. Indirectly, it is connected to the role of UPSI students as future teachers in introducing this technology in schools. The research employs a quantitative methodology, involving 181 students enrolled in the Design and Technology (RBT) course at the Faculty of Technical and Vocational Education (FTV) at UPSI. The researcher utilized an online questionnaire via Google Forms and established that students exhibit a substantial understanding of AR technology, especially concerning information dissemination and communication development through technological application. In general, the importance of this study is to examine the extent of UPSI students' knowledge of AR technology and how it can impact future education particularly in the application of "game-based learning" activities in the classroom. This simultaneously indicates that UPSI students, as future teachers in schools, are prepared to integrate AR technology into teaching and learning. In conclusion, the use of AR technology can be explored more extensively by examining the data obtained from respondents, where the university should take the right

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approach in encouraging research focused on AR technology in the field of education.

Keywords: Augmented reality; Design and technology course; Education; Quantitative method

Abstrak

Teknologi realiti terimbuh (AR) di dalam bidang pendidikan semakin diperkasakan dalam pelbagai bidang disiplin ilmu di pelbagai tahap pendidikan. Teknologi ini banyak memberi kesan positif keatas pengguna baik dari segi pengetahuan, pengalaman mahupun penggunaannya yang bervariasi. Oleh itu, kajian ini berfokus untuk mengukur sejauh mana pengetahuan pelajar daripada Universiti Pendidikan Sultan Idris (UPSI) terhadap penggunaan teknologi AR. Ia secara tidak langsung mempunyai kesinambungan dengan peranan pelajar UPSI sebagai pendidik di masa akan datang untuk mengetengahkan teknologi ini di sekolah. Pendekatan yang digunakan adalah kaedah kuantitaitf yang melibatkan 181 orang mahasiswa yang mengambil kursus Reka Bentuk dan Teknologi (RBT), Fakulti Teknikal dan Vokasional (FTV) di UPSI. Pengkaji menggunakan borang soal selidik melalui google form secara atas talian dan mendapati bahawa tahap pengetahuan mahasiswa terhadap teknologi realiti terimbuh (AR) adalah tinggi dari perspektif penyebaran maklumat dan pembentukan komunikasi melalui penggunaan teknologi. Perkara ini sekaligus menunjukkan bahawa, pelajar UPSI sebagai individu yang akan menjadi guru di sekolah mempunyai persediaan dalam mengintegrasikan teknologi AR dalam pembelajaran. Intihannya, penggunaan teknologi AR ini dapat diteroka dengan lebih meluas lagi dengan melihat kepada data responden yang diperoleh, yang mana pihak universiti perlu mengambil pendekatan yang betul dalam mempelawa penghasilan kajian yang berfokus kepada teknologi AR dalam bidang pendidikan.

Kata kunci: Kaedah kuantitatif; Pendidikan; Realiti terimbuh (AR); Reka bentuk dan teknologi

1.0 INTRODUCTION

The development of augmented reality (AR) technology over the past 25 years has progressed rapidly. Studies by Garzón (2021) and Roopa, Prabha and Senthil (2020) show that this technology has been widely implemented across various sectors such as industry, entertainment, medicine, tourism, education, the military, flight training, and more. In addition, according to statistical data compiled by Garzón (2021), the surge in AR technology usage began around 2014 and continues to the present day. This is driven by several factors, including easy access through smartphones, affordable costs, and the suitability of AR as a

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mini project in educational institutions (Qiao et al., 2019; Roopa, Prabha & Senthil, 2020). The Business Research Company (2025) projects that by the year 2025, the AR technology usage growth rate will reach $51.34 billion, and it is expected to rise by 48.5% by 2029, reaching $249.42 billion. As a result, the need to know, understand, use, and implement AR technology in institutions must be given due emphasis.

In Malaysia, the implementation of this technology corresponds with the Ministry of Higher Education's objective to advance lifelong learning initiatives via digital platforms and Industry Revolution 4.0 (IR4.0) technologies, alongside contemporary pedagogical methods, thereby enhancing educational significance and fostering student achievement through technological integration (Abdul Rahman, Abdul Hameed & Hassan, 2023; Mustapha, 2024; Taib, Ismail & Abdin Lubis, 2019). The integration of digital technology in education ensures a nation's capacity to cultivate a competitive society characterized by creativity, innovation, and critical thinking skills for the future. This initiative represents a strategic approach to ensuring that Malaysian society, particularly the younger generation, remains relevant and capable of competing effectively across diverse sectors at the global level.

Essentially, AR technology combines the virtual and real worlds of users to create media forms (3D models) viewable on a smartphone (Mohammadhossein, Richter & Richter, 2024; Nordin et al., 2022). This technology incorporates audio, video, or other sensory data to augment the user experience while navigating the environment surrounding the programmed 3D mode (Bakim & Abdul Hanid, 2024; Faizzuddin, Aman & Zulkifli, 2024; Nordin et al., 2022; Qiao et al., 2019). Consequently, students possess the autonomy to utilize AR applications at any time and location due to the adaptability of this technology. Anggarwal et al. (2024) and Li & Liu (2023) concur that the advancement of this technology allows designers to develop multifunctional applications pertinent to their field of study, characterized by low ownership costs and enhanced accessibility. Given the extensive and pragmatic examination of AR technology globally (Majid, Mohammed & Sulaiman, 2015), it is imperative that Malaysian students integrate their understanding of this technology with its application in everyday life.

The implementation of AR technology in education is undoubtedly a positive step for those who utilize it. While AR technology is being integrated across various subjects, there is a need for a specific subject that provides in-depth knowledge about how this technology is developed and operates, namely, the Design and Technology or in Malay known as *Reka*

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Bentuk dan Teknologi (RBT). The RBT subject emphasizes the use of technology in the construction and production of products for students from Form 1 to Form 3 (Kementerian Pendidikan Malaysia, 2016). This aligns with the concept of 21st-century learning, which focuses on creative, critical, and innovative thinking, as well as the use of technology in education in line with current modernization trends. Hussain et al. (2023) also state that this subject not only equips students with knowledge on the use of technology but also nurtures individuals capable of repairing, improving quality, and creating new technologies. Therefore, AR technology can be integrated into the learning of the RBT subject. In line with this, UPSI students (future teachers) must possess knowledge that aligns with the Ministry of Education's goals so that this technology can be formally introduced in schools in the future.

In contrast, the use of AR technology in Malaysian schools is still rarely practiced and has only been introduced informally (Yusoff @ Che Man, Ghazali & Sulaiman, 2022). However, considering the potential of AR technology in the advancement of current education, the need to introduce AR technology to students is highly encouraged. This is because AR technology can be categorized as game-based learning, which enhances students' experience and engagement in the classroom (Yusri, Zainal & Ismail, 2023). Moreover, the benefits of AR technology contribute to the effectiveness of modern technologies and assist in designing a more intuitive and informative learning curriculum. The study by Yusoff @ Che Man, Ghazali and Sulaiman (2022) also highlights the positive perceptions of teachers towards AR technology, as it helps students better understand abstract and visual-based subjects. Therefore, it is essential to conduct studies that fundamentally examine students' knowledge in institutions before they embark on the teaching profession.

This study aims to assess the level of knowledge among students, specifically those in the RBT course at the Faculty of Technical and Vocational Education, regarding their understanding and readiness to use AR technology in education. This is consistent with the assertion made by Deputy Minister of Higher Education Datuk Ts. Mustapha Sakmud that the country's future should be shaped by initiating the integration of technology into everyday life in higher education institutions (Mustapha, 2024). Therefore, in achieving the objectives, the researcher has set several research objectives to assess students' perceptions and knowledge of AR technology. The objectives of this study are:

- To assess the knowledge and effectiveness of AR technology among students of the RBT course.

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- To evaluate the formation of communication and an effective environment in the learning process focused on RBT course students.
- To assess the reliability of information and the level of dependency of RBT course students on AR technology in learning.

2.0 LITERATURE REVIEW

The foundation of AR technology was not created just for education; rather, it is utilized in a variety of domains, including robotics, engineering design, medical procedures, military operations, psychological treatments, and more, offering users guidance on tasks that range from simple to intricate (Mohammadhossein, Richter & Richter, 2024). Due to its direct interpretation of 3D objects, this study will concentrate more on educational knowledge, especially in subjects with a visual and environmental concept.

Abdul Rahman, Abdul Hameed and Hassan (2023) assert that AR technology can augment student motivation and confidence, as well as its contemporary relevance in contrast to traditional learning methods. This results from the operation of AR technology, which integrates virtual 3D objects with real-world 3D environments, thereby offering enhanced information and comprehensive understanding in a specific field of study (Basri Nadzeri et al., 2022). This aspect compels researchers to investigate students' perceptions and understanding of the functionality of AR technology in everyday life, with the objective of establishing a preliminary definition of students' perspectives on this technology.

A study by Abdul Rahman, Abdul Hameed and Hassan (2023) indicates that students have a high perception of AR technology, addressing its acceptance in educational contexts. Majid, Mohammed and Sulaiman (2015) conducted research indicating a favourable perception among students regarding the utilization of AR technology. The findings indicate that students exhibited interest, enjoyment, and active engagement in discussions to accomplish tasks utilizing AR technology.

3.0 METHODOLOGY

This study uses a quantitative methodology based on a purposive sample with a specific and targeted population (Fauzi, Jamal & Mohd Saifoul, 2014). The selected sample must meet specific criteria and demonstrate expertise and experience in the domain. The required criteria include: (i) being a university student; (ii) enrolled in a TVET education course; (iii) having

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experience in using AR technology; and (iv) possessing knowledge of AR technology. The researcher took an approach by focusing solely on students enrolled in the RBT course, who were then provided with an explanation about the study through a briefing in the Google Form. As a result, a total of 181 students RBT course were chosen as the study sample.

In general, no specific AR application was provided to the respondents. The data collected was based on the respondents' knowledge and experience in exploring AR technology within their educational institution. This indicates that there will be varying levels of knowledge and experience among each student regarding AR technology, making this study broader in scope and not biased.

The research process was conducted entirely online from the beginning until the end of the study. Firstly, the researcher focused on the study sample, which consisted of students enrolled in the Design and Technology (RBT) course at UPSI. The sample size was determined using the table developed by Krejcie and Morgan (1970). With an estimated population of 360 students from the Faculty of Technical and Vocational Education (FTV), the table indicated that a total of 181 students should be selected as the study sample. Using Google Forms, the researcher collected responses from students by distributing the link through the faculty's official WhatsApp group. Once the required number of respondents was achieved, the researcher proceeded with conducting descriptive analysis (refer to Table 3). The results of this analysis were obtained in terms of frequency (*N*), percentage (*%*), mean (*M*), and standard deviation (*s.d*).

The tool employed for data collection was a questionnaire. Before the questionnaire was distributed to the respondents, the researcher took the approach of validating the questionnaire by referring it to three expert lecturers. The experts reviewed and provided comments on each question in the questionnaire. The researcher made corrections and then obtained re-approval until agreement was reached from all three experts. As a result, the disseminated questionnaire comprised seven principal sections: respondent demographics (Section A) and inquiries pertaining to the study objectives (Sections B~F) (see Table 1).

The questions were created using Google Forms and subsequently disseminated to the study sample online. Table 2 shows the questions used to evaluate students' knowledge and perceptions of AR technology.

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Table 1: *Questionnaire Information*

Section	Section Details	Numbers of items	Type of questions
A	Respondent demographics	3	Nominal
B	Information dissemination	5	5-point Likert scale
C	Skills and effectiveness of technology	5	5-point Likert scale
D	Formation of communication through technology use	8	5-point Likert scale
E	Communication environment in technology use	3	5-point Likert scale
F	Reliability of information and dependency on teaching through technology	4	5-point Likert scale
	Total Items	28	

Table 2: *List of Questions Based on the Study's Sub-Objectives*

Objective	Sub-objectives	Questions
Objective 1	Information dissemination	1. I receive information about AR technology from internet sources. 2. The information display in AR technology adds value to the field of study. 3. AR technology is a shortcut for me to convey information related to the knowledge I am studying. 4. The concept of AR technology in education aligns with students' needs. 5. I am satisfied with the concept of AR technology in disseminating information to students.
	Skills and effectiveness of technology	1. I can generate new ideas based on the stimuli provided in AR technology. 2. AR technology is suitable for use in learning. 3. The use of AR technology is very easy. 4. AR technology can enhance skills in visualizing the related field of study.

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		5. The effectiveness of AR technology can be felt during its direct usage.
Objective 2	Formation of communication through technology use	1. The use of media technology with attractive displays can facilitate the delivery of information. 2. The use of AR technology helps in understanding the concepts of technological design. 3. The use of AR technology in teaching sparks interest in learning design and technology. 4. Information obtained through AR technology allows me to provide insights into design knowledge. 5. Learning with AR technology enhances my thinking ability in design knowledge. 6. Learning with AR technology enhances my skills in design knowledge. 7. Learning with AR technology stimulates my interest in thinking. 8. Learning with AR technology is suitable for application in design and technology teaching and learning.
	Communication environment in technology use	1. The use of AR technology gives me space to communicate comfortably. 2. The use of AR technology provides a conducive environment when used. 3. The use of AR technology gives me the opportunity to become more skilled in using technology.
Objective 3	Reliability of information and dependency on teaching through technology	1. Learning using AR technology is reliable. 2. Learning using AR technology can have a positive impact on users. 3. Learning using AR technology can obtain information. 4. Learning using AR technology can facilitate the learning process.

To ascertain the extent of knowledge regarding each item's contents, respondents are required to respond to all inquiries posed in the study. Table 3 details the researcher's methodology. Table 4 states that the researcher will interpret the mean scores based on the

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level of knowledge and perception of the item contents, measured using a 5-point Likert scale.

Table 3: *Data Analysis Method*

Study Sub-Objectives	Data Analysis
Respondent demographics Information dissemination Skills and effectiveness of technology Formation of communication through technology use Communication environment in technology use Reliability of information and dependency on teaching through technology	Frequency *(N),* percentage *(%)* Mean (*M),* and standard deviation *(s.d.)*

Table 4: *Range of Interpretation for the 5-Point Likert Scale*

Likert scale	Likert scale description	Likert scale interval
1	Strongly disagree	1.00-1.80
2	Disagree	1.81-2.60
3	Neutral/Uncertain	2.61-3.40
4	Agree	3.41-4.20
5	Strongly agree	4.21-5.00

Source: Nyutu et al. (2021)

4.0 FINDINGS AND DISCUSSION

This section will discuss the findings obtained through data analysis such as frequency *(N),* percentage *(%),* mean *(M),* and standard deviation *(s.d.),* all presented in table form. The researcher can evaluate students' knowledge of AR technology in education based on the collected data, offering insight into their preparedness to utilize this technology. We categorize the study results into two primary sections: respondent demographics and students' knowledge level concerning AR technology in education.

4.1 Section A: Respondent Demographics

Based on the data in Table 5, female students are more engaged (*N* = 109, 59.6%) than male students (*N* = 72, 40.6%). The data distribution across semesters exhibits varying percentages; however, the differences are not substantial when examining semesters 2 through 8. It can be established, based on this range of semesters, that the representatives

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from each semester are balanced, which leads to response patterns that are more comprehensive and varied.

Based on the educational level, the majority of students are enrolled in vocational colleges (*N* = 63, 50.8%), diplomas (*N* = 43, 19.2%), polytechnic diplomas (*N* = 34, 13.9%), etc. This suggests that students have previously been exposed to the use and implementation of technology in accordance with the objectives of their respective institutions. Consequently, the researcher can ascertain that the respondents possess a robust understanding and perception of AR technology's application in education.

Table 5: *Demographics respondents*

Gender	Number of respondents *(N)*	Percentage (%)
Male	72	40.6
Female	109	59.4
Total	**181**	**100.0**
Semester		
1	0	-
2	29	18.7
3	27	15.5
4	26	13.9
5	24	13.4
6	24	12.3
7	19	10.7
8	25	12.3
9	5	2.2
10	1	0.5
11	1	0.5
Total	**181**	**100.0**
Level of Education (Before Degree)		
Vocational College Graduates	63	50.8
Matriculation Graduates	15	7.5
STPM/STAM Graduates	26	8.6
Diploma	43	19.2
Polytechnic Graduates	34	13.9
Total	**181**	**100.0**

4.2 Section B: Students' Knowledge Level Regarding AR Technology in Education

The researcher determined that students' perceptions of AR technology were significantly positive in relation to each of the study's objectives, Table 6 – 8. Compared to the other sub-

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objectives, the first objective, information dissemination *"to assess the knowledge and effectiveness of AR technology among students of the RBT course"* scored the highest (*M* = 4.81, *s.d.* = 0.892), followed by skills and effectiveness of technology (*M* = 4.55, s.d = 0.738). The respondents' responses to the questions posed indicated that AR technology has the potential to be a highly practical communication tool for sharing information. Li and Liu (2023) share a similar viewpoint, asserting that the environment strongly influences the application of AR technology, making it adaptable to various situations and locations for information retrieval.

For the second objective, *"to evaluate the formation of communication and an effective environment in the learning process focused on RBT course students"* the interpretation was "strongly agree," with a mean score of *M* = 4.78 (*s.d.* = 0.883) regarding the establishment of communication through technology utilization. Participants viewed the application of AR technology as a way to engage with technological advancements and enhance creative knowledge, particularly in the creation of tools and instructional aids for primary and secondary school students through AR integration. The prevalence of AR technology development has notably increased, as evidenced by the final-year students' presentation colloquium.

Lastly, for the third objective, *"to assess the reliability of information and the level of dependency of RBT course students on AR technology in learning"* the score was *M* = 4.61 (*s.d.* = 0.775) concerning the dependability of infor*m*ation and reliance on technology for instruction. From the students' perspective, the level of trust in AR technology is very positive. This confirms that the use of AR technology strongly supports the field of education, similar to the findings in the study conducted by Yusoff @ Che Man, Ghazali and Sulaiman (2022) regarding teachers' perspectives on AR technology.

Overall, this study shows an excellent level of knowledge about each of the sub-objectives that were developed. According to the researcher's findings, students view AR technology as a useful and interactive way to communicate and share information, which can excite and motivate them to use it. This aligns with the results of research conducted by Abdul Rahman, Abdul Hameed and Hassan (2023), Majid, Mohammed and Sulaiman (2015) and Sofianidis (2022). Furthermore, a *'strongly agree'* level is indicated by the interpretation of all sub-objectives, indicating that the readiness and acceptance of AR technology in higher education is highly anticipated. This indicates that UPSI students (future teachers) have great potential to introduce, use, and integrate AR technology in future learning due to early

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exposure and the benefits gained from the technology.

Table 6. *Score Value for Objective 1*

Sub-Objectives	Mean *(M)*	Standard deviation (*s.d.)*	Interpretation
Information dissemination	4.81	.892	Strongly agree
Skills and effectiveness of technology	4.55	.738	Strongly agree

Table 7. *Score Value for Objective 2*

Sub-Objectives	Mean *(M)*	Standard deviation (*s.d.)*	Interpretation
Formation of communication through technology use	4.78	.883	Strongly agree
Communication environment in technology use	4.51	.724	Strongly agree

Table 8. *Score Value for Objective 3*

Sub-Objectives	Mean *(M)*	Standard deviation (*s.d.)*	Interpretation
Reliability of information and dependency on teaching through technology	4.61	.775	Strongly agree

5.0 CONCLUSION

In general, the study's findings suggest that the students' level of knowledge exhibits a highly accurate interpretation. This is linked to the introduction of technology to students before their university enrollment. Consequently, the researcher acknowledges the need to prioritize the integration of AR technology in the early stages of education to improve educational quality and develop students capable of competing in the global economy. As a recommendation, the researcher suggests that studies be conducted at the school level to evaluate the knowledge of students and the implementation of augmented reality technology across a variety of subjects.

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