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Knowledge and Attitude of Nursing and Medical Students Towards Augmented Reality/Virtual Reality as an Approach to Tabletop Exercise

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ABSTRACT

Background: Augmented reality/virtual reality (AR/VR) has been recognised as an excellent technology for many fields, especially emergency and disaster management. This technology can also be applied to one of the disaster exercises, a tabletop exercise (TTX). In TTX, a group discusses a simulation of an emergency led by a facilitator. This study aimed to determine the knowledge and attitude of nursing and medical students towards using AR/VR as an approach to TTX in emergency and disaster preparedness and its association with sociodemographic data.
Methods: A quantitative cross-sectional study with convenience sampling was conducted among 211 International Islamic University Malaysia (IIUM) Kuantan Campus nursing and medical students from April to June 2022. Data were collected using questionnaires through Google Forms, available in English. The questionnaire for students' knowledge and attitude on AR/VR was self-developed, and a reliability test was conducted with reliability of 0.720 and 0.865 for knowledge and attitude, respectively.
Results: Most respondents have high knowledge and positive attitudes towards using AR/VR to approach TTX in emergency and disaster preparedness. It was found that the frequency of playing on a computer or mobile games is statistically significant regarding attitudes toward AR/VR. In comparison, no significant difference was identified between gender, ownership of computer/mobile devices, and period of daily internet use regarding attitudes towards AR/VR.
Conclusion: AR/VR can be beneficial in emergencies and disasters. The relevant authorities, predominantly in healthcare education institutions, can implement this advanced technology to prepare students for the future.

Keywords: Augmented reality; Virtual reality; Tabletop exercise, Nursing students; Medical students; Knowledge; Attitude; Disaster preparedness training

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INTRODUCTION

Emergency and disaster preparedness is critical to reduce the impact of disaster and minimise casualties, as disaster can strike at any time. According to Albattat and Mat Som (1), a disaster is an incident that occurs suddenly and is complex, causing loss of lives, damages to property or the natural environment, and profoundly affecting local activities. Furthermore, as mentioned by Ahayalimudin (2) there is a need for an integrated disaster management system to deal with any disaster and a specialised and highly skilled emergency medical response team.

Healthcare personnel (HCPs) are vital in responding promptly and accurately during emergencies and disasters to save lives. Nonetheless, limited numbers of HCPs can react to stressful situations, perhaps due to a lack of familiarity or exposure to such conditions (3). Hence, disaster preparedness training is required to improve healthcare personnel skills and familiarise them with emergency and disaster management (4). With the current conditions of COVID-19, it is challenging to physically hold a disaster exercise. In response, one discussion-based called tabletop exercise (TTX) can be used to conduct emergency and disaster preparedness. TTX is an activity in which key personnel assigned emergency management roles and responsibilities are gathered to discuss various simulated emergencies in a non-threatening environment (5).

TTX is more than just a drill since high technology systems, such as augmented reality/virtual reality (AR/VR), can be applied in this exercise. AR/VR is an excellent technology for many fields, especially emergency and disaster management (6–8). During their education and training processes, nursing students in Turkey show high acceptance of AR technology (9). Meanwhile, a systematic literature review has been conducted by a group of Korean researchers on the effectiveness of virtual reality in healthcare education (10). Through a thorough literature review, they revealed that VR has enormous potential and offered valuable recommendations for educational environments. Other researchers from Saudi Arabia analysed the literature and found that formulating disaster preparedness training through a virtual reality approach is much better than conventional TTX (8). It has many advantages and is more cost-effective, but it still requires improvement.

However, unlike other countries, the use of AR/VR itself is yet to be significantly recognised in Malaysia, especially in emergencies and disasters, despite many studies conducted worldwide. As nursing and medical students learn the subject of emergency and disaster, this study examined their knowledge and attitude towards using AR/VR to approach TTX in emergency and disaster preparedness.

METHODS

The study used a cross-sectional survey among undergraduate nursing and medical students at the International Islamic University Malaysia (IIUM) Kuantan campus through convenience sampling selection. It was conducted from April to June 2022. The inclusion criteria included students who owned any devices and excluded those who were inactive during data collection.

The self-administered questionnaire used in this study consists of three parts: parts A, B and C. Part A were sociodemographic data, which consisted of gender, age, kulliyyah, year of study, ever heard of AR/VR, ownership of personal computer/smart devices that can access applications, period of daily internet use, and frequency of playing on a computer or mobile games. Part B combines students' knowledge of AR/VR and TTX. The items used in the questionnaire on students' knowledge of AR/VR were self-constructed from the websites of the School of Professional Advancement, Tulane University (11). Meanwhile, the items used in the questionnaire on students' knowledge of TTX were adapted from studies developed by Husna et al. (12). Part C, which determines students' attitudes towards AR/VR, was developed from various literature readings (6,13–15). For attitude towards TTX, this study used a previous study by another student of Kulliyyah of Nursing adapted from Evans (16), named Tabletop Attitude Questionnaire. The questionnaire was tested for its reliability by 30 respondents from nursing and medicine students. For this study's results, Cronbach's alpha was conducted with a reliability of 0.720 and 0.865 for knowledge and attitude, respectively. The last item was an open-ended questionnaire to get students' feedback regarding using AR/VR as an approach to TTX training modality in emergency and disaster preparedness.

This study received approval from Kulliyyah of the Nursing Postgraduate and Research Committee (KNPGRC) and IIUM Research and Ethics Committee (IREC). Consent from the questionnaire's owner was also obtained. Before obtaining permission to participate in this research, the participant was provided with an

information sheet about the study's objectives and confidentiality.

Data was analysed using Statistical Package for Social Science (SPSS) version 22.0. A *p*-value less than 0.05 was considered statistically significant. A descriptive statistical test measured the variables' frequency, percentage, mean and standard deviation. The normality test of Kolmogorov-Smirnov showed that both variables of total score of knowledge and total score of attitudes showed significant values of 0.001 and 0.000, respectively, which was less than 0.05. Hence, the non-parametric Chi-Square test and Fisher's Exact test were used to analyse the data.

RESULTS

Sociodemographic Data

About 211 IIUM Kuantan undergraduate nursing and medical students participated in this study, which took about three months of data collection (April to June 2022). According to the results **Table 1**, the highest number of respondents came from females 65.4% compared to males 34.6%. More than half of respondents were 23 and above 65.4%, while the rest were 22 years old and below 34.6%. Moreover, most respondents were from Kulliyyah of Medicine, 59.7%, while the rest were from Kulliyyah of Nursing, 40.3%. Approximately 16.1% of the respondents were from year 5, 31.3% were from year 4, 14.2% were from year 3, 19% were from year 2, and 19.4% were from year 1. Based on the results, while only 46.9% of respondents have heard of AR/VR, 52.6% have never heard of it, and 26.1% were unsure.

Students' Knowledge Towards AR/VR

Students' knowledge of AR/VR was measured using a 12-question questionnaire. The total score for knowledge of AR/VR was categorised into low, which ranged from 0 to 5, and high, which ranged from 6 to 12. As presented in **Table 2**, students' knowledge of AR/VR was high, 194 (91.9%), with a mean of 0.92 and a standard deviation of 0.273.

Students' Knowledge Towards TTX

As presented in **Table 3**, a minority of respondents, 45% (95), have a low level of knowledge on TTX, while most respondents, 116 (55%), have high levels of knowledge on TTX.

Association Between Ownership of Personal Computer/mobile Devices and Knowledge

The Chi-Square test determined the association between personal computer/mobile device ownership and knowledge. Since the assumption was not met where the expected frequency was more than 20% (50%), Fisher's Exact test was done. The result in **Table 4** demonstrated that ownership of personal computer/mobile devices was not significantly associated with the level of knowledge of AR/VR.

Students' Attitudes Towards AR/VR

To identify students' attitudes towards AR/VR, a set of 13 questionnaires was used. The questionnaire was categorised into positive and negative attitudes. Based on **Table 5**, each attitude has its own score. Negative attitudes score between 0 and 31, while positive attitudes score between 32 and 65. The mean was 0.56 (SD=0.498).

Students' Attitude Towards TTX

As presented in **Table 6**, the data showed that most respondents, 116 (55.0%), have negative attitudes towards TTX, while only 95 (45.0%) have negative attitudes towards TTX.

Association Between Gender, Ownership of Devices, Period of Internet Used and Frequency of Playing Games With Attitude

The chi-square test was used to test the association between gender, ownership of personal computer/mobile devices, period of daily internet use and frequency of playing personal computer/mobile games) with attitude. All assumptions were met except for ownership of personal computer/mobile devices. Therefore, Fisher's Exact test was conducted. The result in **Table 7** showed that only the frequency of playing personal computer/mobile games showed a significant association between the frequency of playing computer/mobile games and attitude toward AR/VR since the *p*-value was 0.006. Other investigated variables were shown to be not statistically significant.

Table 1: Sociodemographic data (N=211)

Variable	n (%)	Mean	Std. Deviation
Gender		0.65	0.477
Male	73 (34.6)		
Female	138 (65.4)		
Age		0.65	0.477
22 years old and below	73 (34.6)		
23 years old and above	138 (65.4)		
Kulliyyah		0.60	0.492
Nursing	85 (40.3)		
Medicine	126 (59.7)		
Year of Study		0.206	1.389
Year 1	41 (19.4)		
Year 2	40 (19.0)		
Year 3	30 (14.2)		
Year 4	66 (31.3)		
Year 5	34 (16.1)		
Have you heard of any AR/VR?		0.99	0.730
Yes	99 (46.9)		
No	57 (27.0)		
Unsure	55 (26.1)		
Ownership of personal computer or mobile devices		1.00	0.069
No	210 (99.5)		
Yes	1 (0.5)		
Period of daily Internet use		2.16	0.723
Less than 1 hour	-		
Between 1 to 4 hours	41 (19.4)		
Between 5 to 8 hours	96 (45.5)		
More than 8 hours	74 (35.1)		
Frequency of playing on a computer or mobile games		1.49	0.875
Frequently play PC/mobile games	29 (13.7)		
Sometimes, I play PC/mobile games	71 (33.6)		
I rarely play PC/mobile games	86 (40.8)		
Never play PC/mobile games	25 (11.8)		

Table 2: Students' knowledge towards AR/VR (N=211)

Variables		n (%)	Mean	Std. Deviation
Student's knowledge	Total score		0.92	0.273
Low	0 – 5	17 (8.1)		
High	6 – 12	194 (91.9)		

Table 3: Students' knowledge towards TTX (N=211)

Variables		n (%)	Mean	Std. Deviation
Student's knowledge	Total score		0.55	0.499
Low	0 – 13	95 (45.0)		
High	14 – 23	116 (55.0)		

Table 4: Association between ownership of personal computer/mobile devices and knowledge (N=211)

Variables	n	Knowledge level, n (%)		X^2 (df)	*p*-value*
		Low	High		
Ownership of personal computer/mobile devices				0.088 (1)	1.000
No	1	-	1 (100)		
Yes	210	17 (8.1)	193 (91.9)		

*Fisher's Exact test, *p*-value<0.05

Table 5: Students' attitudes towards AR/VR (N=211)

Variables		n (%)	Mean	Std. Deviation
Student's Attitudes	Total score		0.56	0.498
Negative	0 – 31	93 (44.1)		
Positive	32 – 65	118 (55.9)		

Table 6: Students' atitudes towards TTX (N=211)

Variables		n (%)	Mean	Std. Deviation
Student's attitudes	Total score		0.45	0.499
Negative	0 – 31	116 (55.0)		
Positive	32 – 65	95 (45.0)		

Table 7: Association between gender, ownership of devices, period of internet used and frequency of playing games with attitude (N=211)

Variables	n	Attitude level, n (%)		X^2 (df)	*p*-value
		Negative	Positive		
Gender				0.857 (1)	0.355
Male	73	29 (39.7)	44 (60.3)		
Female	138	64 (46.4)	74 (53.6)		
Ownership of personal computer/mobile devices				0.792 (1)	1.000*
No	1	0 (100.0)	1 (100.0)		
Yes	210	93 (44.3)	117 (55.7)		
Period of daily Internet use				0.166 (2)	0.920
Less than 1 hour	-	-	-		
Between 1 to 4 hours	41	19 (46.3)	22 (53.7)		
Between 5 to 8 hours	96	41 (42.3)	55 (57.3)		
More than 8 hours	74	33 (44.1)	41 (55.4)		
Frequency of playing personal computer/mobile games				12.431 (3)	0.006
Never play PC/mobile games	25	19 (76.0)	6 (24.0)		
I rarely play PC/mobile games	86	32 (37.2)	54 (62.8)		
Sometimes, I play PC/mobile games	71	31 (43.7)	40 (56.3)		
Frequently play PC/mobile games	29	11 (37.9)	18 (62.1)		

*Fisher's Exact test, *p*-value<0.05

Feedback on Attitudes Towards The Use of AR/VR for TTX As A Training Modality for Emergency and Disaster Preparedness

One open-ended questionnaire was included in the survey. The question asked for respondents' feedback on their attitudes towards using AR/VR for TTX as an emergency and disaster preparedness training modality. A total of 192 respondents gave their feedback. About 12 respondents did not agree with the implementation of AR/VR for TTX as a training modality for emergency and disaster preparedness. However, no clear reasons were stated. Some respondents were neutral about this implementation as some noted that it was a new thing and knowledge, some did not prepare for the changes, some reported that AR/VR is a rarely used application due to a lack of exposure towards it, and some agreed that they would consider with the implementation if the benefits outweighed the risks.

Overall, most respondents agree with using AR/VR for TTX as a training modality for emergency and disaster preparedness, as many find it interesting since the simulation would be more accurate and can have a better understanding of it. Many respondents think that the use of AR/VR can be beneficial as it helps enhance their critical thinking when facing real-life situations, prepares them more to deal with real-life situations, builds confidence and develops creativity, and critical thinking helps save lives during disasters.

DISCUSSION

Sociodemographic Data

Based on gender, females were dominant in the respondents group compared to males, which was in line with one study conducted by Zhang and team (17). This is probably due to the higher number of female students than males. Moreover, the World Health Organization (WHO) states that women dominate 70% of the healthcare system (18). Additionally, most respondents were 23 years old and above and were from Kulliyyah of Medicine. Most respondents have never heard of any AR/VR before. This is probably due to the AR/VR terms students do not fully recognise or understand. Furthermore, one study by Lazim and Rahman (19) reported that the knowledge of AR technology is only about 40% reported and recognised by the Malaysian. Only one student reported not owning a personal computer/mobile device. This is probably because this respondent had a problem with it when this study was conducted. However, no apparent reason was stated.

Most respondents spend between five and eight hours daily on the Internet. This is probably because the respondents were students who frequently needed access to the Internet for study purposes. Most respondents reported rarely playing PC/mobile games. This is perhaps due to the limited time that the students had due to study purposes and clinical posting requirements.

The Level of Knowledge of AR/VR

The respondents' AR/VR knowledge level was determined by summating the total score of 12 questions. Despite many respondents having never heard of AR/VR, the findings from the statistical test showed that most respondents had a high level of knowledge of AR/VR, with 91.9%. This is probably due to technological advancements nowadays that students can easily access. Furthermore, AR/VR technology implementation has risen in various devices for general use (20), which might be why respondents' knowledge about AR/VR is high. There are limitations to the study regarding the level of understanding of AR/VR.

Student's Attitudes Towards AR/VR

In this study, the majority % of respondents, 55.9%, had positive attitudes toward AR/VR, and only 44.1% had negative attitudes toward AR/VR. This is comparable to another study by Sirakaya and Çakmak (13) that reported positive attitudes toward AR/VR. This result is believed to be related to the advantages of AR applications in educational environments. This finding is also supported by Stojšić et al. (21), where students have a primarily positive attitude toward the application of mobile AR in higher education. One hundred respondents (%) agree that AR/VR can be applied in emergency exercises. This is possibly due to the high knowledge of the benefits of AR/VR itself, which might create a positive impact on students' attitudes. Respondents may also develop awareness of emergency and disaster situations that have occurred recently, such as the COVID-19 outbreak, the worst flood in December 2021 and landslides in Kuala Lumpur, which may develop positive attitudes toward AR/VR.

Association Between Sociodemographic Data and Knowledge Toward AR/VR

Based on the findings, there is no association

between personal computer/mobile device ownership and the level of knowledge of AR/VR among IIUM Kuantan nursing and medical students. This may be due to the respondents' lack of interest in learning about AR/VR itself. In contrast, Lazim and Rahman (19) stated that only about 40% of Malaysians report and recognise knowledge of AR technology. Despite Malaysia's lack of information and technology equipment, many are interested in AR technology.

Association Between Sociodemographic Data and Attitudes Toward AR/VR

The present study revealed a significant association between the frequency of playing computer/mobile games and the attitudes toward AR/VR. Those who rarely played PC/mobile games had more positive attitudes toward AR/VR than those who frequently played PC/mobile games. This finding is consistent with a previous study by Sirakaya and Çakmak (13), where compared to students who frequently played PC/mobile games, students who rarely played PC/mobile games had significantly more positive AR attitudes. This may be related to the realistic graphics in computer games, which show the realistic virtual games and interaction with the players.

According to Roettl and Terlutter (22), video games create a virtual reality in which the individual plays the game. Therefore, those who rarely played PC/mobile games lacked exposure towards games and their realistic graphics, increasing the positive attitudes toward AR/VR. However, those who frequently played PC/mobile games may have been less affected as they are often exposed to these environments (13). In this context, AR/VR can be a handy tool to increase students' interest in learning, especially in emergencies and disasters.

Furthermore, there was no significant association between gender and attitude toward AR/VR. This showed that AR/VR attitudes did not differ based on gender. This result was supported by Sirakaya and Çakmak (13), who found that between gender and attitudes, the difference was not statistically significant. This finding was also supported by previous studies (23,24), which found that male and female students' AR attitudes were highly similar. There was no significant difference in AR attitudes based on gender.

Additionally, there is no significant association between personal computer/mobile device ownership and attitude toward AR/VR. In contrast, respondents who owned personal computers/mobile devices were found to have more positive attitudes toward AR/VR. This result aligns with the previous study by Sirakaya and Çakmak (13), where the difference between personal computer/mobile device ownership and attitude toward AR was not statistically significant. This may be due to the high-interest level of respondents towards advanced technologies nowadays, where they can have more vivid experiences with AR/VR. Furthermore, today's generation of students can effectively use technology in all aspects of their lives without any prior training (25,26), and it may be related to the self-confidence of the new generation in this era where they regard themselves as competent in using technology. Another study by Pavlin and Sužnjević (27) reported the same findings where, overall, students had positive attitudes towards AR/VR in education as they believed that it would help pupils to visualise teaching materials better and help them to learn better.

Regarding the period of daily internet use and attitudes toward AR/VR, it was found that there was no significant association between the variables. A similar finding was found when Sirakaya and Çakmak (13) testified that those who used the daily internet between 5 to 8 hours had more positive attitudes than those who often used the internet for more than 8 hours. Their finding may be related to students who use technology less, who may perceive it as more attractive. Moreover, it may be because those who use the internet more often may find AR/VR is no longer innovative as they may have previously encountered similar settings to AR/VR environments.

CONCLUSION

AR/VR is beneficial in various aspects, especially in emergency and disaster management. Although its use is still not widely recognised by Malaysians, research results showed that students displayed positive attitudes towards using AR/VR as an approach to TTX in emergency and disaster preparedness. The fact that positive attitudes were not dependent on the investigated variables such as gender, ownership of personal computer/mobile devices and period of daily internet use. This finding showed that AR/VR can be successfully used in educational settings. Overall, students were very positive and interested in AR/VR. Neutral students indicated that this technology is not commonly recognised and is expensive to implement.

Moreover, although the knowledge regarding AR/VR is relatively high among students, it cannot be denied that many are still unaware of it; perhaps the term AR/VR itself is not fully understood. Also, no recent study has been found to measure the knowledge and attitude regarding AR/VR, especially in emergencies and disasters, particularly among healthcare students. Therefore, any healthcare education institute can implement this advanced technology of AR/VR in any disaster preparedness training, such as tabletop exercises, to provide early exposure to students since they are always kept up with it.

Finally, to overcome this study's limitations, the limited study period should be extended to get a larger sample size, hopefully to all IIUM Kuantan students and staff. Other than that, there should be more constructive and concise research instruments by a more professional researcher in AR/VR and the emergency and disaster field in the future.

CONFLICT OF INTEREST

The author(s) declare there is no conflict of interest in this study.

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AUTHOR CONTRIBUTIONS

NAA: provide the ideas of this project, examine, revise and finalise the manuscript.
ZAN: conducted this project and drafted the manuscript.

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