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ORIGINAL ARTICLE

A Comparison Between Video-Assisted Teaching (VAT) and Traditional Teaching (TT) Methods on Knowledge and Confidence Level on Performing Focus Assessment with Sonography for Trauma (FAST) Among Final Year Medical Students in Emergency Department Teaching Hospital Northeastern Malaysia

Mohamed Abdallah Mohamed Ahmed[1], Mohd Hashairi Fauzi[*2,3], Mohd Boniami Yazid[2,3], Mohammad Zikri Ahmad[2,3], Wan Syahmi Wan Mohamad[2,3], Kamarul Aryffin Baharuddin[2,3], Shaik Farid Abdull Wahab[4]

[1]*Armed Forces Hospital Southern Region, Khamis Mushayt, Saudi Arabia*
[2]*Emergency and Critical Care Ultrasound Unit, Department of Emergency Medicine, School of Medical Science, Universiti Sains Malaysia Health Campus, 16150 Kubang Kerian, Kelantan, Malaysia*
[3]*Department of Emergency, Hospital Universiti Sains Malaysia, Health Campus, 16150 Kubang Kerian, Kelantan, Malaysia*
[4]*Faculty of Medicine, Universiti Sultan Zainal Abidin, 20400 Kuala Terengganu, Terengganu, Malaysia*

Corresponding author: Mohd Hashairi Fauzi (hashairi@usm.my)

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ABSTRACT

Introduction: In response to the COVID-19 pandemic in 2020, many universities switched from face-to-face teaching to alternative forms of delivery without jeopardizing the quality of teaching and learning due to lockdown. Our study aims to discover the alternative way of teaching ultrasound among medical students and uses Focused Assessment with Sonography in Trauma (FAST) as an example of training. **Methods:** A prospective interventional study was conducted involving 100 final-year medical students. The study's primary endpoint was to compare the level of knowledge and confidence pre- and post-workshop of FAST scan among medical students who received Video-Assessed Teaching (VAT) versus those who received Traditional Teaching (TT). **Results:** Our study showed a significant improvement in knowledge and confidence after the workshop. There was a significant mean difference between pre- and post-workshop for both knowledge and confidence among both groups (VAT and TT) (P <0.001). However, the two groups had no significant mean difference in knowledge and confidence levels (P >0.050). It was noticed from students' responses that 31% preferred the hands-on session, 28% preferred bedside teaching, while few preferred lectures and videos, with 20% and 18%, respectively. **Conclusion:** VAT is non-inferior compared to TT in terms of knowledge and confidence in training ultrasound among undergraduate students. Thus, VAT can be considered an alternative method of teaching during a pandemic outbreak, with certain limitations.

INTRODUCTION

In medical practice, ultrasound technology has been used since the late 1940s and early 1950s and has significantly progressed. It is predicted that ultrasound equipment will become more compact and will be the new stethoscope of the future [1,2]. Therefore, it is essential to introduce ultrasound and its significance in undergraduate teaching early in their education.

Ultrasound is a valuable teaching tool that improves physical exam technique [3]. For patient care, there is a growing emphasis on using ultrasound at the point of care to help diagnose and manage patients [4]. In undergraduate medical education, ultrasound is becoming more widely incorporated into basic science, especially anatomy and physiology [2,5]. In a study by Bell III et al. (2015) at the University of South Carolina, ultrasound is used to teach medical students cardiac physiology with 95% of the student's agreed ultrasound was a valuable teaching tool and improved their understanding of cardiac physiology. All students agreed the ultrasound was helpful from a visual learning standpoint. A hands-on ultrasound can help medical students learn the nonelectrical components of cardiac physiology [6]. To our knowledge, there is no formal ultrasound training in the Malaysian undergraduate curriculum. Thus, we decided to explore the feasibility of teaching basic ultrasound skills to undergraduates using Focused Assessment with Sonography in Trauma (FAST) scanning as a model module.

Traditional Teaching (TT) in ultrasound is often expensive and time-consuming, requiring live human models, instructors, and ultrasound machines [7]. Video-Assisted Teaching (VAT) has several potential advantages over TT, including the flexibility of access (anytime and anywhere) rich multimedia, and non-linear navigation [8].

Since March 2020, the COVID-19 pandemic outbreak has affected many universities due to lockdowns, leading academics to explore alternative ways of reaching students since the traditional setups are no longer viable. The use of e-learning platforms has received greater attention and become a part of the mainstream. [9]. Using videos in medical teaching has been known to enhance observational skills and clinical reasoning and is among the most preferred methods of blended learning [10]. Prior to the COVID era, our ultrasound teaching involved dedicated lectures followed by hands-on sessions. However, this was not possible during COVID. We decided to explore alternative teaching-learning methods that could be implemented during and after the COVID pandemic. Therefore, our aim was to compare the knowledge and confidence levels of FAST scan pre- and post-workshop among medical students who underwent VAT versus those who underwent TT.

MATERIALS AND METHODS

Study Design

This prospective interventional study was conducted from September 2019 to August 2020, involving 100 final-year medical students at teaching hospital in northeastern Malaysia. The students were posted to a four-week Emergency rotation during their fifth-year posting. Five consecutive batches, each consisting of 20-25 students, were selected. Later, each batch was divided into two study groups; the control and intervention groups using computer randomization software (www.randomizer.org).

Intervention

The students were explained about the intended outcomes, assured of confidentiality, and written consent was obtained. Both groups underwent a pre-course assessment together. The control group received TT, which included a 30-minute lecture on the basic physics of sonography and knobology, 30 minutes on FAST, and a hands-on training session (HOTS) ranging from 60 to 90 minutes. The duration of HOTS varied for the TT group and depended on the success and ability of students to obtain optimal images.

Qualified trainers (Fellowship in Emergency and Critical Care Ultrasound Unit) delivered the lectures and HOTS. At the same time, the intervention group sat together in the same room and watched a 1-hour recorded video covering the same topics, prepared by an emergency medicine lecturer qualified in ultrasound training but without HOTS. On the same day, both groups underwent a post-course assessment. Before posting ends and after study recruitment, the intervention group will have the opportunity to engage in HOTS with trainers.

Data Collection

In this study, a validated questionnaire was used as an assessment tool, obtained from previous studies by Bashir and Chaudhry et al. (2016) who permitted its use, and it was reviewed by the Emergency & Critical Care Ultrasound Unit Committee. The questionnaire comprises three domains:

1. Socio-demographic domain: This includes age, gender, race, and previous attendance of ultrasound courses.

2. Knowledge domain: This assesses knowledge about basic physics and knobology, the anatomy of the abdomen, and FAST scan using either Multiple Choice Questions (MCQs) or interpretation of printed ultrasound images.

3. Assessment of confidence domain: This involves answering five questions using a Likert Scale.

The knowledge was interpreted based on the total score obtained by the participant for each assessment. Each knowledge item was marked as either true or false, with an additional option for "don't know". Incorrect or uncertain (don't know) responses received a score of zero, while a correct answer received a score of one. The total score ranges from zero to 23, with higher scores indicating better knowledge. Meanwhile, the confidence level was interpreted into two categories by participants: confident (participant who strongly agree and agree) and not confident (participant who strongly disagree, disagree, and are neutral). The questionnaire was a set of self-administered questionnaires designed to be completed within 25 minutes by most respondents.

Data Analysis

The data were analyzed using IBM SPSS for Windows, version 24.0 (SPSS Inc. Chicago, IL, USA). Descriptive statistics were used to summarize the students' socio-demographic characteristics and USG experience. Numerical data were presented as mean (SD) for the knowledge score based on their normal distribution. To compare the knowledge level among both groups, paired T-test, independent T-test, and one-way ANCOVA were applied. The significance level was expressed as 95% confidence interval (CI) and a P-value of less than 0.05 ($P<0.05$). The confidence assessment categorical data were presented as frequency (percentage). The study received approval from the ethics committee of Universiti Sains Malaysia (USM/JEPeM/18110719).

RESULTS

100 medical students were recruited, with a mean age of 23.72 (SD= 0.89). Most subjects were female (61%), Malay (55%) and had no prior experience in USG courses (97%). The mean knowledge levels of basic physics/knobology, anatomy, and FAST were compared between pre- and post-workshop assessments. As shown in Table 1, there was a significant difference between pre- and post-workshop knowledge levels of knobology, anatomy, and FAST ($p<0.001$) in the control group. Post-workshop results were higher than the pre-workshop results for all three parameters, with the highest change observed in FAST ($p<0.001$).

Table 1 Comparison of related variables in control group (TT) and intervention group (VAT)

Group	Variables	Measurement		Mean Difference (95% CI)	t-statistics (df)*	P-value
		Pre Mean (SD)	Post Mean (SD)			
TT	Knobology	6.24(1.82)	8.70(1.85)	2.46 (1.79,3.13)	7.35	<0.001
	Anatomy	3.78(2.65)	7.62(1.72)	3.84 (3.11,4.57)	10.51	<0.001
	FAST	5.94(2.53)	8.70(2.39)	4.00 (3.08,4.92)	8.77	<0.001
VAT	Knobology	5.96(2.03)	8.51(1.94)	2.55 (1.92,3.18)	8.16	<0.001
	Anatomy	3.02(2.63)	6.98(2.06)	3.96 (3.18,4.74)	10.24	<0.001
	FAST	5.94(3.21)	8.66(1.67)	2.72 (1.65,3.80)	5.11	<0.001

* Paired t-test was applied

Similarly, there was a significant mean difference between pre- and post-workshop knowledge levels for all three parameters (basic physics/ knobology, anatomy, and FAST) in the intervention group ($p<0.001$). Post-workshop results were also higher than pre-workshop results for all three parameters, with the highest difference observed in anatomy (3.96; 95% CI: 3.18,4.74) (Table 2). To compare the knowledge levels between both groups (VAT and TT), we analyzed the data by conducting independent T-test and one-way ANCOVA (Table 3). However, we observed no significant mean difference between the two groups for all compared parameters ($p>0.05$) when the pre-workshop results were controlled.

Table 2 Comparison of post results between two groups among total samples

Variables		Measurement		Mean Difference (95% CI)	t-statistics	P-value
		TT Mean (SD)	VAT Mean (SD)			
Knobology	Crude Mean (SD)[a]	8.65 (1.87)	8.51 (1.94)	0.14 (-0.62,0.89)	0.36	0.720
	Adjusted mean (95%CI)[b]	8.90 (8.19,9.61)	8.62 (7.96,9.27)	0.28 (-0.69,1.25)	0.08	0.565
Anatomy	Crude Mean (SD)[a]	7.65 (1.72)	6.98 (2.06)	0.67 (-0.09,1.42)	1.76	0.082
	Adjusted mean (95%CI)[b]	7.52 (7.02,8.03)	7.08 (6.56,7.59)	0.45 (-0.27,1.16)	2.42	0.221
FAST	Crude Mean (SD)[a]	8.76 (2.37)	8.63 (1.76)	1.40 (-0.69,0.97)	0.33	0.741
	Adjusted mean (95%CI)[b]	8.79 (8.19,9.39)	8.63 (8.01,9.25)	0.17 (-0.71,1.04)	0.14	0.706

* Paired t-test was applied

The distribution of confidence results for both groups, pre- and post-workshop, was listed based on each question used in the study, as shown in Figure 1. There was a noticeable improvement in confidence levels observed after the workshop. Students showed confidence in detecting free fluid in the Right Upper Quadrant (RUQ) at 63% and the Left Upper Quadrant (LUQ) at 51%, respectively, after the workshop. In a comparison of both groups (TT and VAT) after the workshop (Figure 2), students who received TT felt more confident in learning basic physics and knobology (24%), detecting free fluid in the RUQ (32%), detecting free fluid in the LUQ (26%), and detecting free fluid in the suprapubic region (23%). In comparison, they felt less confident in detecting free fluid in the pericardium (17%) than students who received VAT (22%).

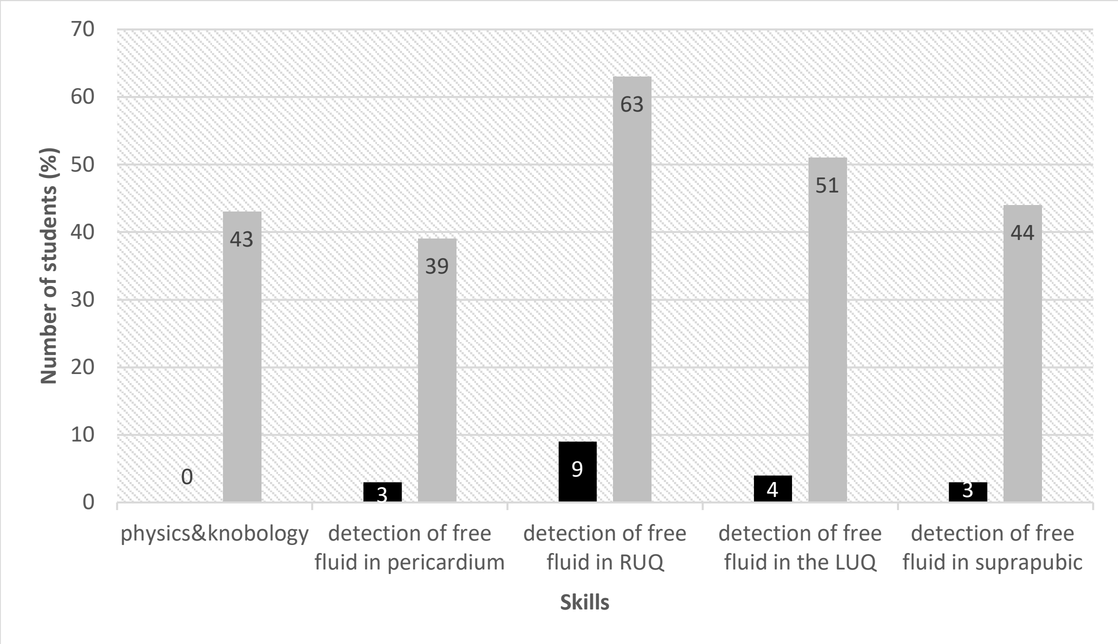

Figure 1 Bar graph showing the comparison of pre (black) and post-confidence (grey) results by each question used

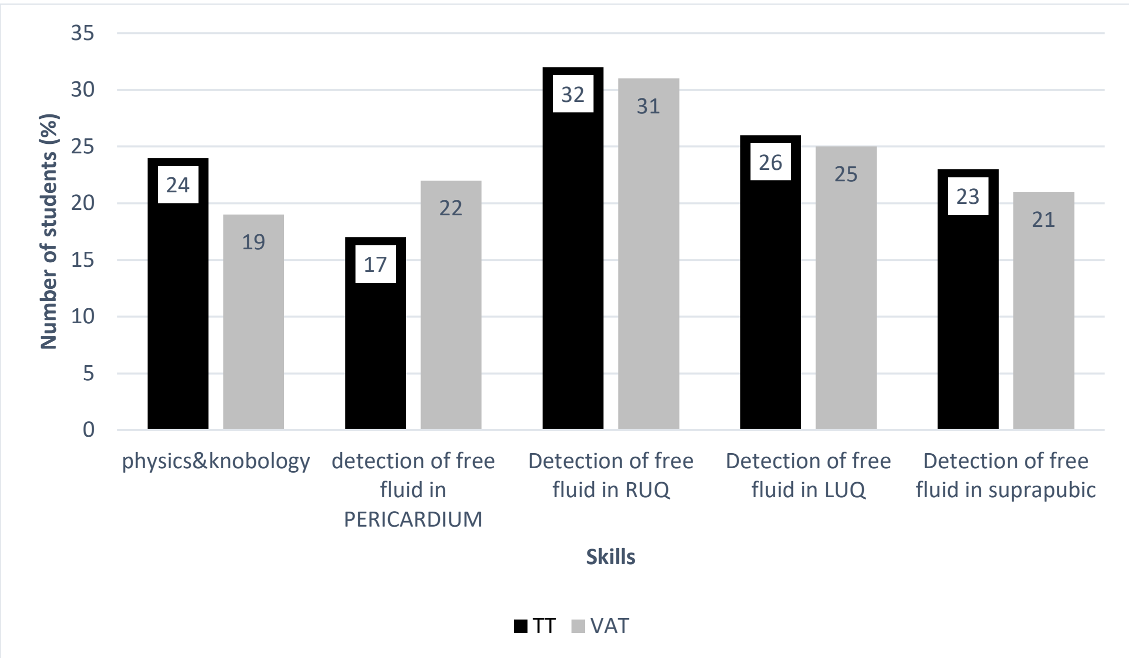

Figure 2 Distribution of participants who feel confident after the workshop for each item based on groups (TT and VAT)

DISCUSSION

Even though the COVID-19 pandemic has now subsided, healthcare educators must remain prepared for near-future challenges in delivering information to students. During the pandemic, most medical schools swiftly adapted to online classes by shifting from live clinical exposure to virtual ones [11]. VAT could provide a short-term alternative method for teaching FAST and other ultrasound applications.

Experience in Ultrasound

Our study showed 97% of the students did not undergo formal USG training courses. This could be due to the ultrasound module not yet being incorporated into the curriculum. In addition, only a few departments organize USG courses for final-year students on their initiative. Conversely, in certain developed countries like the United States, medical students receive USG training in their early years of medical school [12]. It proves valuable in understanding human anatomy and learning physical examination skills [13]. This innovative program demonstrates USG as an additional learning modality. Future goals include expanding this work to incorporate USG education throughout medical school years.

Knowledge

Knowledge measures were derived from information in the instructional videos and specific concepts related to the FAST exam. Three broad areas were sampled: knowledge of anatomy, knowledge of physics and knobology, basic FAST exam procedures, and window interpretation. Knowledge of the abdominal area was emphasized because interpreting FAST scans requires proficiency in abdominal anatomy. Basic physics and knobology knowledge are necessary to understand image acquisition and facilitate interpretation. Knowledge of the FAST exam procedures was used to measure participants' existing knowledge before instruction on FAST concepts and how much knowledge participants acquired from the instruction. Finally, window interpretation was sampled the most because it represented the essential knowledge outcome of the training.

There was a significant improvement in the knowledge of all domains after the workshop in both groups, which had similar findings from previous studies [14-16]. Students scored higher in the knowledge of anatomy and FAST procedure with a mean difference of 3.69 (CI: 3.18, 4.74) and 4 (CI: 3.08, 4.92), respectively, and they scored lower in the knowledge of knobology and basic physics with a mean difference of 2.55 (CI: 1.92, 3.18). This discrepancy may be attributed to some students' prior exposure to anatomy in their early medical years and their experience performing FAST scans during rotations in other departments. Nevertheless, when the pre-result was controlled, our study showed no significant mean difference ($p>0.05$) in all compared parameters between the TT and VAT groups.

Our findings are in agreement with other published studies indicating that using multimedia teaching techniques for urology, surgical procedures and neuroanatomy is as effective as face-to-face teaching [17,18].

Confidence

The students in this study reported an increase in confidence using ultrasound after the educational intervention in both groups, similar to the survey conducted by Bashir K. et al. (2016) among emergency physicians and residents working in Qatar [19]. The study reported that doctors perceived less complicated scans, such as those in the Right Upper Quadrant (RUQ) and Left Upper Quadrant (LUQ). This result was similar to our findings, as 63% and 51 % of our students reported confidence in detecting free fluid in the RUQ and LUQ after the workshop. The improvement in confidence is not limited to accurately performing ultrasound but can also extend to enhancing learning in anatomy and physical examination skills. That confidence will benefit students in preparing for clinical clerkships and residencies [20].

Interestingly, students who received TT felt more confident than other groups who received VAT in learning basic physics and knobology, detecting free fluid in the RUQ and LUQ, and detecting free fluid in the suprapubic region. Direct communication with the lecturer and hands-on sessions may be the reason behind this result. However, we fully acknowledge that our assessment is incomplete without practical skills to assess the true value of confidence levels. Yet, these findings provide us some insights into using VAT as a short-term measure in teaching methods, especially in special conditions like COVID-19 pandemic.

Limitations

There are a few limitations in our study. Firstly, this is a single-center study, so the findings may not be generalizable to other centers in Malaysia. Secondly, this study did not assess practical skills. Thirdly, the investigator could not ensure that all questions were answered without using mobile phones, referring to books, or copying answers from each other, as participation was voluntarily and depended on the goodwill of the students involved in this study. Lastly, there was no test conducted to assess long-term knowledge retention.

CONCLUSION

Within the limits of our study, VAT is at least as effective as TT in teaching ultrasound to final-year medical students. Therefore, we suggest that VAT be used as an alternative teaching method alongside other methods. We also suggest incorporating ultrasound into the early years of undergraduate education and utilizing it for teaching basic knowledge such as physiology and anatomy. Once these changes have been implemented or expanded within the curricula, further research would be necessary to assess their effect on patient outcomes.

CONFLICT OF INTEREST

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests.

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AUTHORS' CONTRIBUTIONS

Study conception and design (MAM,MHF,SFAW),
Statistical expertise, analysis and interpretation of data and supervision (MAM,MHF,MZA),
manuscript preparation (MAM,MHF,MBY,KM),
supervision, administrative support and critical revision of the paper (SFAW,WSM,MHF,KM).

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