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Should Ultrasound Education be Incorporated into Medical Education? A Medical Student's Perspective after the Trial of SonoSim System

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Abstract

Objective: This article aims to assess whether or not medical students from Louisiana State University School of Medicine-Shreveport supported the idea of adding ultrasound training into the current medical school curriculum, while also highlighting the current knowledge and confidence these medical students had when performing ultrasound-guided procedures. **Materials and Method:** After completing a trial of the SonoSim system, 28 fourth-year medical student volunteers were assessed for current comprehension and ability to use ultrasound, their level of interest in enhancing their knowledge, and their sentiments about the current ultrasound curriculum. Additionally, we inquired about practices, procedures, and techniques they would like to see added to the curriculum. **Results:** Students were overwhelmingly motivated to learn but felt underprepared due to insufficient knowledge and lack of ultrasound training in their medical school curriculum. **Conclusion:** The implementation of ultrasound training is greatly needed for the greater framework of our education. **Relevance:** This article highlights the lack of ultrasound skills in medical students who do not have ultrasound training in the medical school curriculum.

Subject Areas

Radiology, Education

Keywords

Medical School Education, Ultrasound, SonoSim System

1. Introduction

Point of care ultrasound (POCUS) describes the use of portable ultrasound at

the patient's bedside and is increasingly integrated into clinical practice along with physical exams. Ultrasound is utilized in nearly all medical specialties, with Internal, Emergency, and, more recently, Family medicine at the forefront [1]. Across the globe, ultrasound training is implemented in undergraduate programs [2] [3] [4]. Various studies have shown two main benefits from POCUS in medical school education. First, it has been shown to increase medical students' clinical understanding and pathologies associated with the hepatobiliary and cardiovascular anatomy and other systems as well [5] [6]. Dinh *et al.* found that students that had ultrasound incorporated into their physical examination curriculum obtained greater OSCE scores than a cohort of students that took the exams prior to the introduction of ultrasound in the same medical school [7]. Secondly, POCUS training has been shown to improve medical students' understanding of musculoskeletal and vascular anatomy [8] [9].

Despite the popularity of ultrasound usage, ultrasound training is not something that all U.S. medical schools have implemented in their medical school curriculum. This may be due to cost, staff availability, or lack of requirements from accrediting bodies. Without this training in the medical school curriculum, this can be detrimental to medical students, as they are not receiving training on a diagnostic technique that is so commonly used in medicine. This article aims to assess if fourth-year medical students from Louisiana State University (LSU) School of Medicine-Shreveport, a medical school that currently does not have ultrasound implemented into their medical education curriculum, supported the idea of adding ultrasound training into the current medical school curriculum, while also highlighting the current knowledge and confidence these medical students had when performing ultrasound-guided procedures after completion of a trial with the SonoSim ultrasound medical education training software.

2. Materials and Methods

During the COVID-19 outbreak, we reached out to SonoSim regarding US training and resources for LSU School of Medicine-Shreveport. Fortunately, they gave interested medical students a free, two-week trial of their online courses and modules. These courses included basic anatomy with US integration of anatomical structures and clinical modules from FAST protocols, DVT, and focused cardiac ultrasound (FoCUS) to pregnancy pathologies for every trimester. SonoSim is currently used in over 800 medical institutions, notably Harvard Medical School, John Hopkins University, Mayo Clinic, Texas A & M, University of Florida, Columbia University, and Duke University. In addition, they have over 200 hours of CME credits approved for AMA PRA Category 1 Credit and boast the most extensive industry collection of peer-reviewed ultrasound training content. After receiving a one-week trial of the simulation probe with the associated program, we asked the medical school classes at LSU School of Medicine-Shreveport to participate in the trial and test the program. At this institution there is a lack of ultrasound training that is limited to nonphysical demon-

strations.

Post-demonstration questionnaires were created and distributed to 28 fourth year medical student volunteers after completing a trial of the SonoSim system. Instructions on how to physically operate an ultrasound probe was given prior to post-demonstration questionnaires. The questionnaire assessed current comprehension and ability to perform ultrasound, their level of interest in enhancing their knowledge, and their sentiments about our current ultrasound curriculum. Additionally, we inquired about practices, procedures, and techniques they would like to see added to the curriculum.

3. Results

The data in Figure 1 is representative of responses to two different, but related, questions concerning student preparedness with ultrasound. First, we assessed current understanding using a Likert scale from 1 to 4; 1 = "no understanding", 2 = "poor understanding", 3 = "good understanding", and 4 = "excellent understanding". Similarly, the second question assessed confidence with performing ultrasound using a Likert scale from 1 - 4; 1 = "Not comfortable", 2 = "somewhat comfortable", 3 = "comfortable", 4 = "very comfortable". 22 out of 28 (79%) respondents reported poor or no understanding, and only 6 out of 28 (21%) respondents had a good understanding of ultrasound. Similarly, all respondents were somewhat or not comfortable with performing an ultrasound.

The data in Figure 2 is representative of responses to two relative questions about our school's ultrasound curriculum. First, we assessed adequacy using a Likert scale from 1 to 4; 1 = "N/A", 2 = "not adequate, 3 = "adequate", and 4 = "excellent". The second question assessed the efficacy of our curriculum using a Likert scale from 1 - 4; 1 = "N/A", 2 = "not effective", 3 = "effective", 4 = "very effective". N/A was defined as students' inability to comment. 20 out of 28 (71%) respondents reported the curriculum is not adequate, and 6 out of 28 (21%) respondents chose N/A. Similarly, 20 out 28 (71%) respondents felt the curriculum was ineffective. 7 out of 28 (25%) respondents chose N/A.

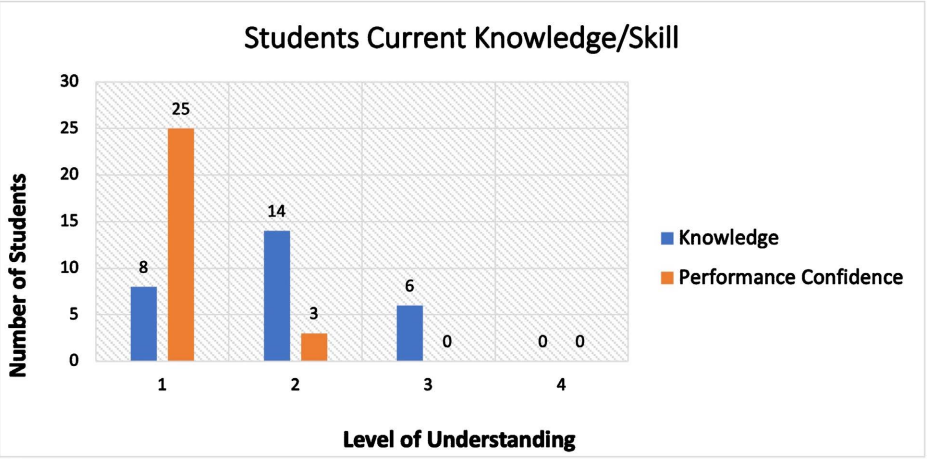

Figure 1. Assessment of current knowledge and skill.

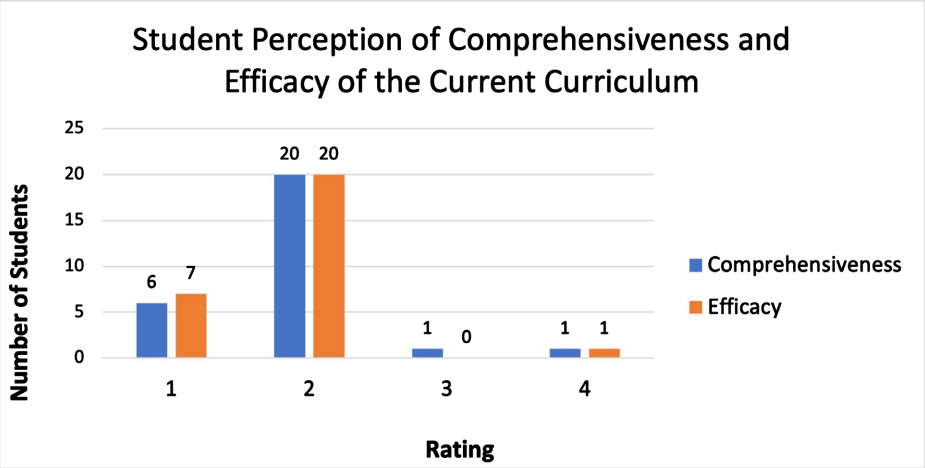

Figure 2. Current curriculum's adequacy and efficacy.

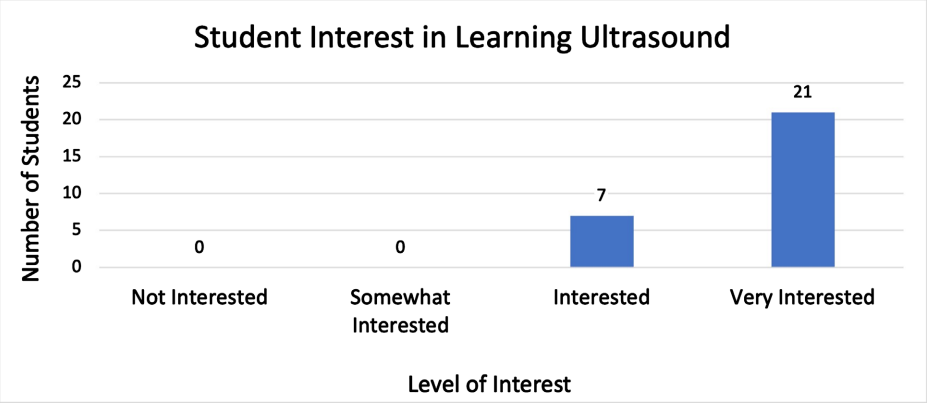

Figure 3. Student interest in learning ultrasound.

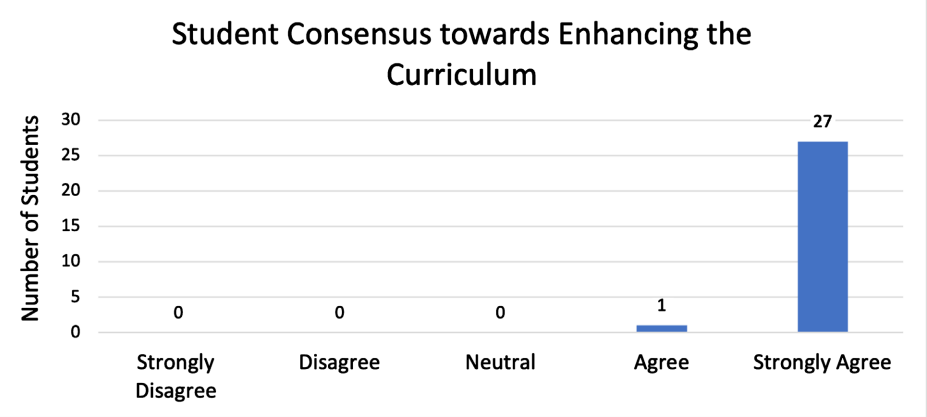

Figure 4. Benefit in enhancing ultrasound curriculum for students.

Figure 3 & Figure 4 represent Likert scales for 1 to 4 and 1 to 5 with the associated labels listed along the horizontal axis of each graph respectively. All respondents were interested in learning more about ultrasound, with 75% of respondents being very interested. 27 out of 28 (96%) respondents strongly agreed that adding additional tools to the curriculum would enhance their understand-

ing of ultrasound.

Figures 5-7 represent preferred learning modalities and practices of ultrasound that medical students were interested in. This set of questions was "select all that apply" type questions. Figure 5 provides a distribution of curriculum additions that students would like to see. 93% of respondents thought a simulator, SonoSim or a similar product, will be beneficial to their education. 86% of respondents thought workshops would be helpful in learning ultrasound. 64% of respondents thought more lectures will be helpful. 50% of students thought online modules would be helpful. Figure 6 demonstrates the ultrasound practices students preferred to learn. In order of preference, DVT (89%) and Pulmonary (89%) were highest, followed by FAST (86%), OB/GYN (79%), MSK (61%), Bladder Scan (61%), and Intestinal/Biliary (57%). Figure 7 reflects the procedures students preferred to learn. Needle Localization (89%) was preferred the most, followed by Venous Access (86%), Thoracentesis/Paracentesis (82%), and Biopsy (82%).

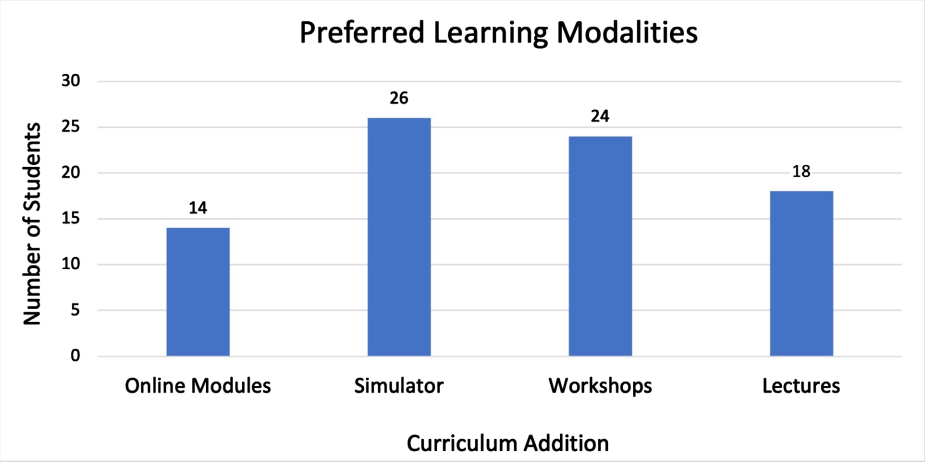

Figure 5. Student preferred learning modalities.

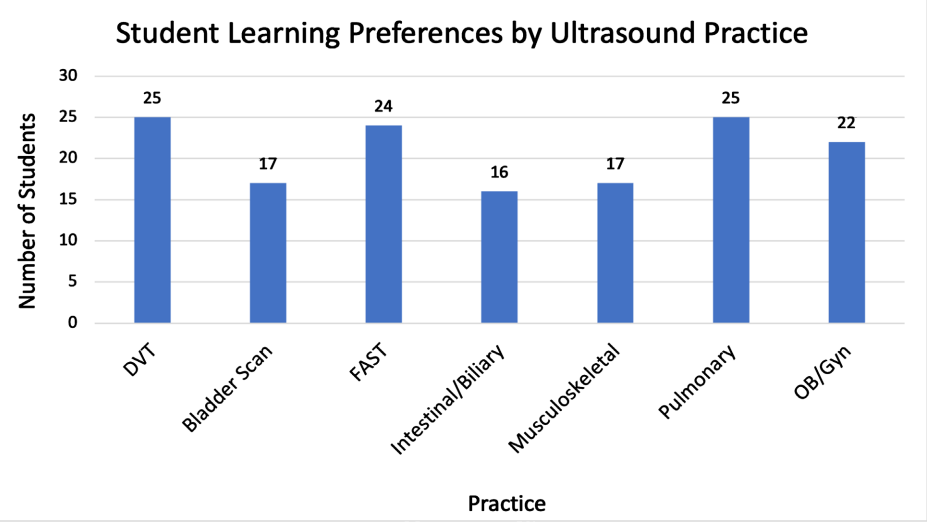

Figure 6. Student preferred learning practices.

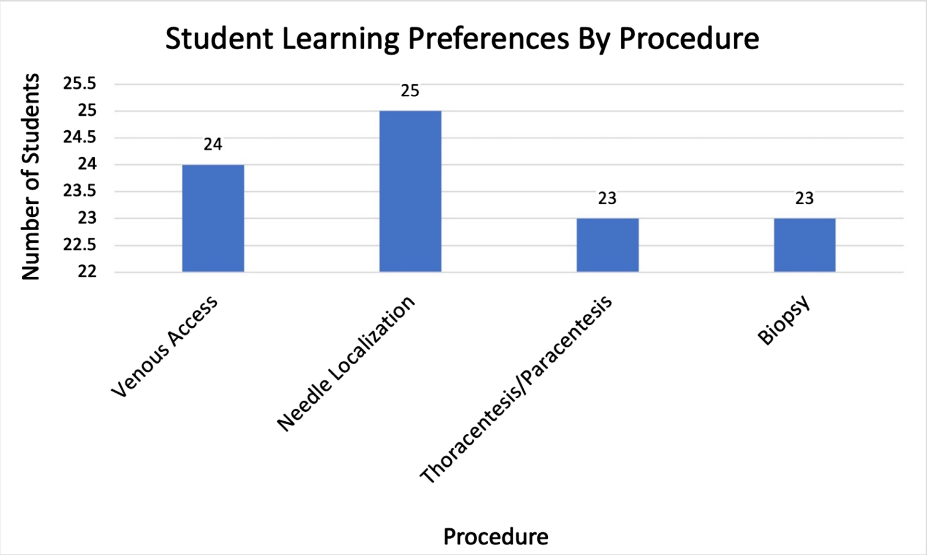

Figure 7. Student preferred learning procedures.

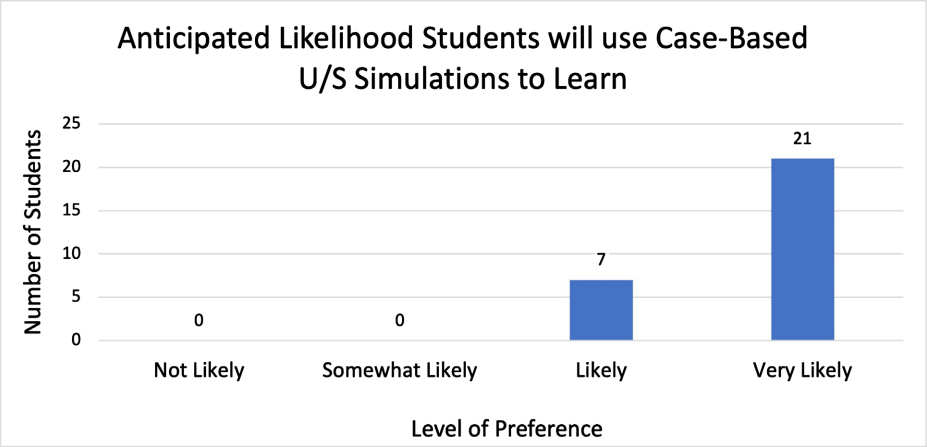

Figure 8. Student interest and willingness to use case-based ultrasound simulation.

Figure 8 shows the students' responses when asked about the likelihood of them using SonoSim, or a similarly styled program, to learn. 100% of respondents indicated they were at least likely to use case-based ultrasound simulations to learn, of which 75% were very likely to.

4. Discussion

In more recent years, medical schools and residency programs have used ultrasound, in conjunction with phantoms and cadavers, to teach peripheral IV placements, intercostal nerve and stellate ganglion blocks, and other invasive procedures [10] [11] [12]. Guidance needle systems have also shown to improve procedure times and reduce the learning curve for medical students. Most notably, McVicar *et al.* randomized two groups of students that performed 30 simulated ultrasound nerve blocks on a porcine meat tissue phantom model with the study group utilizing the needle-tracking system. They assessed success rate and

learning curves and found that the needle guidance group reached competence more often and had fewer attempts than using conventional ultrasound [13]. These technologies provide a safe environment where students can learn the fundamentals of ultrasound-guided vascular access before attempting these procedures on patients. Many institutions and independent companies have since built their own simulators that link movement with real-time changes on anatomical computer programs. Some institutions have made transthoracic echocardiographic simulator training programs, FAST scan programs, and even transvaginal sonography simulations, and studies have shown positive results for these in medical school education [14] [15] [16] [17] [18].

Based on the current study, medical students at Louisiana State University School of Medicine-Shreveport showed readiness and motivation to learn about ultrasound. Most preferred learning about DVT, pulmonary, FAST, OB/GYN practices, needle localization, and venous access procedures. Most importantly, 93% of student respondents preferred to learn hands-on through a simulator. However, despite being motivated and wanting to learn about ultrasound, most were not confident and had poor knowledge on the aspects of ultrasound usage, as ultrasound training was not implemented in their medical school curriculum. These results, combined with the fact many different medical specialties use ultrasound, highlight an area of the education curriculum that can be improved upon at medical schools that currently do not have ultrasound training in their curriculum. SonoSim provides an interactive, hands-on case-based simulator that covers these practices and procedures while tracking and assessing student performance, and it can serve as an excellent addition to the pre-clinical ultrasound curriculum as it can easily be used by professors and faculty.

5. Limitations and Future Studies

While this study adds to the existing literature the idea that implementing ultrasound into the medical school curriculum can be very beneficial for medical students, it suffers from limitations. The biggest limitation is that the sample size was very small, as the study was only performed on 28 medical student volunteers. Due to this limited sample size likely, this survey best represents this population at this particular institution. Another limitation is that the study was also only done on fourth year medical students. Future studies that include a larger sample size and a greater diversity of medical students from different graduate years should be conducted.

6. Conclusions

As medical imaging innovation rapidly grows, it is imperative that the medical school curriculum should include a higher level of education in ultrasound concepts and principles. All medical students will benefit from a longitudinal exposure to radiology and ultrasound as they learn gross anatomy during pre-clinical years and progress into more advanced rotations in their clerkship year. Resi-

dents in various specialties have mentioned the lack of preparedness for ultrasound compared with other post-graduates from other medical schools. Although the current medical curriculum may have little room for additional modules and content, the implementation of ultrasound training is greatly needed for the greater framework of our education.

Conflicts of Interest

The authors declare no conflicts of interest.

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