Reviewer's report
Title: An Economical Strategy for Early Medical Education in Ultrasound

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Reviewer: David Bahner

Reviewer's report:
Ethics: The study was approved by the IRB and participants consented both verbally and in writing.

The authors describe a medical education study using ultrasound in short focused education utilizing minimal faculty time to develop a focused ultrasound curriculum for medical students and measure pre and post confidence and skills in a favorable fashion. The study looked at first year medical students and concluded that 1 faculty member can train 28 medical students over a 4 week period with 6 ½ hour training sessions and hands on practice.

The authors describe a study with one machine one faculty member, 6 30-minute hands on sessions, students grouped in pairs and 28 total students. The training occurs over 4 weeks but total faculty time is not reported. The authors list out a curriculum but it is superficial at best and in outline form. There is no clear content source, text book, website, LMS, or time accounting of learning outside of the 6 one half hour training sessions.

The methods consist of the authors describing the 2 main components of the US study the first being the 6 hands on training sessions of 30 minutes each. The second is a survey of confidence administered prior to and following the training sessions. Listed questions cover acquisition skills, knowledge elements, and confidence in performing the scans.

The authors model their assessment after Evans and Evans but fail to mention how they save the images or print them out. The faculty graded the images during the session to determine if they were of diagnostic quality. There are some details missing on how each learner recorded the
image. Did they save to the modality? Did they print them out? Did the faculty see it on the screen, complete an assessment and move on? Should more than one faculty grade the images?

The authors describe this as an economical analysis yet fail to report in hard metrics other than "time" and line 37 on page 8 detailing the price of gel 50$--$50. They use a GE LOGIQ e R7 with three probes (which are misrepresented in Hz when should be MHz). The authors do not detail the cost of the ultrasound machine or the cost of the simulation center or classrooms and only report the cost of the gel. (?)

On page 5 line 18 to 45 sound more like the conclusion with the authors reporting the findings of the study and it's implications. This is out of place.

The authors describe that participants were taught in pairs but there are 28 students and 6 modules. Not sure of the math. Also describe that one participant volunteered to sign a consent form and serve as a scanning subject. Was that one of the 2 in the pair? Did they switch? Was it another participant from another group? The authors don't totally clarify the arrangement of who scans whom. Were there alternatives if the students did not want to model?

In the background section on page 5 line 18 to 45 sound more like the conclusion with the authors reporting the findings of the study and it's implications.

In the Methods on page 6 line 30 the sentence sounds like a result rather than describe the methods of the study.

Table 1 on page 6 went over the Training Program Curriculum.
Of note in line 53 page 6 and again on page 7 line 49, Morrison's pouch should have one r Morison after James Rutherford Morison who described the hepatic renal recess.

Before the conclusions the authors try to summarize the results and put them into context. On page 13 line 17 The authors "...feel that since only eight hours per week required of the instructor that more time would be available for a single person to handle assessment." They end
with 'using pre recorded flipped classroom type lectures would also help to save faculty time" 
The last statement seems thrown in there and is a superficial comment on an areas that could be 
more clarified or expounded upon—educational content and learner expectations. As one gets 
through the paper, no mention of this study's educational flipped classroom or educational 
learning management system is mentioned.

The conclusions starts with "... an effective ultrasound training program does not need to tamper 
with already carefully crafted medical school curricula. --- I am not sure of the authors point 
do they 1. Negate their conclusions about ultrasound in med ed in "carefully crafted medical 
school curricula. Or 2. Teaching ultrasound to medical students can be worked into existing 
educational experiences during medical school.

Under Practical applications and future directions on page 14 beginning in line 27 the writing 
could be clearer. The above conclusions based on the time commitments and number of 
students somehow changes in the future directions. Now groups of 4 students complete 6 hours 
of training over 8 weeks. Then a single instructor could train 40 students throughout the course. 
The authors then speculate this could be offered once a quarter to accommodate 160 students 
over a year's time. The authors then comment on a summer elective with training of 30 students. 
The math does not seem to add up and the authors reporting and jumping from what was done to 
what is planned is confusing.

The reader is wondering how the authors went from a small sample of an underpowered study of 
learner confidence in ultrasound can be abstracted into the administrative needs of a much larger 
scale that is not in similar proportions to what the study reported. The authors seem to make 
substantial leaps in logic without explicitly explaining their rationale.

The sessions were well received by students and the testimonials personalize the experience. 
The authors describe 96% strongly agreed that the training sessions were beneficial and that it 
was enjoyable.
The question comes up on how the authors validated the survey instrument. How was it created? Was it expert opinion? Has it been used before? Can we trust the questions are not skewed or biased? The questions seem leading.

On page 9 it states Table 2 (Should table 2 be in the body of the text?) Why is Table 1 in the body of the text and not Table 2? Page 17 Starts Table 2: Where is table 1?

Figure 1 shows demonstrable improvement in pre and posttest questions in the various focused areas.

The manuscript reads as a construct for educating students and producing a highly enjoyable experience focused on ultrasound. The expansion of the results into future directions seems ambitious and not totally supported by the results reported in their study.

There is no specifics on the curriculum on where or what they learned from besides table 1 on page 6 and 7 that is only an outline at best.

I am still unclear on the math of how many students and the total faculty time if they worked in pairs. Does the faculty do 14 pairs of 6 sessions? (3 hours? Is the total faculty time 42 hours?). The faculty performed 8 hours per week for 4 weeks 32 hours (?).

The authors have a series of compounding components in this manuscript that call into question the entire document. The authors would benefit from a better description of the methods, the accounting of hours, the roles of each person and keeping the content in each section on topic and not bleeding into the wrong area.

The paper is lacking in clarity and over reaches with its conclusions. Reviewing their methods and what each student has to accomplish in their allotted times seems impractical unless ideal circumstances. As one digs deeper into the methods, more questions arise from the unclear writing.
Are the methods appropriate and well described?
If not, please specify what is required in your comments to the authors.
No

Does the work include the necessary controls?
If not, please specify which controls are required in your comments to the authors.
No

Are the conclusions drawn adequately supported by the data shown?
If not, please explain in your comments to the authors.
No

Are you able to assess any statistics in the manuscript or would you recommend an additional statistical review?
If an additional statistical review is recommended, please specify what aspects require further assessment in your comments to the editors.
I am able to assess the statistics

Quality of written English
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Not suitable for publication unless extensively edited

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If you can answer no to all of the above, write 'I declare that I have no competing interests' below. If your reply is yes to any, please give details below.

I declare that I have no competing interests. I have no current financial competing interests.

In my career I have received equipment loans from Sonosite and flew out to their offices to lecture in November 2015. I did not receive fees, funding, or salary but they arranged my airfare, accommodations and meals. I have no current fiduciary relationship with any ultrasound company.

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