Author’s response to reviews

Title: Implementing Blended Learning in Emergency Airway Management Training: A Randomized Controlled Trial

Authors:
Madeleine Huei Tze Kho (madeleine.kho.ht@gmail.com)
Keng Sheng Chew (cksheng74@yahoo.com)
Muhaimin Noor Azhar (muhaimin@um.edu.my)
Mohd Lotfi Hamzah (drlogp@yahoo.com)
Kee Man Chuah (kmchuah@unimas.my)
Aida Bustam (aiibustam@gmail.com)
Hiang Chuan Chan (hcc2000us@yahoo.com)

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Author’s response to reviews:
Point-by-point response to Reviewers’ comments

Reviewer #1:

Comment:
The results section detailing participant response to questionnaires to be overly long and difficulty reproducing this study in another setting based on the methodology reported

Response:
The results section has now been shortened. Detailed responses to the qualitative questionnaire are now tabulated in Table 3.

Comment:
Alternative forms of learning (eg- "flipped" or "inverted" classroom) should be mentioned and rationale for the choice of online learning given.
Response:

An additional paragraph describing flipped learning has now been added in the Background section (Lines 82-89):

A closely related learning approach known as the flipped learning (also called “the inverted classroom”), is a pedagogical model which reverses what typically occurs in classes [6]. Students are first exposed to the material outside of class, typically in the form of video-based lectures, and then class time is transformed into an interactive learning environment where students engage in activities for active learning such as problem solving, discussion, and analysis [6]. In this study, BL rather flipped learning was chosen as emergency airway management training still requires the instructor to take a central role during practical skills learning.

Comment:

It was not clear what the overall aims of emergency airway management training were (theory, skills, or human factors or all of the above), how these were derived (from local safety gaps identified, from the literature (eg- NAP4), from the content of other courses (as mentioned), or from college learning requirements or others) and which of these learning aims were best suited for online learning and why (eg- skills and human factors training may not be suitable for blended learning, but theory might), and which were best suited to other forms of learning and why.

Response:

Additional description to address the overall aim of the training workshop in addressing the safety gap as highlighted in the NAP4 has now been added in the Materials section (lines 151-153):

Besides training the participants in the fundamentals of airway management, this workshop also aimed to address the safety gaps identified in the 4th National Audit Project of The Royal College of Anaesthetists and The Difficult Airway Society (NAP4).

The selection and validation of the contents to be included in the online learning was done by a panel expert. This is addressed in the last paragraph of the Materials subsection (lines 157-160) and the first paragraph of the Procedures subsection (lines 165 – 181).

Comment:

More detail about the module topics and skills stations would be helpful (and whether module topics were the same for both the online learning and lecture-based learning groups).

Response:
The details of the module topics and skill stations are as listed in Supplementary Table 1.

Comment:

More detail on the video’s, quizzes, and forum topics for the online learning group would also be helpful, perhaps as supplemental material.

Response:

The details of videos and quizzes, etc can be found by accessing the openlearning.com with this url https://www.openlearning.com/courses/emergency-airway-management/HomePage
This has been described in the second paragraph under the Procedures subsection (lines 182-183).

Comment:

The derivation of the outcome measures (theory and practical assessment) and more detail on their content would be helpful.

Response:

The derivation of the questions is discussed in the first paragraph under the Procedure subsection (lines 177 – 182):

Experts also contributed to the assigned pre-test and post-test assessment questions (comprising of four sections, i.e., one best answer (OBA) questions, multiple true/false questions, “fill-in-the-blanks” questions and practical skills stations. See Supplementary Table 1 for the detailed descriptions).

Comment:

The participants were combined for the "one-day hands on session", were there any measures undertaken to prevent confounding (eg- separating groups into BL and F2FL)?

Response:

No measure was undertaken to prevent confounding influence among participants during the practical training. Nonetheless, this confounding effect is on the post-test performance, and not on the pre-test performance. This confounding effect is now listed in the limitation of the study (lines 345 – 347):

Similarly, participants in both arms were combined together during the practical training session and their interaction and discussions might have a confounding effect on the post-test performance.
Comment:

Were the assessors blinded to participant study arm?

Response:

Yes. This is now mentioned in line 223.

Comment:

The results section would benefit from significant shortening. Many of the results could be summarized, tabulated, or presented as supplementary (online) material only. Table 2 could be omitted.

Response:

The original Table 2 is now deleted. The results section is now shortened significantly, notably with regards to the participants’ responses to the qualitative questionnaire (shortened from 7 paragraphs of 1017 words to 1 paragraph of 189 words and the detailed responses are now tabulated in Table 4).

Comment:

Discussion: It is unclear what content was delivered by online learning, this would be worth clarifying in the methods and adding to the discussion.

Response:

The contents or topics delivered via online learning for participants in the blended learning arm are listed in Supplementary table 1 and the specific video lectures can be accessed by the public via the URL: https://www.openlearning.com/courses/emergency-airway-management/HomePage This link is now mentioned in line 184

Comment:

The theoretical discussion (lines 361-377) could be omitted or related directly to the outcome measures.

Response:

The theoretical discussion on Tobin’s framework is now shortened and rendered more focussed to the findings of this study.
Comment:

Limitations should include the internal validity only of study interventions, the potential for confounding by combining participants for the "one-day hands on session", the potential for bias if assessors were not blinded, and the fact that no patient-centered outcomes were targeted.

Response:

The suggested limitations are now included except for the fact that the assessor was blinded to the intervention arms of the participants (lines 342 – 356)

Comment:

Conclusion: without more detail on the content of online learning, it is difficult to say whether skill-based training delivered by online learning is equivalent to that delivered by lecture.

Response:

The conclusion is now shortened and focused to only its non-inferiority to face-to-face learning:

In conclusion, this study suggests that BL may be a feasible alternative to F2FL for skill-based training such as the emergency airway management training as it was shown that the effectiveness of the BL is non-inferior to F2FL.

Reviewer #2:

Comment:

The authors note that the BL course contents were with those delivered in the f2fL arm. What was the actual content - was it related to indications for airway intervention, procedural technique, pharmacology for airway management, etc.?

Response:

The details of the content of online learning are tabulated in Supplementary Table 1. The specific and exact contents of all materials in the BL arm can be viewed here from the link: https://www.openlearning.com/courses/emergency-airway-management/HomePage

This link is now mentioned in line 184
The authors estimate the online sessions would take approximately 40 minutes per day. Where did this estimate come from? Was timing performed during the vetting and revision of the materials to assess the accuracy of this estimate?

Response:

The estimation of 40 minutes is based on the following: personal time spent on online learning per day - 30 minutes for video lectures and lecture notes, and 10 minutes for other online activities. However, we realize that mentioning this 40-min duration is not only redundant but may add to more confusion. The important thing is that in both arms, the participants had been given the same duration of 12 days to go through the materials. Furthermore, we cannot be exactly sure how long each participants spent each day learning the materials. Hence, the 40-min per day timeframe is now deleted in the revised manuscript.

Comment:

The BL online materials were noted to include videos, manuals, and quizzes. In the discussion section, this is further identified as "online quizzes and activities such as crossword puzzles and 'fill in the blanks' with instant feedback in the form of answers." Did the presentation of the material in the f2f arm use similar techniques in the classroom? If not, it is possible that the online learning was improved because of engaging pedagogic strategies not available to those in the f2f workshop, and had similar approached been used in person that learning might have been enhanced. As the learners identify, these engaging strategies were "to help solidify the lessons learnt." Were the f2f participants offered the same learning strategies? Was there additional benefit of BL related to spaced learning, gamification, use of videos and dual channel learning, etc. that might also have been used with f2f? Similarly, the authors note that social networking was promoted in the BL arm, and in the results (line 220-227) suggest that this may have been beneficial for many learners. Were there equivalent efforts to promote discussion and sharing of ideas during the f2f workshop? The aim would be to have the two arms have equivalent active participation by learners in the two arms.

Response:

The optional online quizzes and the social networking or messaging application were included for participants in the BL arm. But these features were not included as part of traditional face-to-face learning precisely because these are considered as part of the enhancement feature of a blended learning environment. One would not expect online quizzes and the use of social networking applications in a typical face-to-face learning environment.

While we agree that ideally participants from both arms should have as many identical learning features as possible, this is not possible for the mere fact that as participants in the BL arm lacked the human contact and social interaction, this might already have disadvantaged them. In a sense, these additional enhancement features could be seen as a substitute for the lack of human contact in the BL arm.
Furthermore, as we have alluded in the 2nd paragraph in the Background section by citing Garrison and Kanuka (2004), “internet and technology is certainly involved, BL is not just about delivering or uploading old contents in a new medium. Rather, it involves a fundamental reconceptualization and restructuring of the entire learning process.”

The enhancement features in the BL arm therefore, should not be seen as an additional peripheries that might have disadvantaged participants in F2FL, but rather than these should be seen as part of the en bloc package of BL.

Comment:

Was there standardization of the teaching/experience during the simulated hands on component of the course for the two groups?

Response:

The contents of the learning materials were standardized for both arms, the mediums of delivering these contents were not.

Comment:

What was the actual content of the questions used to assess the impact of the educational interventions? Some information emerges from the open ended questions (lines 283-285), but specific assessment items are not offered. Perhaps an additional table or an appendix would be valuable.

Response:

The details of the content of online learning are tabulated in Supplementary Table 1. The specific and exact contents of all materials in the BL arm can be viewed here from the link: https://www.openlearning.com/courses/emergency-airway-management/HomePage

This link is now mentioned in line 184

Comment:

The authors provide a great deal of information regarding the secondary outcomes in the results section. It would be helpful to include a descriptive plan for these analyses in the methods section.

Response:
Thematic content analysis were performed on qualitative aspects of the feedback. This is now mentioned in the last sentence of the last paragraph under the Procedure subsection (lines 230-231).

Comment:

The measured outcomes are participant reactions to the instruction and change in knowledge. While these are helpful, they are considered lower level outcomes using Kirkpatrick's training evaluation model. Particularly for a procedural skill like advanced airway management, demonstration of improved procedural performance would be particularly valuable. Given all participants were onsite using simulators for one day, were there any attempts to assess behaviors/skills rather than just knowledge?

Response:

No. There was no assessment of on-site actual work competency on real patient. We mentioned the evaluation on actual behavioural or skill changes using Kirkpatrick Model as part of the potential future works.

Comment:

The authors report validation of skills stations (line 140), course objectives (line 149), and questionnaire items (line 155) were all validated. What was the methodology for validation of these materials? Content validity by expert consensus? Was a Delphi technique used? How were differences of opinion resolved?

Response:

The development and construction of the contents and assessment questions was done via a mini or modified Delphi method consisting of 3 rounds of online discussions – the first round was a video conferencing discussion, followed by 2 rounds of online discussion. This is now mentioned in the first paragraph of the Procedure subsection (lines 165 – 182).

Comment:

How was the sample size calculated? The authors note it was based on a prior study, but were the expected differences between the two groups in this study expected to be the same as in the Lancaster study? How were expected differences here estimated?

Response:

The sample size was calculated using a 2-mean formula based on Lancaster et al (2012) where it was found that the mean scores were 92.7 +/- 3.8 and 96.6 +/- 1.9 for traditional learning and
blended learning respectively. The sample size was calculated with 95% power of study with an alpha level of 0.05. This information is now added into the second paragraph of the Participants subsection (lines 140 – 148).

Comment:

Did any participants drop out of the study? If so, were these rates equal between the two groups? A flow diagram might be helpful.

Response:

None of these participants dropped out from the study. This information is now added in the first paragraph of the Results section (line 236).

Comment:

There is little reference to findings from prior work. It would be valuable to include references addressing the use of BL in other disciplines and/or alternative strategies for teaching airway management and how this study adds to that prior work.

Response:

The reference to Lancaster et al (2012), which is a work done on nursing education comparing effectiveness of traditional vs blended learning on pharmacotherapeutics. In fact, that paper was used as the reference to estimate our sample size.