Author’s response to reviews

Title: Medical students: what educational resources are they using?

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Cover Letter

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Medical students: what educational resources are they using?

Lucinda Wynter1, Annette Burgess1, Jack Edward Heron1, Jane Bleasel1

Dear reviewers,

Thank you for your helpful comments on our manuscript entitled “Medical students: what educational resources are they using?“ Please find below our response to your comments as well as the updated manuscript, with changes highlighted, attached.
Editor Comment 1:

“The major issue in the current version of the manuscript is the statistical analysis. This was indicated by both reviewers. We are aware that some statisticians permit using parametric methods with Likert data, yet this has limitations, needs to be discussed…”

We have now consulted a statistician regarding the paper and hope that we have now corrected the problematic statistical analysis.

For the concern about the limitations of using parametric statistics, we have added the following to the Methods section:

Since the survey scales employed are ordinal (Never=1, Always=7), the inability to assume equidistance between scale points complicates the use of parametric statistics. Although non-parametric alternatives are provided in the tables and appendices, finding no substantive differences between these in the results, means and standard deviations are reported in-text for ease of navigation.

We have amended Tables 2 and 4 to include the non-parametric data (Wilcoxon matched pairs and Mann-Whitney) data which demonstrates the above.

… “and on top of that, the type of analysis which is performed in the "Career Aspiration" section, where a non-binary categorical variable is introduced, clearly crosses boundaries what is possible with a simple t-test. The authors are advised to consult the paper with a statistician prior to resubmission and justify the statistical methods they use.”

A different approach has now been used to demonstrate the interplay between gender, career aspiration and preferred learning tools. Please see below additional paragraph. We have also removed the inappropriate use and reference to “controlling for gender” in the same section.
Career Aspiration

Resource use, both for learning new material and for the purpose of revision, differs substantially by career aspiration, which interacts in important ways with gender. Question banks, online interactive tools, and apps for learning new material form a reliable online learning scale (Cronbach’s $\alpha=0.76$), demonstrating that respondents pursuing careers in surgery/critical care use significantly more online resources for learning new material than those pursuing other careers ($t=2.4, p<0.05$). However, this effect is almost entirely driven by females. While there is no significant difference on this measure between males pursuing surgery/critical care and other careers ($t=0.4, p=0.7$), females pursuing other careers utilise less online learning materials than males ($t=1.9, p=0.05$), while females pursuing surgery/critical care consume significantly more ($t=2.4, p<0.05$; Figure 2). For revision, these items again form a reliable scale (Cronbach’s $\alpha=0.7$) and show an identical pattern by gender and career goals (Figure 2), with no difference between males pursuing surgery/critical care and other careers ($t=0.18, p=0.9$), but males utilising significantly more online resources than females pursuing “other” careers ($t=2.4, p<0.05$) and significantly less than females pursuing surgery/critical care ($t=2.3, p<0.05$).

The discussion has also been updated to reflect this change.

In addition, while interpreting correlations consider that the strength of detected correlations (r) is weak.

After further consultation with a statistician, we agree that in the section of “Predictors of Learning Behaviours: Age”, some of the correlations were too weak to be reported meaningfully and we have removed reference to the five weakest correlations with r values of less than 2.

Removed: for learning new material, age correlates with using medical apps (r=0.14, p<0.01) and inversely correlates with attending lectures in person (r=-0.14, p<0.01).

Removed: For the purpose of revision, “age correlates with watching lectures online (r=0.15, p=0.04) and using question banks (r=0.16, p<0.01) and inversely correlates with attending lectures in person (r=-0.13, p=0.01).
These weaker correlations are not referred to in our discussion.

The passage now reads:

Age

The resources used for learning new material and revising old material were correlated with age using a Pearson's correlation test (see Table 3). For the purpose of learning new material, age correlates with watching lectures online ($r=0.23$, $p<0.01$) and using question banks ($r=0.21$, $p<0.01$) but inversely correlates with attending small group tutorials ($r=-0.26$, $p<0.01$). For the purpose of revision, age inversely correlates with attending small group tutorials ($r=-0.23$, $p<0.01$).

Editor Comment 2:

Page 11: line 26. $t$-value should be 4.42 (not 0.01)

Corrected

Page 9: "Revising Old Material" paragraph: first sentence (line 52) is obvious in this context.

Removed

Table 1: typo in the total number of participants, 174+173 is 347 not 343.

Corrected

Captions of tables 2, 4. The way how you internally encode binary variables (learning, gender) is irrelevant to the reader as you do not use the codes in headers

Table 2 corrected to:

Comparison of the means, where Never=1, Always=7. A paired samples $t$ test was performed ($n=350$).
Table 4 corrected to:

Comparison of the means, where Never=1, Always=7. A paired samples t test was performed (n=350).

Reviewer 1, Comment 1

This is an interesting manuscript in which the authors explore the resources utilised by undergraduate and graduate medical students at two universities in Sydney. The rationale is clearly explained and, indeed, the whole manuscript is written succinctly and with clarity.

Consideration of the following specific points would allow the authors to enhance the manuscript.

Introduction

The introduction and rationale for the study are clear and comprehensive.

Thank you kindly for this feedback.

Reviewer 1, Comment 2

Methods

The method used for data collection is appropriate. It would be helpful for the exact questions asked to be included in the manuscript.

We have amended the methods section to include the wording of the questions asked:

The survey was designed by the authors. Students were asked to identify on a 7 point Likert scale, to “indicate to what extent you use the following educational resources for learning new skills and knowledge”, with the following resources then listed: “making written notes”, “attending lectures in person”, “reading medical textbooks”, “using online or downloaded question banks (single best answers and extended questions)”, “attending small group tutorials”, “watching online teaching videos”, “watching lectures online”, “consulting medical literature”, “using interactive online materials (not question banks)” and “using medical apps (other than question banks)”. They were then asked the same question but for “revising old skills and
knowledge”. Demographic information was collected included age, gender and future career interest (see Table 1) for sub-group analysis.

Reviewer 1, Comment 3

A 33% response rate is good for this type of survey, but because the survey was delivered online it is possible that a disproportionate number of the respondents like to work online and are more likely to make use of online resources. This needs to be discussed. Those less enamoured of online resources may be less likely to respond to an online survey.

Yes, thank you, we have added the following into our limitations section:

The response rate for the study was 32%. It is also possible that students who respond to an online survey are more likely to use online learning materials than those who do not. This is unlikely to cause a large skew in the data however, as both medical schools use online learning management systems and online assignment submission, so it is likely that most students are comfortable with using online platforms.

Reviewer 1, Comment 4

The authors have aggregated their Likert scale data and presented it as means and SDs. However Likert scales are ordinal. There is no guarantee that each person rates the difference between each pair of points on the scale identically. Neither can it be assumed that different individuals perceive the intervals in the same way to each other. It is therefore debatable whether these data should aggregated and meaned as if they were true numbers.

We have now consulted a statistician regarding the limitations of using parametric statistics and have added the following to the Methods section:

Since the survey scales employed are ordinal (Never=1, Always=7), the inability to assume equidistance between scale points complicates the use of parametric statistics. Although non-
parametric alternatives are provided in the tables, finding no substantive differences between these in the results, means and standard deviations are reported in-text for ease of navigation.

In addition, by aggregating data it is no longer possible to see the spread of the responses which, for this type of survey can be very illuminating. This point should be discussed and the decision to use mean data justified. In addition some illustrations of data distribution might be helpful.”

The decision to use mean data has been explained above but we have also included the histograms, in a new Appendix A, which displays the full distribution for interested readers.

See Appendix A

Reviewer 2, Comment 1

more information about question banks (pg. 6)

We feel that the description of question banks is adequate and suggest that “Question bank” is now a commonly understood term. We have however included more information on how they are being used. Two recent papers have directly studied online question bank use, the first in students studying for the USMLE (Ripp and Braun, 2017) and the second in the UK EMS exams, which correlated with improved pass rates (Clemency, 2017). See below changes:

Question banks have also emerged as a popular online learning tool. There are several commercially available question banks for medical students and doctors in training, including: ‘Passmedicine’, ‘PasTest’, ‘OnExamination’, ‘Examdoctor’ and ‘NEJM knowledge +’. Each has between 1500 and 6500 practice questions in the form of single best answer or extended matching questions, accompanied by practice exams, quizzes, images and feedback. Students are able to track their own progress over time and often compare their results with other students. They are used by students studying for the United States Medical Licensing Examination (Ripp and Braun, 2017), and associated with improved rates of passing the Emergency Medicine Services certification examinations in the United States (Clemency 2017). In these contexts, students are using the question banks to revise and practice exam technique for specific examinations. It is also possible that students are using question banks more broadly than this, for example, to learn new information for the first time. Harris and colleagues, generated a question bank of student-written multiple choice questions and made them available online to medical students at Cardiff University.13 They found a significant uptake, with 600 students using the resource within a three month trial period. It is not currently known, however, what
proportion of students use commercial online question banks and for what purpose: revision or learning new information.

Reviewer 2, Comment 2
line 26 of pg. 7 is a fragment
Corrected to:
“Finally, so that universities can more effectively allocate resources to develop education tools that students are likely to use.”

Reviewer 2, Comment 3
using two different programs weaken study

In order to address this comment, the following paragraph has been added to our Limitations section:

Inclusion of participants from two different universities potentially weakens this study, as the lecture programs, online resources and assessments will differ between universities, which may influence the learning resource preferences of students.

Reviewer 2, Comment 4
provide more detailed explanation of concept of "revising old skills" and "revision versus learning"

Question banks

Question banks have also emerged as a popular online learning tool. There are several commercially available question banks for medical students and doctors in training, including: ‘Passmedicine’, ‘PasTest’, ‘OnExamination’, ‘Examdoctor’ and ‘NEJM knowledge +’. Each has
between 1500 and 6500 practice questions in the form of single best answer or extended matching questions, accompanied by practice exams, quizzes, images and feedback. Students are able to track their own progress over time and often compare their results with other students. They are used by students studying for the United States Medical Licensing Examination (Ripp and Braun, 2017), and associated with improved rates of passing the Emergency Medicine certification examinations in the United States (Clemency 2017). In these contexts, students are using the question banks to revise and practice exam technique for specific examinations. It is also possible that students are using question banks more broadly than this, for example, to learn new information for the first time. Harris and colleagues, generated a question bank of student-written multiple choice questions and made them available online to medical students at Cardiff University. They found a significant uptake, with 600 students using the resource within a three month trial period. It is not currently known, however, what proportion of students use commercial online question banks and for what purpose: revision or learning new information.

Reviewer 2, Comment 5

line 6, pg 13: explain your categorization of careers (expected residencies?) particularly explain critical care typology

We have included clarification of “critical care” on page 16 under the heading “career choice”. This explains that in Australia “critical care training” can include anaesthetics, emergency medicine or intensive care medicine. Eventually trainees will pick one of these three to finish their training. We have also clarified surgical training, which to Australian interns means applying for a general surgical training position (SET) or subspecialised surgical training position after residency. We hope this is clearer. Please see below changes:

Career choice

Self-reported utilization of learning resources is also variable by career aspiration. Students aspiring to have a career in surgery, (which involves applying for a Surgical Education Training (SET) position or surgical sub-specialty training after residency), or critical care training, (which can include post-residency training in one, or a combination of intensive care medicine, anaesthetics and emergency medicine), are less likely to report attending lectures in person than those aspiring to other careers.
Reviewer 2, Comment 6

"like a game with a top score that needs to be beaten, appealing to the naturally competitive nature of medical students” need citation to support this

We agree that this assertion is probably a generalisation and so have removed the phrase “appealing to the naturally competitive nature of medical students”.

Reviewer 2, Comment 7

perhaps connect these gender findings to recommendations vis-a-vis programs and availability of question banks, pg. 15

We have made the connection between gender findings and recommendations more explicit, adding to the paragraph. See below:

Lecture attendance

Traditional resources such as attending lectures in person, making written notes and reading textbooks remain, the most utilized resources for learning new material. Although attending lectures or watching them online were identified as the least utilized resource for revision, medical schools should continue to focus on delivering high quality lectures for the purpose of students learning new material. This finding is mainly driven by female students who make written notes, attend lectures, read textbooks and attend small group tutorials more frequently than using question banks or other non-traditional resources for learning. It will be important for universities not to disregard traditional teaching methods, in lieu of online teaching tools, so as not to inadvertently disadvantage female students.

Thank you for taking the time to again review our manuscript.

Kind regards,

Lucinda Wynter