Author's response to reviews

Title: Motivating medical students to do research: a mixed methods study using Self-Determination Theory

Authors:

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Shaun Wang (S.Wang@uws.edu.au)
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Version: 3
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Author's response to reviews: see over
Dear Mr Aldrin Ulep,

Thank you for the opportunity to revise our original manuscript for publication in BMC Medical Education. We believe the referees comments have led to substantial improvements to our manuscript. Further, we have considered each comment and responded appropriately within the revised document. These have been detailed below in the point-by-point responses to the referees.

Sincerely,

Sara K Rosenkranz, Wendy Hu, and Shaun Wang

**Reviewer 1: Ralph Pinnock**

**Reviewer's report:**
The question posed is important and well-described, Well-designed appropriate methods. Conclusions consistent with data. No ethical issues.

**Level of interest:** An article whose findings are important to those with closely related research interests

**Quality of written English:** Acceptable

**Statistical review:** Yes, but I do not feel adequately qualified to assess the statistics.

**Declaration of competing interests:** 'I declare that I have no competing interests'

We would like to thank Dr. Pinnock for his kind review of our work. Since there were no revisions required from Dr. Pinnock, we have not made any alterations to our work in response to his review.
Reviewing 2: Rex Billington  
**Reviewer's report:** ‘Motivating medical students to do research: a mixed methods study using Self-Determination Theory’ Sara K Rosenkranz, Shaun Wang and Wendy Hu  
BMC Medical Education Research article.

We would like to thank Dr. Billington for his thoughtful review of our work. We have responded point-by-point to the issues he has raised, and have made corresponding changes to the manuscript (as shown in red).

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<th>Referee Comments</th>
<th>Author Responses to Query</th>
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<tr>
<td>1. The question posed by the authors is clear and well defined.</td>
<td>Thank you for your comment.</td>
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| 2. The methods used in the study in the study are appropriate, but there are a couple of areas that could be more fully reported:  
It would be useful to have the quantitative survey instrument in full in the paper. I did not try to access reference 26 and note 6 derived questions in the script. But the full scale is central to the study such that it should be in the paper. The scales open ended data questions are not reported nor seem to be made use of either. Additionally, reporting the psychometric properties of the scale would help convince of its validity and reliability. (minor essential additions). | We thank the reviewer for these comments. We chose not to include the full survey instrument, for the following reasons. First, the surveys were adapted slightly to account for previous and current research experiences for each year cohort of the 5 year program, resulting in 5 different surveys. Including these, would have led to reader confusion. Second, the study was exploratory in nature and so we are not attempting to present a data collection instrument that arose from, or was grounded in theory. Third, the survey questions were developed as described, from the literature and consensus from experienced medical student research supervisors, so was not subjected to psychometric testing. Fourth, one of the authors (SW) performed an independent thematic analysis of the free text responses from the survey tool and did not find any additional themes. We did not include this data as the paper is already very long and this would not have provided any additional insights. Finally, the information provided in the paper, such as the 6 derived questions and the tables of results about prior research experience actually summarize all the key content covered in the survey, so appending the full survey would not additionally inform the reader. Given the referee’s comments, however, we have included additional information about the survey’s content and findings within the |
Questions asked students about the type, duration, quality and any outcomes from their research experience prior to and during medical school (closed-ended dichotomous and open-ended free text questions), intention to conduct research afterwards (quantitative estimate of likelihood), and level of agreement with attitudinal statements regarding research (5 scale Likert items: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree). The survey was slightly adapted for each year cohort to account for cumulative research experiences in each year of the program.

Free text responses in the questionnaire (n = 184 responses for all years) underwent independent thematic analysis by one of the authors (SW) and was compared with themes from the qualitative interviews through joint iterative discussion (WH, SR). No new insights or themes were identified from the free text responses.

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<p>| Details of when and how the scale was administered to each class would be helpful. Fuller definitions of the 3 domains of the SDT in the paper would be useful because they may not be well known to readers with only a medical and biological background. (minor essential addition) |
| Per the referee’s request, we have added information regarding how the scale was administered to each class within the text of the manuscript. |
| Students in all Years were invited to complete a written survey between 2011-3. Two cohorts of final year students were sampled due to the lower enrolments in the first graduating cohort of the medical school in 2011. Paper-based surveys and participant information sheets were distributed as questionnaires during mandatory sessions of the medical program, including small and large group sessions. Completed surveys were collected at the end of these sessions, after teaching activities had been conducted. |</p>
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<th>We have added more comprehensive definitions for the 3 domains of SDT as requested by the reviewer.</th>
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<td>In SDT, Autonomy, or behaviors initiated with a sense of volition and choice [19]; Competence, or being effective, optimally challenged, exercising personal capacity and extending skills [19]; and Relatedness, or having secure attachments, being involved in caring relationships, and a sense of connection with a group purpose and ideals [19,21], are psychological needs that when fulfilled, promote positive functioning in the educational context [20,22]. Previous research has found that environments that promote autonomy (such as by increasing student choice) rather than reducing it increase intrinsic motivation [22]. Further, external regulation, a form of controlled motivation, describes acting only to receive an external reward, or avoid a punishment, or comply with social pressure. In contrast, identified regulation, a form of autonomous motivation, occurs when an individual identifies highly with the importance or value of a behavior or practice [20,22]. In the SDT model of change, autonomy serves to facilitate an increased sense of competence, but competence alone is not sufficient to ensure change or adherence. Rather, competence must be associated with increased autonomy. Finally, based on the idea that humans possess the universal need to interact, social environments can positively influence relatedness (such as a sense of belonging) or can be a negative influence, disrupting the processes of growth and integration.</td>
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<td>Self-determination is also specific to particular behaviors, and applied to student learning, SDT begins with the premise that students are intrinsically motivated to learn and be challenged intellectually. To remain intact and grow, this innate motivation should be supported by interactions in the social environment that satisfy both intrinsic and extrinsic motivators in the three domains. Over time, the effect of these experiences is internalized so that research, for example,</td>
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becomes inherently interesting or enjoyable, and students become more intrinsically motivated to continue research, and more likely to take up research as graduates. Conversely, according to SDT, when students perceive that the primary focus of learning is to obtain external rewards, such as exam grades, they can perform more poorly due to a negative effect on intrinsic motivation [23].

It would have been very useful for the students to have taken the multidimensional IMI scale with perhaps its 6/7 subscales reflected in the analysis. However the discussion section does make use of the domains of this scale in analyses dialogue and does it well. (no action)

Thank you for this insightful comment. We were aware of the intrinsic motivation inventory (IMI), however, it was not possible for us to add an additional 45 questions to our survey given the time constraints of our data collection. Second, SDT was not used a priori for our study, but rather as a theoretical framework upon which our data analysis and synthesis took place. In the future, validation work would be very useful, using the IMI as well as the survey instruments from the current study.

Sequential triangulation is the key approach used and it would be useful to know to what extent the SDT or IMI scale were well known to the researchers and influenced their interviews with students. At least some statement about this could be made. (minor addition). But all in all the quantitative analysis method is clearly reported.

We have added the following section to the methods for qualitative interviews.

The additional section reads as follows:

It is also important to note here that while authors had prior knowledge of SDT, the interview questions were not guided by SDT resulting in more authentically grounded results.

When did the medical school begin?

The medical school began in 2007. This statement has been added to the context section of the manuscript.

The new section reads as follows:

The study setting is a recently established medical school (2007) in a public University with an emerging medical research profile.

3. The sample distinguishes between males and females but no gender analysis is made. Any reason for this (no action). Not having and age analysis was argued however. Was the data collected in year 4 at

This is a great question. The primary reason we did not engage in any comparison between males and females for the current study is that this was not the research question. Secondarily, for some of the year
the end of the academic year following their community research exercise or when and clinical training? (minor additional distinction) Although the composition of the interviewed group of 23 is well described, the reason(s) behind the selection of those students interviewed might be noted. (minor addition).

cohorts, there was a relatively small sample size, and by dichotomizing according to sex, our power would have been reduced to the point that differences and associations could not be seen.

We have now added a section in our paper to reflect more precisely when the data was collected in year 4.

For Year 4, data were collected following completion of the CR project.

Additionally a statement regarding the sampling for the interviewees has been added.

Purposive sampling of those who gave consent in the survey for further contact, was used to sample views from all Years and levels of experience; from Year 1 students with no prior research experience to students who conducted doctoral research, to final year students who had completed the compulsory research program. This sampling strategy allowed for data across key variables likely to affect the range of student experiences with research to be gathered.

The data in general are sound. Line 219 and 220 report low correlations that challenge the practical usefulness of the relationships to which they refer. Likewise the table 2 presenting the similarity and differences across the 5 years and the pre/post clinical student comparison for the do not show practical significance. Good to know though.

We agree that many of the associations and year comparisons were statistically significant, but with questionable clinical or practical utility. As mentioned, we also thought these statistics reflected questions that the readers might want to know about and also agree that these associations and differences between years were good to know.

Figure 2 is a little confusing particularly box 2 where external “threats” to internalization may be considered more reasonably as “factors requiring change”.

Thank you for the thoughtful comment. In keeping with comment and response below that external factors are neither “bad” or “good”, we have changed the label to “External factors predominate” and to be consistent, also changed “External factors recede, motivation internalised” in the corresponding part of Figure 2.

All through the paper external motivational factors are considered as bad and
only internal motivational states are “acceptable”. Is this real? (consideration).

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Thank you for your comment. In keeping with SDT, however, the point we were trying to convey was that as motivators for doing research are increasingly internalized, the likelihood of intention to pursue research following graduation from medical school is increased. So, where motivation to do research comes solely from external motivators (which may act in either direction, so are neither “bad” or “good”), this is likely to lead to a lower likelihood of pursuing research post-graduation, particularly as external motivators are context dependent, and may not operate in post-graduate context.

One important section within our introduction which highlights this point is the following:

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4. The figures appear to be genuine. The 4th paragraph of para 2 above should be noted in this context.  

Apologies as we are not sure what was intended by this statement, and therefore, we are unable to address this comment.

5. The manuscript adheres to standards. However, the attached additional material giving the some interview transcript highlights of some students was both interesting and explanatory. Space probably precludes its addition to the paper. (Editors rules and option).

We agree, however, given the word and table limits for the journal, we wanted to adhere to standards and chose to add these materials in as additional material rather than a part of the main manuscript. We agree that the Editor should reserve the right to present the material in the appropriate way.

6. The discussion section was well done. The development of individual facets of the SDT to research activity were well reasoned and connected to the community research project. It makes an overall strong case for curriculum planners to seek and use student opinion survey data in their work besides classroom and clinical evaluation. Perhaps more could be discussed about how the autonomy domain external motivators with time and maturity may eventually become internal motivators upon graduation and medical experience.

We have added a short section about the autonomy domain external motivators and how they could become internal motivators with time and maturity. We thank you for this suggested improvement.

The additional section reads as follows:
As mentioned previously, in the SDT model of change, autonomy serves to facilitate an increased sense of competence, and competence alone is not sufficient to ensure change or adherence, but rather, must be associated with increased autonomy. Since external motivators are likely to be context dependent (e.g. money, time) these may not hold in the postgraduate context, making it all the more important to internalize motivation as undergraduates.

7. The limitations section mentions the need for longitudinal research to further understand the relationship of the 4th year research exercise to clinical practice upon graduation from this school. Good point. It challenges other medical schools to examine their approaches to fostering research.

We agree! This is ultimately our hope.

8. 9. 10. No special comment. Satisfactory. Overall an interesting paper that suggests the value of studying the impact of an educational activity/course on student development and their career preparation. An article whose findings are important to those with closely related research interests. Written English - Acceptable.

Thank you for your comments.
Quality of figures - Acceptable  
No, the manuscript does not need to be seen by a statistician.  
I declare that I have no competing interests.  
Accept after minor essential revisions (which the authors can be trusted to make).

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Thank you for your comments.