Reviewer’s report

Title: Virtual reality technology for teaching neurosurgery of skull base tumor

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Reviewer: Sonny Chan

Reviewer's report:

The authors of the manuscript describe the findings from a study assessing the efficacy of virtual reality technology for instruction of skull base anatomy and surgical intervention methods for tumor resection. They enrolled 30 undergraduate medical students into the study, half in a control group exposed to traditional learning materials, and half in the experimental group who used VR learning technologies.

The study found that learners in the experiment VR group performed better on a theoretical knowledge assessment, and self-reported a higher level of engagement, though no statistically significant differences were observed when assessing knowledge of intervention methods. These findings are very consistent with Stepan et al.'s work, cited as reference [12]. Indeed, my primary concern with the manuscript at hand is that it largely replicates the study from [12], but adds little in terms of new insights or findings -- the only notable difference I can see being a slight improvement in the learning of theoretical knowledge. Still, there may some value in publishing these findings.

The writing is generally good, though some explanations of the methodologies used are somewhat vague or unclear. I would strongly encourage the authors to use Stepan et al.'s article as a guideline and standard for clear, concise, and correct written presentation of study and analysis methodology.

A few specific questions and comments:

1. In Methods, Data Collection: Who performed the image processing and preparation of the 10 patient models for VR? Were any standardized methods or techniques used in the preparation? Or were the anatomical models created at the "best discretion" of the operator?

2. In Methods, Teaching Methods: Was it a conscious decision not to expose the experimental group to the traditional learning materials at all? And if the intent was to teach specific surgical intervention techniques, why not expose the control group to real case data (but without AR or VR)?

3. In Discussion: Many of the advantages of using VR are discussed, but none of the limitations or current weaknesses of VR for teaching surgical anatomy are mentioned. I am concerned that the result is a rather one-sided discussion that does not represent the reality of the present state of affairs. Additionally, it's state that "the excellent interaction provided by virtual technology..." but reviewing the supplementary video would indicate to me that the interaction is anything but "excellent".

Overall, I believe this research has merit and represents some contribution to the body of knowledge related to the use of VR/AR technology in surgical education. I would recommend that revisions be made to improve the clarity in the description of the methodology, and a revisiting of the discussion of results, before the manuscript is accepted for publication.
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.

Yes

Are the conclusions drawn adequately supported by the data shown?
If not, please explain in your comments to the authors.

Yes

Are you able to assess any statistics in the manuscript or would you recommend an additional statistical review?
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I am able to assess the statistics

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Needs some language corrections before being published

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