Response to Reviewer’s Comments for ‘Tools for High-Tech Tool Use: A Framework and Heuristics for Using Interactive Simulations’

Dear Kimberly Olivares,

We are pleased to submit our revised manuscript “Tools for High-Tech Tool Use: A Framework and Heuristics for Using Interactive Simulations”. We would like to thank the reviewer for their thoughtful and constructive comments. Below, we describe our responses to the reviewer’s comments. For each section, the reviewer’s comments are presented in italics, and our responses follow in regular font.

We are excited to have our work published in the *Journal of Teaching and Learning with Technology* and hope this article will have a positive impact on the technology education community.

Sincerely,
Daniel Rehn

1. Purpose: Goals, Objectives, Rationale, Research Question, and Hypothesis

 *Clear, well written.*

We have not changed anything in this section.

2. Background: Theoretical Framework, Literature Review

*Acceptable; this could be expanded but given the length of the article I think it is okay.*

We have not changed anything in this section, but attend to literature review and theory more in the discussion at the end.

3. Methodology: Participants, instruments, data collection, and data analysis

*Focus less on content of quantum tunneling and more on applying heuristics – remember this journal is not specific to physics or chemistry; also since this journal is not for K-12, significantly reduce the discussion of the second case*

We agree with the reviewer that the focus of the section should not be too heavily centered on the physics of quantum tunneling, but instead, more on the pedagogy. We have minimized the length of the quantum tunneling overview as much as possible. However, because the application of the framework and heuristics provided in later sections depend on this introductory section, we feel we cannot shorten it further. We have added a prefacing sentence in the opening paragraphs of this section (Section V., pg. 13) to better inform the reader on why this background is provided:

“This section provides the minimum amount of background necessary for understanding the design of the assignment and simulation, and can be skipped by those already familiar with the conceptual foundations of quantum tunneling.”

In the second case study, we followed the reviewer’s recommendation in shortening the section (roughly one page of material has been removed). We also wish to further explain our rationale for using this study, and as noted below, include this framing in the paper itself:

1) This section presents a case study where the heuristics and framework were successfully implemented, unlike the quantum tunneling case study, where the heuristics were not implemented. We feel that presenting a case study showing the success of this approach is important in supporting the utility of the framework and heuristics.

2) The study is used to show the robustness of the heuristics across different environments. The fact that the heuristics can be used in radically different environments is an essential point that we wish to convey to readers.

3) While the study was conducted in a middle school classroom, we know that a similar approach could be used in a college setting. For example, prior literature shows that using and understanding molecular formulae are prominent difficulties even for students in college-level chemistry classes (Davidowitz, 2010; Sanger, 2005).

Davidowitz, B., Chittleborough, G., & Murray, E. (2010). What can student-generated diagrams tell us about their understanding of chemical equations? SAARMSTE 2010: Proceedings of the 18th Annual Meeting of the Southern African Association for Research in Mathematics, Science and Technology Education: Crossing the Boundaries, 51-58.

Sanger, M. J. (2005). Evaluating students' conceptual understanding of balanced equations and stoichiometric ratios using a particulate drawing. Journal of Chemical Education, 82(1), 131-134.

In order to address these issues, we have changed the second paragraph in Section IV. (pg. 12) to end with:

“While the molecule-building assignment was used in a middle school classroom, a similar implementation process can be followed in a college level classroom. Student difficulties with chemistry content – specifically, molecular formulae – have been well documented at the college level (Davidowitz, 2010; Sanger, 2005), and our findings therefore likely apply to college level chemistry courses.”

We have also changed a sentence at the end of the first paragraph in Section VI. (pg. 27) to read:

“Furthermore, this assignment addresses content that spans a wide range of audiences, including college students who struggle with understanding molecular formulae (Davidowitz, 2010; Sanger, 2005.)”

Additionally, we have added the following sentence to the end of the last paragraph of Section I (pg. 5) to emphasize our rationale for using the study, as mentioned above:

“The second study demonstrates the effective application of the heuristics, their applicability to a wide range of environments, and highlights approaches that span from middle school to college.”

4. Findings: Data summaries, Statistical significance, assertions, and themes

 *The organization of this worked for me*

We have not changed anything along these lines.

5. Conclusion: Discussion, Implications

*I'd like to see this section expanded - how do the current findings relate to prior research and theory?*

We have significantly expanded the conclusion to incorporate details on how this paper relates to prior research and theory. Because the changes are somewhat lengthy, we do not include them here.

6. Presentation: Format, style, and organization

 *Overall, I liked the format, style, and organization of this manuscript.*

We have not changed anything along these lines.

7. Substance: Detail, Length, Scope, and Coverage

 *Please see above comments and comments on the manuscript - second case needs to be minimized; both cases need to be revised for a more general audience; the point of this article is not the science but the pedagogy*

Again, we thank the reviewer and editor for detailed comments and suggestions that have helped us improve the paper.