Author’s response to reviews

Title: Virtual Reality among the Elderly: a Usefulness and Acceptance Study from Taiwan

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Author’s response to reviews:

Dear Reviewers,

We are thankful for your review of our manuscript and appreciate all your comments and suggestions. We have modified the manuscript (using track changes) as per your feedback as below.

Reviewer 1
Reviewer reports:

1. Mario Ulises Pérez-Zepeda, M.D., M.Sc. (Reviewer 1): This manuscript is about a relevant topic in aging, including technology and in particular virtual reality in order to ameliorate older adults' conditions. Unfortunately there are a number of important concerns:

   - Active ageing is not more physical activity. The title is misleading and should be changed. As can be seen in a document from the WHO, active ageing is defined as: the process of optimizing opportunities for health, participation and security in order to enhance quality of life as people age. The free complete text 'Active ageing:a policy framework can be downloaded from https://www.who.int/ageing/publications/active_ageing/en/ And is not how the authors are thinking about active ageing, from what can be read in the introduction, authors thing an older adult with active aging is just more physically active. That is a conceptual mistake.
     • Thank you for the suggestion. We have modified the title of this manuscript as below: Virtual Reality for Active Ageing among Elderly: A Usability and Acceptance Study from Taiwan

   - The manuscript needs and overall revision of style. It is in general well-written but there are still some sections that need arrangement.
     • The revised manuscript has now been re-arranged and modified for the introduction, methods, results and discussion.

   - The abstract needs to be written all over again. It leaves too many questions of what the study is about. In addition, there is this 'SUS' acronym that is not defined. Moreover, it is suggested not to include acronyms in abstracts, so please try to avoid them in the abstract.
     • Thank you for pointing out this. We have removed the SUS acronym and completely modified the abstract to pertain to the study aims.

   - The conceptual frame about the TAM is the best part of the paper, however, what authors actually present is a validity study of a questionnaire. Hypothesis cannot be addressed by the methodology used by the authors. They just present the construct validity of a questionnaire. Moreover, it is not clear what the role of the use of the VR. Some questions arise from this; what was the perception of the older adults previous to the exposition? Why not making the questionnaire without the exposition? Would two set of questionnaires would gave different results? What would happen if the older adults were exposed to different software/hardware?
     • We have revised the manuscript, the conceptual model of TAM, included a theoretical rationale for the TAM variables, reformulated the hypothesis (all can be found in the Introduction—Research Model section), and also changed the methodology of statistical analysis (Methods—Data analysis). VR can be used to encourage physical activity, motivate the elderly age groups, and help improve mental health while ageing.

   - Statistics are poor, and by no means should a manuscript include a copy-paste directly from the software program, this table should be deleted.
     • The statistical analysis methods have now been modified to −Cronbach’s alpha reliability analysis, factor analysis and linear regression. The previous results from the statistical software program are replaced by new results.

   - In summary, authors should present their work as the testing for validity of a scale, and re-write the manuscript with that in mind. Discussion are overreaching, anything the authors write can be drawn
from their results.
• Thank you for the suggestion. We have re-written the manuscript methods as per the suggestions, and also have modified the “Discussion” section, pertaining to what can be drawn from the results of our study.

Reviewer 2

Jason Fanning (Reviewer 2): Thank you for the opportunity to review this work. The authors present a small single-arm pilot study on older adults' perceptions of nine virtual reality (VR) applications. The authors collected data on constructs from several applied (the TAM) and theoretical models (TPB), and reported basic Pearson correlations. It is not clear that the authors have conducted a preliminary review of physical activity promotion efforts for older adults, behavioral mechanisms driving effective studies, or the current state of technology-supported activity interventions. The methods are poorly described and appear unsystematic. The results are unclear, and the discussion seems unrelated to the data collected and the results reported. This reviewer believes the authors would benefit from a review of both the content and structure of other work in the area, and a careful rewrite of this manuscript. Due to the low quality of the writing and reporting, I have focused only on broad issues:

General Comments
1. A thorough rewrite is needed to iron out issues related to wording and grammar. Likely because of issues in this area, the entire manuscript reads as superficial and unorganized. A thorough and careful rewrite my address many of the issues outlined here.
• We have modified and re-arranged the entire manuscript for the introduction, methods, results and discussion.

2. The structure of the manuscript as a whole is rather sloppy, with much of the important information missing (e.g., any information on rationale for the statistical test used; the data on the "discussion"/qualitative content the authors note in the abstract) or misplaced (e.g., information on measures and statistical tests in the introduction and results sections). A quick review of other published work and the use of a reporting checklist may help with this.
• Thank you for the suggestion. We have revised the manuscript, the conceptual model of TAM, included a theoretical rationale for the TAM variables, reformulated the hypothesis (all can be found in the Introduction—Research Model section), and also changed the methodology of statistical analysis (Methods—Data analysis). The statistical analysis methods have now been modified to –Cronbach’s alpha reliability analysis, factor analysis and linear regression.

3. Similarly, it seems as though many important ideas are poorly understood by the authors. For instance, the authors seem to pick single constructs from a number of theories (e.g., the intentions construct from theory of planned behavior) but do not assess the other key constructs (e.g., perceived behavioral control, attitudes, norms) nor their relationships. They seem to suggest that the system usability scale is a statistical test, and try to derive causative relationships from Pearson correlations. The descriptives table does not contain most demographic variables and is very oddly formatted. Key figures are not logical.
• We have modified the hypothesis and the construct of the research model (all can be found in the Introduction—Research Model section) and also included a theoretical rationale for the development of hypothesis and the construction of variables for the questionnaire.
• The system usability scale results have been removed from the manuscript.
• The demographic characteristics table has now been modified (Results-Table 1).
• The figure of the summary of responses has also been modified based on percentages of responses. (Figure 2)

Specific Comments:

1. Abstract
1.1. It is unclear what the primary outcome measure is, whether formal qualitative assessment procedures were used, and the study design employed. Several measures show up in the results section that are not mentioned earlier.
• Thank you for the suggestion. We have modified the abstract to comply with the purpose of the study.

1.2. The results note effects on measures that are not collected, including physical activity and mental health outcomes.
• We have modified the abstract for the results to note the effects on the measures that were collected, as below:

Results: In total, six male and twenty-four female participants aged 60-95 years volunteered to participate in the study. Perceived usefulness, perceived ease of use, social norms and perceived enjoyment were seen to have a significant effect on the intention to use VR. Participants showed agreements to a large extent with regards to the perceived usefulness, perceived enjoyment and their experience to use VR. Thus, VR was seen to have high acceptance among elderly population.

2. Introduction
2.1. It is recommended that the authors refrain from ageist wording, such as "There will always be two problems addressing older populations: declining productivity and increasing health expenditure." This may just be an artifact of word choice, but is something worth considering.
• Thank you for pointing this. These sentences have been modified or removed from the introduction.

2.2. The authors do a poor job of covering the very large body of intervention science specifically focused on promoting physical activity among older adults. Similarly, they do not discuss many of the core limitations of virtual reality and gamified interventions. Most notable is the very short duration of effects. A more focused discussion on existing physical activity interventions for older adults, the core behavioral mechanisms underlying those that are successful, and a clear indication of how the short term influence of VR and another gamified techniques may fit into these broader intervention frameworks is needed.
• We have modified the entire introduction based on the suggestions. In our study, we are focusing on the acceptance and usefulness of VR among the older population. Some limitations of the VR have been included in the Discussion section of the manuscript.
3. Research Model

3.1. It is unclear what the authors are indicating with H1-H5. This paragraph also appears to be laying out the measures used, which would be more appropriately done in a more clear manner in the methods section.

- We have reformulated the hypothesis from H1-H7, and also added a theoretical rationale, in the section: Introduction—Research Model. Because it describes the derived research model, we have included it in the introduction section.

3.2. Is there a theoretical rationale for the research model detailed in Figure 1? It seems as though the authors simply selected a handful of constructs from different frameworks and tossed them together.

- Thank you for the suggestion. We have now included a detailed theoretical rationale for the derivation of the variables of the research model, and also modified the figure 1.

3.3. The authors note that they utilized theory of planned behavior, but do not report on other central variables, including perceived behavioral control or attitudes. They also do not assess the relationships as detailed in the theory of planned behavior. Importantly, the authors also stop at intentions rather than assessing activity behavior itself.

- Thank you for pointing out this. We have modified the theory to be based on TAM and reviewed literature, including social norms and perceived enjoyment from Venkatesh. It can be found in the ‘Introduction’ section in the first paragraph of the ‘Research model’.

4. Methods

4.1. The system usability scale is a questionnaire, not a statistical test.

- The system usability scale has now been removed.

4.2. The authors need to report whether assumptions were checked for correlations.

- We have modified the methodology and included the linear regression analysis to check for the relationships among the variables for the assumptions, as below:

  - Methods—Data analysis: Linear regression analysis was utilized to identify relationships among the variables: perceived usefulness, perceived ease of use, user experience, social norms, perceived enjoyment, and intention to use VR. The means of variables were used for regression analyses.

  - Results—Linear regression analysis: H1, H2, H4 and H5 were tested by using linear regression analyses (Table 4a). The regression results indicated that perceived usefulness, perceived ease of use, perceived enjoyment and social norms have a significant influence on the intention to use VR with p-value < 0.05.

  - The regression analyses for H3 and H6 are shown in Table 4b. The results indicated that perceived ease of use and user experience have a significant effect on the perceived usefulness of VR with p-value < 0.05.

  - For H7 (Table 4c) user experience showed significant effect on perceived ease of use with p-value < 0.05.

4.3. A rationale is not given for the use of basic correlations here, and it seems as though correlations do not suite the story the authors are trying to assemble.
We have added a rationale for the basic correlations, in the section- Introduction—Research Model.

5. Results
5.1. The descriptive characteristics table is very odd - the authors would benefit from a quick review of other manuscripts to see how these are typically done.
   • Thank you for pointing out this. We have modified the table 1.

5.2. Why do none of the bars rise to 100%? These should be percentages, correct?
   • In the previous version of the manuscript, the graph was designed as per each question answered by the respondent in each item of the variable (for instance, 3 questions answered by 30 respondents for PU, makes it total up to 90 responses). However, to make it simple and easy to understand, we have modified the figure as per the percentages of the responses.

5.3. The authors follow an odd reporting format, often including methods content and skipping over much of the important content, commenting on significance without displaying p values, etc.
   • We have modified the methods of analysis and the results obtained, including p-values from the analysis. (Table 4)

5.4. The abstract suggested that qualitative interviews were conducted - where is this information?
Since the qualitative discussions did not yield any additional information about the use of VR apart from what was asked in the questionnaires, we have removed this part from the abstract and the manuscript.

6. Discussion
6.1. The results are very much over-interpreted, with causative language being used frequently. The results only show that those who generally liked the system also tended to want to use it more. This is intuitive and not illustrative of the utility of this as a tool for promoting physical activity in older adults. The lack of physical activity data make it very hard to determine whether using the VR headsets indeed promotes activity as the authors hope it does.
   • We have now modified the discussion section, to explain the obtained results, and removed the part that explained about promoting physical activity.

6.2. Discussion that falls outside off the data collected, including discussion of effects on physical activity and mental health, should be removed from the manuscript.
   • Thank you for the suggestion. We have removed the discussions related to effects on physical activity and mental health.