

# Answers to the comments made by reviewers on the manuscript titled “Review of augmented paper systems in education: an orchestration perspective”

*August 22, 2014*

Dear Prof. Kinshuk,

We have revised our paper “Review of augmented paper systems in education: an orchestration perspective” according to the recommendations made by the two reviewers. In the subsequent pages, we answer to the issues raised by each reviewer, and summarize the changes done to the manuscript as a consequence.

It is worth noting that we have had to reduce the manuscript length to comply with the journal’s 9000-word limit. Thus, aside from the changes due to the reviewer’s comments, there has been a general shortening of the prose and elimination of superfluous references (none of them within the target studies of our review). If you believe that such reduction has damaged the integrity of the manuscript, a longer version of the manuscript could also be provided.

In our responses below, we have employed the following format:

1. The comment of the reviewer is reproduced **in bold font style**.
2. We provide *answers* to the reviewer’s comments.
3. We indicate the *modifications which have been made* as a consequence in the resubmitted manuscript.

## Reviewer #1

This review is comprehensive, well-focussed, and examines attempts to integrate technology within formal education through an "augmented paper" concept. This is important as the educational deployment of ICT is sporadic with uneven linkages between research and practice. The literature review applies the notion of "classroom orchestration" to identify elements of interest (of agreement and tension) which can guide a review of paper-based computing systems applied to education noting their advantages and difficulties for learning. The paper sets out a commentary on the evaluations of the practical applications of such systems under a framework of "classroom orchestration" as an aid in underlining the potential and the challenges which the technological approaches present. Following this, the discussion points to the lack of continuity (and to limitations) in lines of research, requirements for further developing (via authentic evaluation studies) the notion of classroom orchestration, and some challenges which remain in exploiting technological developments in education.

This study is comprehensive, was carefully planned and executed and well-referenced. It is wide-ranging in its scope and thought, and adequately illustrated in its coverage, with clear discussion. It is a very useful document for researchers and practitioners interested in applying technology effectively in educational contexts where paper holds a strong presence....especially bearing in mind the rapid developments in tablets and apps. However there is much material here and many lines of inquiry, and it would be useful if the authors, from their experience, were able to suggest (in a paragraph) what they would regard as significant next steps that would feature in their further work.

**Answer:** We agree with the reviewer that our survey covers many different lines of work from a variety of perspectives, from human-computer interaction to pedagogy, which may make it difficult to extract a coherent set of open challenges to be addressed in the future. However, this should be addressed in the revised manuscript.

**Changes in the manuscript:** We have reorganized the last sections (merging the discussion and conclusions, due to space restrictions), and we have gathered the directions for future research (which were scattered in these sections) in the two last paragraphs of the manuscript.

## Reviewer #2

**This article presents a survey of augmented paper systems in education.**

**I am generally very positive about this article. First of all, as the authors convincingly point out, it is a relevant topic given that no prior survey exists which specifically focuses on augmented paper systems in learning. The rising number of publications in this area indicates that it is an active area of research; however the history is sufficiently long to warrant a survey article.**

**The article is very well written and clearly structured.**

**The article is using a strong and sound methodology. It is rare that survey articles apply so much rigor in selecting references to discuss. The orchestration perspective is a very helpful conceptual lens for classification of prior work in the field. The article gives a succinct overview of the main aspects and dimensions of the orchestration perspective. In a next step it convincingly applies the dimensions for analysis.**

**The article covers all major streams of the literature and provides exhaustive references. The observations and analysis are of high significance. Important avenues for future work are identified. It provides a very good overview, from a learning perspective. I can see this article to become a very useful reference for researchers who are new to the field, but also for people in the field who seek to update their knowledge of the latest publications or seek a partially novel perspective -- orchestration has the potential to provide new insights to those who have not applied this perspective before. Below I will suggest ways to further improve the quality of the survey.**

**My main criticism is that the article does not provide a concrete sense of how these systems work, look like, are used etc. The description and analysis remains on a quite abstract level. It is good to provide this abstraction and there is no need to condense this part. But I'd suggest selecting a handful of very representative systems and introduce them in some more detail, including photos of the form factor, how it is used by learner, etc. This could be added to the section on "Stage 1"**

**Answer:** We agree with that having more detailed and concrete descriptions of augmented paper systems (which are themselves a very heterogeneous lot, with several different form factors) would help the reader understand their main features. We should address this in the new version of the manuscript (as much as the space limitations allow it).

**Changes in the manuscript:** We have added a new paragraph to the "Stage 1" section (the first paragraph), briefly detailing examples of educational augmented paper systems for each of the basic form factors mentioned in the background section. We have also moved some of the images towards this part of the manuscript, to better illustrate the systems.

**Moreover, the discussion of results is at times too exemplary in style. In particular I found the bullet style presentations to be less adequate for a journal article.**

**Answer:** We agree with the reviewer that the bullet format we used in our “Stage 2” of review results, although very synthetic (prompted by the space limitations), can be strange for the readership of the journal. We will address this in the new version of the manuscript.

**Changes in the manuscript:** We have changed the prose of this section to a more usual paragraph format.

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**In Stage 2 the authors present systems that have been evaluated in a learning context. However the article remains silent about the results of these empirical studies. It could be strengthened by a summarizing discussion of the main findings, maybe even added as one more column in Table 2.**

**Answer:** We agree with the reviewer that a summary of the results of the empirical studies would give readers a better sense of the state of research in authentic settings in this field, and the kind of evidence available so far.

**Changes in the manuscript:** As suggested by the reviewer, we added one column to show the main findings of these empirical studies, in Table 3.

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**In Table 1 quite a number of systems seem to be missing. I'd like to see a more comprehensive overview here. At least it should include all systems that are discussed in Stage 2.**

**Answer:** We agree with the reviewer that all systems that are discussed in Stage 2 should be included in Table 1.

**Changes in the manuscript:** We have re-checked to make sure that Table 1 includes all systems that are discussed in Stage 2. Moreover, we also added another two papers to our review and to this table (Signer et al.'s and Klemmer et al.'s), as per another reviewer comment below.

**In the tables, what does N.A. imply? Does it imply that there are sweet spots for future research? If so, which ones?**

**Answer:** We agree with the reviewer that N.A. was not a clear label (its meaning was simply “no system found in this category”).

**Changes in the manuscript:** We have removed the N.A. labels in the tables. Also, we have added remarks in the conclusions to point out that the blank cells in this analysis can be understood as parts of the augmented paper design space which are unexplored so far (as hinted by the reviewer).

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**The authors should also reference the following articles, as this work can be used right away in learning settings:**

**Signer et al.: PaperPoint**

**Klemmer et al.: Books with voices**

**Answer:** After analyzing the papers mentioned by the reviewer, and applying the criteria for inclusion detailed in the methods section, we agree that Signer et al.’s PaperPoint paper should be included in the review. We consider, however, that Klemmer et al.’s paper about “books with voices” should not be included, since the study is not aimed at formal education (being rather “edutainment”). Nevertheless, thanks to the reviewer’s recommendation, we further checked Klemmer’s other studies and found another relevant paper (Klemmer & Landay, 2009), about Papier-Mâché, a toolkit for integrating physical and digital interactions, which was evaluated through a laboratory study and longitudinal use in courses and research projects.

**Changes in the manuscript:** We have added Signer et al.’s and Klemmer & Landay’s papers to the Stage 1 of our review (which now includes a total of 40 studies).

Reviewer #3

**Very stimulating review paper. The paper is anchored in the relevant literature. it is well structured and discussed. The discussion and conclusion are very clear and in line with the goal of the paper. However, the authors can improve the quality of the paper by:**

**- operationally define classroom orchestration**

**Answer:** We agree with the reviewer that orchestration definitions and perspectives are so varied that is difficult for the reader to understand what notion of orchestration we were using in practical terms. This needs to be fixed in the new manuscript.

**Changes in the manuscript:** We have streamlined the section on orchestration, to remove superfluous remarks that could prove confusing. We have also added an operational definition of “technology for orchestration” (in the last paragraph of the section), which we believe is actually more relevant to the review than a definition of orchestration itself (of which a definition is provided at the beginning of the section).

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**- making the tables bold and more readable**

**Answer:** We agree with the reviewer that the style chosen , and did not comply with the journal’s usual format. This should be addressed in the new manuscript.

**Changes in the manuscript:** We have changed the style of the tables to be more readable, using the journal template’s style for tables (ETS Table).

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**- reducing the text (if possible the tables and figures) little bit to make the text more readable**

**Answer:** We agree with the reviewer that the results part of the review had a profusion of figures that could make the reading experience a bit difficult. We need to address this in the manuscript.

**Changes in the manuscript:** We have removed several of the figures appearing in the “Stage 2” section, and we have moved yet others to a previous section, to further illustrate the examples of educational augmented paper systems (as per Reviewer #2’s comment).