Author's response to reviews

Title: Student perceptions of gamified audience response system interactions in large group lectures and via lecture capture technology

Authors:

robin k pettit (rpettit@atsu.edu)
lise mccoy (lmccoy@atsu.edu)
marjorie b kinney (mbuickkinney@atsu.edu)
frederic n schwartz (fschwartz@atsu.edu)

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Author's response to reviews: see over
March 27, 2015

Dear Dr. Sawdon:

We thank the reviewers for their thorough reading of the manuscript. We have incorporated most of their suggestions; as a result, the manuscript is greatly improved. We are excited about the possibility of publishing in *BMC Medical Education*. Please let me know if any additional changes are needed.

Cordially,

Robin Pettit

Reviewer’s report
Title: Student engagement with gamified audience response system interactions in large group lectures
Version:1
Date:17 February 2015
Reviewer:Fiona Curtis

Reviewer's report:
- Major Compulsory Revisions

1. Introduction: The background focuses mainly on ARS; more detail about the features of gamification and the normally passive use of lecture capture would be of benefit to the reader. In particular, a more complete background on the features of gamification would allow readers to better understand the methods.

The Background has been revised accordingly on pgs. 5-7:

The core elements of active learning, student activity and engagement, are central to educational game theory [18-21]. Games are growing in popularity at all levels of education, including medical education [22-35], and include simulations, virtual environments, social and cooperative play,
and alternative reality games [18]. A survey of family medicine and internal medicine residency programs directors in the United States indicated that 80% used games as an educational strategy in their residency training programs [23]. While there is evidence that students find games more enjoyable and stimulating than standard lectures [33,35], evidence for their utility in increasing knowledge is conflicting, perhaps in part due to the limited number of rigorous studies [18].

Gamification is the integration of gaming elements, mechanics and frameworks into non-game situations and scenarios [36]. The purpose of gamification is to make routine activities fun, interesting and addictive [20,37]. When designing learning games, educators can draw from the corporate world’s ‘playbook’ of game dynamics by incorporating game pleasure elements such as challenge, surprise, and pride in accomplishment, and game mechanics such as rules, competition and immediate feedback [20,37].

We introduced multiple game elements and mechanics [20,37] into year 1 medical microbiology TurningPoint (TP) ARS presentations (detailed under Methods), and explored explanations for student engagement.

And in the middle of pg. 7:

Do students who review the TP games via lecture capture (video/audio recording of large group lectures that students can view on their personal devices) perceive learning gains or assign any engagement value?

2. Methods - Section 'Construction of the TP games': For those not familiar with ARS, it may not be entirely clear from the method and Figure 1 what all of the interactive elements consist of. The authors should explain these in more detail.

The Methods have been revised accordingly on pgs. 9,10:
We introduced many more game elements and mechanics [20,37] into our TP ARS large group interactions: *rules, objects* (e.g. leader boards inserted at intervals to show points accumulated during the game by each player or team [Figure 1A], custom correct answer indicators representing the organism being discussed [Figure 1B], mystery bug character for rapid review [Figure 1B]); *action* using fastest responder slides inserted after simple recall-type questions [Figure 1C]); *collaboration* using team competitions where students join teams at the game outset by clicking on their team letter (Figure 1D); *peer teaching* where students answer a question individually using their clickers, then discuss the question with a neighbor, and answer the question again using any knowledge gained (Figure 1E); *individual and team competition* (individual or team leader boards [Figure 1F shows an individual leader board at the end of a gamified TP ARS interaction]); *social fabric* (the idea that people like one another better after they’ve played games together, build a higher level of trust, and have a greater willingness to work together); *progression dynamic* (individual or team participant boards inserted at intervals); *countdown* (fastest responder); *urgent optimism* (desire to act immediately to tackle an obstacle combined with the belief that we have a reasonable hope of success); *achievement, status* (winner of individual participant board or fastest responder or team MVP); *prizes* (trivial prizes, for e.g., candy in the shape of the microbe(s) covered in that interactive lecture); and *chance* (the risk of wagering; these slides were occasionally inserted prior to the final question [Figure 1G]). Game pleasure elements [20] included *sensation* (imported audio of clapping when winning score displayed on screen [Figure 1F, upper right], imported images, holding the clicker), *challenge* (most questions were in the style of United States medical licensing exams), *anticipation* (students told at beginning of lecture that there would be a certain number of fastest responder slides, or that in team competition there would be a MVP that day), *humor* (images, team names), *surprise* (random insertion of fastest responder slides, wager slides and tie-breaker slides), and *pride in accomplishment* (occasional simple questions to build confidence).

- Minor Essential Revisions

1. Methods - Section 'Construction of the TP games': The authors state "The majority of the questions were board-style, multiple choice with clinical vignettes". I am unsure to what board-
The Methods have been revised accordingly on pg. 8:

The majority of the questions were clinical vignettes with multiple choice answers, mimicking the style of the United States Medical Licensing Examination (USMLE) and the Comprehensive Osteopathic Medical Licensing Examination of the United States (COMLEX-USA).

2. Results: Figure 3 is discussed in the section 'Game design and variety', before Figure 2, which is discussed in the section on Engagement within the results. The authors should renumber Figures 2 and 3 and where they are mentioned in the text, in order for them to appear consecutively.

The figures, figure legends and mentions in the text have been revised accordingly.

3. Results - Section: 'Engagement': Figure 1. The details of this image are unlikely to be readable, in particular E. The authors should consider how best to display these images.

On a full-page print-out, the image is clear and readable; however, we will certainly work with the journal to revise the figure if necessary.

4. Results - Figure 2, 3 and 4: There is no vertical axis label. It seems likely that this axis indicates the percentage of survey respondents. The authors should add axis labels.

The vertical axes are now labeled in Figs 2-4.

5. Discussion - Section: 'Learning': Paragraph 2: The authors acknowledge the significant difference in responses between males and females to the phrase "I prioritized the concepts I needed to review", and relate it to previous studies, but do not propose any reasons for such differences. The authors may wish to explore this further.
This section in the Discussion has been expanded on pgs. 24,25:

However, only one question on the survey showed a difference in responses between males and females, *I prioritized the concepts I needed to review* (Figure 4). Major differences between our study and the two discussed above is that our interactions were gamified, and they involved medical students, not undergraduates. Furthermore, the specific survey item in the present study was not queried in the undergraduate ARS studies.

6. Discussion - Section: 'Limitations': The authors discuss some limitations of the study. However, the paper would benefit from the acknowledgement that factors other than those studied may also influence engagement. For example, use of a custom correct answer indicator seems unlikely, by itself, to engage students to the extent it did. The context surrounding the use of this feature, including the design of these slides and the factors relating to the lecturer, may influence outcomes.

The Limitations section has been expanded accordingly on pgs 27,28:

This research is limited by the institutional and cultural contexts in which it was conducted. The outcomes of this study may have been influenced by student perceptions of the instructor, the nominal prizes awarded during some of the TP ARS interactions, the types of questions incorporated in the games, the anonymous play mode, the relative paucity of technical difficulties due to the author’s (RKP) previous experience with ARS, and the purchase of clickers by SOMA instead of by the students. Surveys were collected anonymously in order to reduce the likelihood of response bias. We were not able to characterize non-responders, who may or may not have favorable impressions of TP games. The results of this study might not be generalizable to other disciplines, younger learners, less motivated learners, or cultures that place more value on non-interactive lectures. In attempting to apply these methods and findings toward an innovation in a different context, investigators should consider the specific constraints, type of game employed, outcome measures used, and the natural environment of the study setting.
Reviewer's report

Title: Student engagement with gamified audience response system interactions in large group lectures

Version: 1

Date: 9 March 2015

Reviewer: Judith Barbaro-Brown

Reviewer's report:

1. Is the question posed by the authors well defined? The background and the context seem clear and well-defined.

2. Are the methods appropriate and well described? The method is reasonably well-described. What information was given to the students prior to this study, I can’t seem to locate any mention of an information sheet. It is good to see that the clickers were used in anonymous mode, and that there was no association of performance with grading.

Students received a brief oral introduction to clickers when clickers were assigned to each student during orientation. All gamified interactions were self-explanatory, as students were simply responding to TP questions on PowerPoint slides by clicking letters or numbers on their devices.

There is mention that the study is ‘exempt’ – exempt from what?

The Methods section has been revised accordingly on pgs.11,12:
The ATSU Institutional Review Board (IRB) deemed the study exempt from IRB reporting requirements for human subjects research.

It’s a little concerning that students were sent the survey during a session with a tutor, during which time they were given ten minutes to complete it during the class. Yet, the report states that completion was voluntary? Given the context of the survey being received in class, and time given by the tutor to complete it, can the authors really say this is voluntary? In this situation its possible that students felt compelled to complete the survey, hence the relatively high response rate?

The Methods section has been revised on pgs. 12,13 to explain the survey setting more completely:

Survey data collection involved an email solicitation containing a clickable link to an online survey. Students received the email survey during an unrelated large group session given by a faculty member who was not involved in the TP games. The students were given approximately 10 minutes to complete the survey on their personal devices during this class. Participation was voluntary and anonymous. Students were not asked to provide evidence of completion, and there were no rewards offered for completing the survey.

In addition, the first page of the survey the students received, which was attached to the manuscript, had the following information:

All responses are anonymous. Responses from this survey will be used for educational research and the improvement of the curriculum. The responses will not affect your grade. There are no foreseeable risks or discomforts to you in SOMA’s sharing the aggregate results of this educational research. Any publishable findings will be reported in aggregate format.

3. Are the data sound It appears to be so, but I couldn’t seem to access any charts or tables, which would have helped give a better overview as I would have liked to see how many students really felt disengaged, it only seems that those responding to the very or somewhat engaging options.
It is unfortunate that the reviewer could not access the attached figures and tables. The orange and red bars in Figs. 2-4 are the negative responses, and Table 2 has two sections with negative comments. All negative responses and open-ended comments were included in the manuscript.

How many students on average attended the live teaching sessions? If some students didn’t attend the teaching session, were they still surveyed?

The survey was provided to the entire class, and had an 86% response rate (pg. 13, Results). The Results section, pg. 18, has the details of attendance:

Information gathered in the course of regular educational activities (course evaluations for eight organ system courses than ran from July, 2013 through May, 2014) for the Class of 2017 indicated that the percent of students who always relied on Echo360 instead of attending lectures ranged from 4% in July, 2013, to 22% in May, 2014. Since the survey was conducted in May, students who responded Via lecture capture in response to the prompt, I typically experienced TurningPoint presentations by this professor…, likely had more regular attendance in large group sessions, including interactive microbiology TP sessions, earlier in the year.

4. Do the figures appear to be genuine? See above comments.

5. Does the manuscript adhere to the relevant standards for reporting and data deposition? This appears to be the case.

6. Are the discussion and conclusions well balanced and adequately supported by the data? There appear to be reasonable discussion, although there is little discussion of why some students did not find the gamification engaging – the focus is only on the results which confirm the author’s view, and in the case there is some bias in the reporting. The authors need to balance their argument by exploring the responses of the group of students who did not like the approach.

Results, pgs. 18,19, Table 2:
One student did not value the TP questions during the presentation because they hadn’t had enough time to study the material (Review/Repeat/Practice/Helpful, Negative).

Results, pg. 19, Table 2:

Eight students indicated that viewing the TP presentations on Echo was not as engaging as participating in class (Engagement, Negative). Some of the comments provided insight into why they didn’t find it as engaging, including, it definitely is more valuable in person just based on the atmosphere it creates; it’s definitely not as engaging and fun; on Echo the competition drive was missing.

Discussion, pg. 21,22:

Slightly more than half of the respondents were focused on the prize during TP games, our lowest positive engagement response (Figure 3). The games were low-stakes, no points, just trivial prizes related to topics covered; for example, candy, travel size disinfectant bottles, travel size toothbrushes, and, occasionally, a raffle for a book or flashcard set. The survey results indicate that the students were much more motivated by the competition than the prizes.

Discussion, pg. 22:

Fastest Responder game interactions were rated the lowest; even so, 70% of the respondents found these interactions very or somewhat engaging (Figure 2). Fastest Responder interactions were strict recall. As such, a possible explanation for this result is that students placed less value in these short-stem, non-clinical vignette questions. Alternatively, some students may need more time to think through even short-stem questions since the material has just been presented. Since approximately half of the respondents agreed or strongly agreed that they were focused on the prize, some students may have more negative impressions of the Fastest Responder interactions because they were never able to think quickly enough to win a Fastest Responder prize.
In addition, the Discussion section has been modified to include the following on pg. 26:

A small percent of the participants were not engaged and did not place learning value in the TP ARS interactions (Figures 2-4). This result is not surprising; it’s difficult to satisfy all learning styles with a single teaching method. In addition, it’s possible that these students think that clickers and games are gimmicky, although they did not indicate this in their open-ended responses. Alternatively, these students could have negative feelings about the instructor or the discipline.

I think it’s also interesting to see that use of Echo instead of lectures increased towards the end of the learning period – was there anything in the data which would allow the authors to discuss use of the games at during different points in the learning cycle?

The information in the Results section, pg. 18, regarding increased use of Echo360 throughout the year was for all courses. We do not have attendance data for individual lectures. The Methods section, pg. 12, describes how the games were distributed throughout the year:

Twenty-two gamified TP ARS microbiology presentations were offered during this period; six sessions in the summer of 2013, eight sessions in the fall of 2013, and eight sessions in the spring of 2014. Students were surveyed after completion of these sessions, several days prior to the final exam in their last organ system course.

7. Are limitations of the work clearly stated? I think this could be discussed somewhat further, i.e what are the institutional and cultural contexts and why should they be an issue? Ditto for generalizability – why do they think this?

The Limitations section has been expanded accordingly on pgs 27,28:

This research is limited by the institutional and cultural contexts in which it was conducted. The outcomes of this study may have been influenced by
student perceptions of the instructor, the nominal prizes awarded during some of the TP ARS interactions, the types of questions incorporated in the games, the anonymous play mode, the relative paucity of technical difficulties due to the author’s (RKP) previous experience with ARS, and the purchase of clickers by SOMA instead of by the students. Surveys were collected anonymously in order to reduce the likelihood of response bias. We were not able to characterize non-responders, who may or may not have favorable impressions of TP games. The results of this study might not be generalizable to other disciplines, younger learners, less motivated learners, or cultures that place more value on non-interactive lectures. In attempting to apply these methods and findings toward an innovation in a different context, investigators should consider the specific constraints, type of game employed, outcome measures used, and the natural environment of the study setting.

8. Do the authors clearly acknowledge and work upon which they are building, both published and unpublished? This appears to be the case.

9. Do the title and abstract accurately convey what has been found? The title could be re-worded as it gives little indication to what the study is trying to explore, perhaps posing it as a question would be better?

The title has been changed to:

Student perceptions of gamified audience response system interactions in large group lectures and via lecture capture technology

The abstract covers the important points, although would it be possible to add just an extra sentence to mention that ‘live’ lectures and lecture capture contexts were used? I know this is mentioned, but it’s very brief.

The abstract is at the 350-word limit. Lecture capture is mentioned under Methods and Results in the abstract. The Background section of the abstract describes the live large group setting. While we think the abstract
provides a succinct synopsis of the study, we are willing to revise it if the journal prefers.

Discretionary revisions

1. The abstract covers the important points, although would it be possible to add just an extra sentence to mention that ‘live’ lectures and lecture capture contexts were used? I know this is mentioned, but it’s very brief.

See #9 above.

2. I think this could be discussed somewhat further, i.e what are the institutional and cultural contexts and why should they be an issue? Ditto for generalizability—why do they think this?

See #7 above.

Minor essential revisions 1. The title could be re-worded as it gives little indication to what the study is trying to explore.

See #9 above.

2. There is mention that the study is ‘exempt’—exempt from what?

See #2 above.

Major compulsory revisions 1. The authors need to balance their argument by exploring the responses of the group of students who did not like the approach.

See #6 above.
2. Given the context of the survey being received in class, and time given by the tutor to complete it, can the authors really say this is voluntary? The authors need to make an acknowledgement of the impact this might have had on student responses.

See #2 above.

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

Quality of written English: Acceptable

Statistical review: No, the manuscript does not need to be seen by a statistician.

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