

Interactive comment on “Learning about water resource sharing through game play” by T. Ewen and J. Seibert

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General Comments

This paper presents a useful initial analysis of the learning benefits that may be derived from game play of water resource sharing.

The paper documents a range of games available and how one particular game, Irrigana, appears to be developing as a learning platform. The sample size on which the analysis is based is small and further analysis would be useful in future to support the conclusions drawn. To provide more context for those unfamiliar with Irrigana, it would be useful to provide example input scenarios, decisions and outcomes, preferably visualised, to help the reader appreciate more fully the value and potential of the game. More importantly, to support the evaluation of game play benefits, it would be useful to

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include the survey questionnaire used. Similarly, including the survey results as a table would be useful to clarify the description of the evaluation.

The paper also presents an evaluation of the benefits to learning about water resource sharing derived from developing games. This element of the paper needs to be reviewed; the paper would be improved if it identified the specific points of student learning on water resource sharing that have been derived from developing new games.

Specific Comments

Section 2, Irrigana as a teaching tool Page 2, Line 25 - The text notes that Irrigana assumes "...cost of groundwater increases with increasing depth to groundwater." It would be useful to understand the basis on which this depth increases, presumably the amount and duration of pumping. In this context, it would also be useful to understand how any interactions between groundwater rivers are represented. These points may be covered by Siebert *Vis*, but a brief comment here would help appreciate the conceptual hydrological system represented in Irrigana and therefore, to what scenarios the game can be applied.

Page 2, Line 26 - The text states maximising income is the goal of the game, while previously revenue is mentioned. To improve clarity it would be worth being specific that the income is net of farmer costs, if this is the case, and differs from revenue.

Section 2.1, A survey of using Irrigana Although there were few respondents to the survey, it would be useful to understand where all of the Irrigana users were based, whether they responded or not. This would provide extra information on the geographical spread or restricted distribution of responses and so the international penetration of Irrigana as a learning tool.

It is important to include the survey questionnaire used to underpin the results presented and conclusions drawn. Although this may take up a significant amount of space, it would be useful as the questioning is multi-stage and not simple to follow with a text-

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only description.

It would help as well to present the survey results as a table, including the number of respondents at each stage of the questioning. This should help make the results more accessible to the reader and enable an appreciation of the confidence in the conclusions that have been drawn. This would also help the explanation of results on page 4 line 17-18 and on page 5 line 21-28.

The use of brackets rather than commas can be a matter of personal preference, but in Section 2.1 this results in parts of the text being awkward to read. A particular example to address is on Page 4, Line 16 where nested brackets are used, but are incomplete. To aid the reader, I'd suggest that this and other sentences be reworded to allow many of the brackets to be removed.

Section 3 Page 6, Line 12, reference to Figure 1 - Suggest splitting Figure 1 left and Figure 1 right into separate figures. This would help enable an explanation/translation of the German text labelling to be included. Unfortunately, the text is inaccessible for those unfamiliar with German.

Page 6, Line 13, reference to Figure 2 - It is useful to have Figure 2 included to illustrate game development, but referencing of Figure 2 left (Line 21) and Figure 2 right (Page 7, Line 1) needs to be clarified. For example, it's unclear if there should be a reference to Figure 2 middle and if so, it's very unclear what Figure 2 left actually illustrates and what it adds to the documentation of game development.

Page 6, Line 25, reference to Figure 3 - Including an explanation/translation of the German labelling would help understanding of the Wiapuna game.

Page 7, Line 12, reference to Table 1 - Column headers include Price/year and Yield/year, but the units for price and yield are not specified. If the intention is that they are dimensionless and illustrative in the context of the game, then this needs to be clarified.

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Section 3.1, Evaluation of learning outcomes The key messages from game development seem to relate mainly to insufficient time, planning challenges and need for re-timetabling of other course modules. This is interesting, but the evaluation would benefit from documenting more substance on the value and benefits to learning about water resource sharing derived from the games developed.

In this context, the conclusions on the game development state that the "students had to think through the intricacies and complexity of water resource sharing, as they thought through players' moves and water resource outcomes", but there is no detail on what these intricacies and complexity were. This is in contrast to the learning experiences from using Irrigana noted in Section 2.1, which at least highlights that the learning has been that "cooperative behavior and communication were both key to succeeding". It would improve the paper's contribution if it identified the specific points of learning on water resource sharing that have been derived from developing the games.

Technical Corrections

Page 1, Line 23 - Reference to Johnson, 2012 should either be Johnson et al. or the paper is missing from the reference list.

Page 2, Line 20 - To improve clarity, suggest rewording as follows, "... role of cooperation in, and competition for the use of water as a limited common-pool resource"

Page 3, Line 15 - Reference should read Lecoutere et al. (2015)

Page 5, Line 21 - Rewording suggested as follows "Additional analysis was carried out considering user data collected since July 2013, when user histories began to be saved; this excluded data collected during our own use of Irrigana. This was done to further analyse how"

Page 7, Line 7 - Insert "a" as follows, ".....Heins (1994), as a way to show.."

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