Hydrology and
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Discussions

Interactive comment on "Understanding groundwater – students' pre-conceptions and conceptual change by a theory-guided multimedia learning program" *by* U. Unterbruner et al.

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This paper focuses on the learning behavior of students, both junior pupils and university students. It introduces them to the fundamental concepts of groundwater, as well as introducing a new way of teaching at these levels of education. With this selection of student groups, however, I wonder why the age gap between the two groups of students was not addressed. Having a high school group in the research would better link succeeding levels of knowledge transfer for relatively specialized fields such as hydrology. Why was this not included?

I recommend the following minor revisions before final acceptance:

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1) Pg 11691, line 6: eliminate the use of brackets.

2) Line 14: "adequate" is misspelled.

3) Same line: I would suggest changing the last four words of this line to "adequate understanding of groundwater concepts".

4) Pg 11692, line 10: the sentence would make better sense if it were ". . . developed the theory-guided multimedia learning program".

5) Pg 11694, lines 3-5: numbering these points will make for a better appearance and readability.

6) Pg 11697, line 28: the word "commitment" is highly confusing. It is unclear whether the "robustness", the "defensibility" or the "validity" of groundwater concepts is being discussed, yet any of these words would serve better here.

7) Same line: Include "of" in the phrase ". . . the topic of groundwater. . ."

8) Line 29: the word "probably" significantly weakens any impact an otherwise positive statement should have. I suggest having this word removed.

9) Pg 11698, line 1: use the word "evident" instead of "very present".

10) Same line: replace "and not are probably" simply with the word "nor". This will again remove the word "probably" which seriously undermines the argument contained in any statement.

11) Line 2: instead of just using the word "groundwater" the phrase "the pursuit of groundwater knowledge" will convey the message more effectively.

12) Same line: replace the phrase "independently of whether" with "in spite of the fact that".

13) Pg 11700, line 12: place a full stop (period) after the word "knowledge".

14) Same line: Use the word "acknowledge" or "understand" instead of "identify".

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15) Line 14: instead of just writing " = weak coherence" inside the brackets, a slightly more appropriate elaboration could be ". . . primary problem, which illustrates the weak coherence as mentioned previously (Sinatra, 2005)".

16) Pg 11700-11704 (Section 3.3): Instead of listing the five central questions all together first and writing their detailed explanations afterwards, it would be more appropriate if each of the questions was immediately followed by its explanation.

17) Pg 11704-11705: Sections 4, 5 and 6 could be merged into one single Methodology section to improve readability, with subsections 4.1 Research Questions, 4.2 Sample, and 4.3 Instruments.

18) Pg 11704 (Section 4): number the research questions.

19) Pg 11705, line 7: the description "teacher training students" is slightly confusing as to whether it means these students are being trained to become teachers or it means something different. A little bit more clarity or even the proper name of their training program should be useful.

20) Pg 11711-11714 (Section 8): There seems to be enough of both concrete interpretations and generalized deductions in this section for it to be divided in to two different sections for Discussion and Conclusions. The final paragraph which summarizes the paper could serve as an excellent opening to the Conclusions section and can be supplemented by one or two more paragraphs consisting of relevant selections from the rest of the section and even the rest of the paper.

21) Pg 11711, line 25: remove comma after students.

22) Pg 11712, line 1: remove the word "achieved" as it has already been used in the sentence.

23) Line 6: The word "learning", used twice in the sentence, can be removed from where it is used the second time.

24) Line 18: use the phrase "as compared to" instead of "as opposed to"

25) Pg 11713, line 3: remove brackets from the phrase "well designed".

26) Line 7: "Interestingness" is not a word. Perhaps the program's "interesting interface" or "interesting and comprehensible content" could be mentioned here.

27) Line 12: remove "in" and include "the" when beginning the sentence, i.e. "About half of the pupils..."

28) Line 24-26: A bit more elaboration is needed to justify the inclusion of Dickerson and Dawkins (2004) reference. The link is not quite visible as it is with the other reference, Schwartz et al (2011).

29) Pg 11723-11727: Rather than including the students' diagrams as were, it is recommended that they be refined for example through Computer Aided Design or Graphics, with the labeling done in English.

30) Pg 11728-11730: I would suggest using coloured graphs. Other figures, namely the drawings and screenshots, provide a better appearance since they are coloured.

31) Pg 11732-11738: I suggest translating the text into English in the screenshots

With these minor modifications, I do believe this paper should be worthy of being published.

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This review was written by a student of the Master of Sustainable Environmental Management (MSEM) program at the University of Saskatchewan as a requirement of the course Breakthroughs in Water Security Research. It should be considered by the authors as a regular peer review comment aimed at improving the paper.

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