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Hydrology and Earth System Sciences Discussions

Interactive comment on "Teaching groundwater dynamics: connecting classroom to practical and field classes" *by* V. Hakoun et al.

Anonymous Referee #2

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This paper addresses the issue of how to move from classical classroom teaching to modules that promote active learning, which are well-known for considerably enhancing student performance when implemented in relevant ways. A main contribution of this work is to show example evidence of well-working active learning packages within a key field in hydrogeology (groundwater dynamics).

The paper is generally well-written and interesting, although some parts are unclear and could be improved. In particular, before publication, I would like to see that some of the key concepts are further explained and clarified (points 1-3 below), that the discussion section is extended (point 4) which could considerably improve the paper, and that part of the introduction is changed to fit with the contents of the paper (point 5).

Main points:

1. One of the key points of the presented approach is to maximize integration between class components, as stated in key point (ii) and illustrated in figure 2. The following issues would need clarification: (a) How is integration defined? For instance, do the arrows of Fig. 1 (that attempts to explain the concept) mean that the result from one module are used in the other, and/ or does it rather mean that many modules are run in parallel, e.g. with mutual feedbacks in an iterative manner? Please also check notation: The word “iterative loop” (and not integration) is not used when referring to Fig. 1 for the first time (p. 1076, row 26). (b) Why should integration be maximized? (c) Please check consistency of notation used in key point (ii) and Figure 2: The term “Lecture classes” are used in the latter but not the former.

2. Could the implementation of iterative loops between classroom teaching (section 3.2) and practical classes (section 3.3) be exemplified more concretely?

3. In section 2, bullet “2”, it says that the practical experimental classes aim to (iv) use the data gathered in the field. But was this done? Figure 2 suggests otherwise, as does the text on p. 1077, lines 1-2.

4. The discussion section outlines possible improvements mentions introducing physical models and improving the apparatus and its use. However, a discussion on possible improvements of the pedagogical scheme in the light of state-of-the art knowledge is not included. This would be interesting and useful to have in the discussion, since the pedagogical perspective is strong in the other parts of the paper. Possible fields of improvement are examplified in (a) and (b) below. (a) Formative assignments have been shown to greatly enhance student learning. They imply that feedback is given to various assignments, such that the student can make improvements throughout the course. In the present scheme, group reports on the practical classes (p. 1078, row 7-8) and the field class (p. 1079, rows 19-20) are due 15 days after the end of the course. Could the design of exams and/ or assignments be modified, to better facilitate

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relevant feedback, including written feedback? (b) There are several difficulties related to evaluation of group assignments, including e.g. assessing individual contributions. How has the evaluation of the group assignment worked in the course, and is there room for improvement?

5. In the first part of the introduction (stating the general problem), the stated scientific challenges in the field of hydrogeology do not match the considered course contents well. The paper outlines main challenges as understanding impacts of global change and providing inputs in societal discussions. However, the presented teaching modules do not address connections to societal discussions, and possible relations to global climate change are rather indirect. Quite different modules would be needed to improve awareness and skills to meet such challenges (e.g. in coupled hydro-climatic modelling, etc). The presented modules are designed to give a better process understanding of groundwater dynamics and well testing. It would clearly help the reader if more direct advantages of improving such knowledge would be pointed out upfront in the abstract and introduction (such as local and regional hydrogeological change assessments, issues related to water supply, impacts of other infrastructure, etc).

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 1071, 2013.