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Hydrology and Earth System Sciences Discussions

Interactive comment on "Assessing student understanding of physical hydrology" *by* J. A. Marshall et al.

Anonymous Referee #2

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The article by Marshall et al. undertakes an analysis of student understanding in undergraduate and graduate hydrology courses at the University of Texas. The authors pose three primary questions for assessment, two focused on abstract learning and one focused on integration of basic concepts to address a common problem in hydrologic studies. This reviewer applauds the authors' attempts to increase the awareness and dialogue on student learning, especially with respect to hydrology and the broad spectrum of approaches in pedagogy and in utilized curriculum. In its current form, the manuscript has some concerns that should be addressed before resubmission and potential publication. The manuscript could potentially have some value to the community, but changes are needed to clarify the methods and expand on the results of the study. Ideally, the study should also include more courses (students) in their assessment.

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Specific reviewer's suggestions and concerns are outlined below.

Specific comments/suggestions: 1. The authors utilize assessment results from two courses at UT – one undergraduate (15) and one graduate course (10 students). Two key issues are noted with the design of the study: 1) the overall "n" is low as only two courses were assessed, and they were (theoretically) at different levels of educational maturity (grad/undergrad); 2) the results from the two populations were combined in the analysis and the reader isn't able to discern how the two populations performed on the assessment. Ideally the authors should try to include more courses at both levels in their study. This reviewer realizes this is an initial assessment by the authors and they do state that results are preliminary. It would also be beneficial to disaggregate results of the two populations and how each performed on the assessment. Again, results will be highly uncertain given the low numbers of students assessed, but it would strengthen the manuscript and provide more insight on student learning at the two levels.

2. The abstract doesn't specifically articulate the results of the student learning. Most of the results in the abstract concern the agreement of the expert responses for the rubric that was used for assessment. Some results (though they are very preliminary) on the actual assessment of student learning are needed.

3. More information on the student population that was assessed would strengthen the manuscript and the interpretation of the results. What program/department were the courses taught in? What is the typical background or education of the students coming into these courses? Are there prerequisites? Were these factors assessed? Some review/discussion of these issues are needed as they obviously influence the baseline hydrologic knowledge of the students that were assessed.

4. More details are needed on the actual curriculum used in each of the two courses that were assessed. The authors only state a brief overview of the curriculum in section 2.1. Since this is a pre- and post-learning assessment it would seem logical to provide

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more details on time spent on the various topics in the course – i.e. how much on the various components of the hydrologic cycle – groundwater, infiltration processes, transpiration, evaporation, recharge processes, etc. as well as integration/critical thinking and data synthesis/modeling. In addition, the authors never tie back the results to what was taught in the class and how this might have influenced results for each group (grad/undergrad). This would significantly improve the robustness of their results; especially given the number of courses studied is low. The authors also state that the same curriculum is used at both levels – which is a bit of a surprise. There is no explicit difference between the undergraduate and graduate curriculum?

5. Following the comments above, the manuscript would be significantly improved by inclusion of suggestions in curriculum development and/or key areas where the authors see that more instruction on specific topics (i.e. recharge or evapotranspiration) or improved pedagogy is needed. Given the buzz around "flipping the classroom", do the authors have any suggestions on how their assessment results might inform either our instructional content or pedagogical methods? What was the basic instructional method used? Were any innovative techniques used in either course?

6. The authors revised include a discussion of revision of Question #1 – but it is not apparent from the text when this was revised and implemented. Was this between the pre-test and post-test? More clarification is needed here.

7. The authors use some inconsistent terminology – they seem to use control and pre-test to mean the same thing but do not explicitly state this. The use of control is not truly appropriate in the context of this study (there is no explicit "control" group) and perhaps the authors should constrain their terminology to pre- and post-assessment.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 10095, 2012.

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