

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

Anonymous Referee #1

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I enjoyed reading this study, which is one of relatively few detailed experimental education studies in hydrology that I’m aware of. I would like to commend the authors on a thoroughly reasonable study design (thank you for including the details of the coding and cross validation between independent coders, which gave me confidence in the methods used).

That said, I would also encourage the authors to think a little more deeply about what they are attempting to achieve with this (and future) research endeavor(s). I am concerned that there has been an attempt to “measure” student understanding without deep consideration of the way that the findings of the study can be used. As the authors present their results and think about future work, these considerations become

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critical to ensure that the best possible data are collected with the most valuable end uses in mind.

There are really only 2 fundamental reasons to investigate student understanding:

- * informing teachers of how to teach better
- * understanding something fundamental about the learning process

Given the thoroughly applied nature of this article, I assume that the implicit goal of the research is to enable us to be better teachers of hydrology, ultimately.

To achieve this goal in the long run, I suspect the authors may wish to think about ways to deepen their investigation. Some approaches that might be worth considering include:

- * including a semi-structured interview component along with the surveys (which allows a more in-depth exploration of student understanding, and enables the researchers to prompt students to avoid e.g. misunderstanding of the questions being asked).
- * focusing on some particular processes of interest and investigating the mental models students develop when thinking about these processes
- * identifying areas where there are recurrent misconceptions or confusion
- * linking student understanding back to particular elements of instruction (e.g. asking students to recount any "aha!" experiences they have had)

There is an excellent literature on these factors in e.g. the Chemical Education arena (the work of George Bodner at Purdue and Bob Bucat in Western Australia may well be worth consulting).

The current study is a great starting point, but I think it would be a premature place to end. I would strongly encourage the authors to consider broadening their discussion and conclusions section to highlight the potential value of further detailed investigation

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into student understanding as a core tool to support hydrology education. Rather than worrying too much about the development of standardized tests (is this a path we really want to go down, as a community?!?), there would be a lot of value in demonstrating how further development of the experimental approach trialled here could lead to concrete benefits in instructional design and educational approaches. In the absence of more focused studies and more in-depth design, we risk a future of evaluating the shortcomings of written assessment tools, without having fully exploited the benefit of those students who are kind enough to talk to us about their hydrology learning outside the class.

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