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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Enhancing the T-shaped learning profile when teaching hydrology using data, modeling, and visualization activities" *by* C. A. Sanchez et al.

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1 Summary of the article

The authors have examined the effect of subjecting students to a learning environment with relatively high degree of interactive learning (Interactive spreadsheet based models-'DMDGC') vs. a system which is more traditional (Paper and pensile based calculation[1] (PP). They subject is a cohort of 107 students enrolled in an introductory

[1]The authors use the term 'paper laboratory'

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earth sciences course in a community college in USA. The students were subjected to the identical assessment consisting of eight questions, before and after the learning experience (88 students have completed the process out of 107).

They present the post-test results with results of 2-way ANCOVA analysis keeping pre-test results as co-variate. Based on significance statistics, they propose that compared to those students followed PP exercise, those who followed DMDGC '...were better able not only understand the effects of urbanization and other physical causes of flooding, but also demonstrated better knowledge of maximum discharge rates and impacts of flood management'. Further, they propose that ' [DMDGC approach] ... results in a better understanding of the professional duties within the field.'

They conclude that

1. The study proves that the use of dynamic and flexible simulation tools ... would lead to a marked increase in learning performance.
2. The study suggests that DMDGC approach results in a more complete 'T-shaped profile' of hydrological education.

2 My comments

I read this article with interest. The authors should be appreciated for attempting to shed light into an area that we academics often consider a secondary responsibility, namely creating an effective classroom learning experience.

The article is written in clear language that makes it easy to read and understandable by an international user of English language.

I have a number of critical comments regarding the experiment and its presentation in the article. I'll list the major ones below.

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2.1 Framework of the study

I think educators are almost unanimous these days that it is of critical importance that clear definition of Intended Learning Outcomes (ILOs) or Learning Objectives is critical for ensuring good learning outcomes. (Whether we all practice it all the time is another matter!). Another almost common-sense guidelines is that the assessments (and learning activities) should be aligned to those ILOs (as proposed by constructive alignment [1].

Reading this article, I failed to find a list of well-defined ILOs. Indeed authors list in Fig. 2 (Also in Table 2, which they do not refer to in the text – the 'table 2 they refer in bottom of page 6337 should be table 3.) they list what they refer to as 'nine overall learning outcomes', but these are not specific enough for me to know what were the specific, testable, verifiable goals behind the section in question.

This article would definitely benefit by stating a well defined set of learning objectives (see TeachOnline site of ASU [2] among many others for good practice).

This will shed light also to the appropriateness of the assessment instrument used. More on that later.

2.2 Content, Title and 'T-shape'

Recent literature has shown a large number of uses of the term 'T-shape'. While at the conceptual level these uses agree, the precise meaning varies greatly among the different uses (especially on the 'breadth' aspect). The definition I found in the article is in the abstract, which requires 'professional breadth combined with technical depth'.

Upon reading the article, I wondered whether the important findings of this article are related to the T-shape idea.

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While an interactive tool (DMDGC) will definitely provide a more absorbing learning experience, I fail to find how it provides 'T-shaped' learning. Overall it is my view that this article will be more effective if it does not discuss the notion of the 'T-shape' but focus on the learning quality differences of the two approaches – a worthwhile objective in itself.

2.3 Course material

The authors do not provide the learning material used in the two cases. The article should provide supplements with or links for the learning material in order for the reader to understand the link between the learning experience and the outcomes discussed in the. I was able to find online [3,4] which I suspect are the material used for DMDGC case, but I failed to find the material used for PP case.

I have to admit that I did not read though the material in [3,4], but upon looking at them, I could not see how they will enable the students to better answer questions like Q3 and Q4 (table 1). They authors should attempt to explain what aspects in the interactive material that resulted in students answering such questions better.

The only information regarding PP material is in page 6335 (around line 25). This is a calculation to determine whether a channel will flood before and after urbanization occurs in a watershed. How does completion of such an exercise prepare students to answer questions like Q3 or Q4? If that does not prepare the students in anyway what so ever, then is it logical to test students for that and arrive at the conclusions listed?

The page 6336 (lines 9-10) lists essentially what was different between the two treatments. Then I fail to see how one can explain how that can explain the differences of marks for questions like Q3 and Q4 (or goals 7, 8 and 9).

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2.4 Information provided

I was a bit intrigued by the way analysis was presented. It would be nice to see the pre and after treatment scores for each question rather than presenting the analysis for each 'learning outcome'. This would provide a more straight forward way for the reader to evaluate the findings. Further the authors do not provide any indication about the pre-treatment results (other than the fact that it was used as covarient in the ANCOVA analysis).

Some sort of graphical representation of that results (e.g. box-plots) could have been useful.

Information about how the students were selected for the two types of treatments is also missing (randomly?).

3 conclusion

As indicated in the beginning I find this a useful and intersecting study. However, it needs considerable shaping up in order for it to become genuinely useful for the wide readership. I hope the authors would take up the challenge of revising it.

References

[1] Biggs, John. "Enhancing teaching through constructive alignment." Higher education 32.3 (1996): 347-364.
[2] TeachOnline. "Objectives Builder - TeachOnline." Arizona State University, Web. Accessed: 26 Aug. 2015. https://teachonline.asu.edu/objectives-builder/
[3] Merwade, V. "Developing a Rational Method Hydrograph Model for the Urban Desert Southwest USA." http://serc.carleton.edu/geoinformatics/steps/105479.html.

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[4] Merwade, V. “Calibrating a Rational Method Hydrograph Model for the Urban Desert Southwest USA." http://serc.carleton.edu/geoinformatics/steps/105509.html

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