

Interactive comment on “Every Apple has a Voice: Using Stable Isotopes to Teach about Food Sourcing and the Water Cycle” by Erik Oerter et al.

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This manuscript describes a novel approach to teach school students, school teachers, and university science students about isotope hydrology and the water cycle. The laboratory exercise developed for this teaching purpose has great promise as an interesting and relevant teaching exercise, being a forensic exercise about the origins of food - a topic of obvious relevance to everyone.

There is confusion in the manuscript, arising from insufficient clarity about three separate purposes of the study and the manuscript. You have: (1) developed modules to teach about isotope hydrology and the water cycle (2) including developing a laboratory exercise with the research question on page 5, lines 21-23 'Can we use the stable isotopes of hydrogen and oxygen in water as 'fingerprints' to determine where fruits

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and vegetables come from?', and (3) evaluating the efficacy of the learning modules. A clear statement to address the following questions would have helped me. Are all three of the above purposes original and equally central to the manuscript? Is the laboratory exercise novel, or only its use as a teaching tool?

Similarly, it was perhaps not clear to the participants whether the main learning was about isotope hydrology or the water cycle. This would explain the participants' divided opinions about what should go on their posters.

My research experience is in higher education rather than isotope hydrology, and therefore my specific comments relate to these aspects of the manuscript, although much of the manuscript is about (1) and (2) above.

The design of the modules is sensible. The learning activities are consistent with the learning outcomes, and scaffolded by a presentation and demonstration.

Further detail about the data collection to evaluate the modules is necessary.

A table summarising demographic data about the participants should be added.

Early in the manuscript you report using participant feedback surveys. However on line 13 of page 11 we learn of 'informal, qualitative participant feedback'. Please explain what is meant by this. Is this the feedback surveys?

Page 2, line 1: What is meant by 'engagement'? This sentence does not make sense.

Page 2, line 9: I suggest a new paragraph here. The first 8 lines are about how important the topic is. The following lines are about to difficult it is to teach.

Page 3, line 1: Please explain the United States Next Generation Science Standards, especially for readers outside the US.

Page 4, lines 27,28: This sentence is half in the past tense and half in the present.

Page 6, lines 14 and 15 discuss a 'stumbling point'. On what basis is this considered a

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stumbling point? It would be sensible to describe later in the manuscript what evidence you collected for how well your participants did or did not overcome this point.

Page 12, lines 11 and 12: Do you believe that the study was limited because you did not track individuals? What would you recommend for future research?

Page 10, line 18 refers to 'newly-learned vocabulary terms [used] in nonsensical ways'. Line 19 refers to this as a 'strategy'. Are you sure this is a strategy and not a mistake? Lines 20, 21 state that 'This outcomes implies that the instructor or discussion leader should focus on core concepts over details or implications'. On what basis do you make this conclusion? I would conclude rather that the students need more experience hearing, reading, and using the new concepts and terms. Threshold concept theory explains that when students develop understanding of troublesome concepts they start to speak like someone in the discipline. These students have not yet achieved this.

In section 4.4. mean test results are reported. Please describe the test scale. What does a mean of 2.6 indicate? Please give some examples of the test questions? Are they multiple choice, open, calculations,...?

Page 10, line 30: How do you know the lecture and demos were received uniformly well?

Overall, the initiative is exciting and could inspire many extensions. I suggest considering future possibilities for expanding the teaching modules. Beyond identifying the origins of food, students could design improvements to current practices. For example, students might consider the distances that food is transported and whether these distances could be shortened.

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