

## ***Interactive comment on “Addressing secondary students’ naïve ideas about freshwater springs in order to develop an instructional tool to promote conceptual reconstruction” by S. Reinfried et al.***

**Anonymous Referee #1**

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Addressing secondary students’ naïve ideas about freshwater springs in order to develop an instructional tool to promote conceptual reconstruction S. Reinfried, S. Tempelmann, and U. Aeschbacher

Review for HESS

general comments

“The findings in the manuscript result from one only questionnaire. Is this of a general applicability? Is this result of a general interest to the reader of HESSD?”

“Some of the students’ ideas did not seem so naïve to me. The students tried to

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understand physical principles. As they did not have a basic course in physics, they could not possibly understand the mechanisms of spring flow. I would leave out the expression “naïve”.

Sct. 7 Discussing at length “Aebli’s Vision” seems to me to be out of scope, given the technical reader of HESSD. It is a general approach to learning and does not relate to the specific case of technical knowledge about springs.

Sct. 9 In the Conclusions Section, I would expect some ideas on the practical applicability of the worksheet and the questionnaire: - Can the results be generalized? - What do teachers of the future have to improve for “better” answers?

Table 1 Some of the questions are not of an “agree/disagree” type. Their answers are not “correct” OR “wrong”, as there are but’s and if’s in the possible answers.

specific comments / technical corrections

Manuscript Title The title should indicate that reference is made exclusively to “hillslope springs”

Introduction Section Start the introduction with a paragraph that includes a statement about what is ground water, and what are “springs” specifically. You mix the two, e.g., p.1592, Lines 24-26, p.1593, Lines 3/4. A spring is a natural emergence of ground water. Groundwater scientists differentiate between many different types of springs. See student’s statement, p.1598, Line 12 !! Furthermore, you have to state that you work exclusively with “hillslope springs”.

p.1590, line 8 13 or 14 students? (cf. with p.1591, line 19, p.1592, line 2.) It is 12 - 14.

p.1590, line 9 Continue a second paragraph with an introduction to the reader, why 13/14 years’ old students (and not older or younger ones) should know more about hillslope springs. Shouldn’t they have to know more about the water cycle, in general? - Why do you specifically pick out springs from the water cycle?

p.1591, line 10 "A better understanding is needed" → by the public, or by water experts ? If by the public, then why so ?

p.1590, line 12 Make reference to the alpine/perialpine situation (hillslopes), as springs will not play the same role, e.g., in the Netherlands.

p.1591, line 20 Give an idea on what kind of "erroneous" and "naïve" ideas and "patchy misconceptions" are in the minds of 13/14 years' old students. You use these expressions many times in the introduction that this fact deserves some explanation. Furthermore, you present students' answers in the next section that do not seem to me to be so naïve.

p.1593, line 1 No! Ground water and springs are not the same thing. In HESSD, you present work to expert hydrologists.

p.1593, line 10 There would be ample topics to expand this paragraph: E.g., "spring water" is used as a brand for bottled water, e.g., in the U.S. Some water factories use this brand, even for inverse-osmotized and remineralized water !

p.1596, line 18 What is a "5-point Likert Scale" ?

p.1597, line 8 Who or what is "Cohens Kappa" ?

p.1598, line 10 The student's statement can be correct, in a specific case

p.1598, line 14 A student living in a large plain would not know anything else!

Sct. 5.2. The question discussed in Sct. 5.2. is not a question, which you can answer with "yes" or "no."

p.1600, line 8, Sct. 5.3. What is a "spring source" ? The question discussed in Sct. 5.3. is not a "yes"/"no" question.

p.1600, line 25 From where do you take this assumption ? The thermal type of upwelling is a process, which is different from the pressure type of upwelling. Artesian

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upwelling water is considered an "Artesian Spring", which is different from gravity hillslope springs.

p.1601, line 1 What is a "rock face" ?

p.1602, line 27 Include the process of gravitational flow. You need it to explain the term "hillslope".

p.1603, line 4 If you want to include water quality, you have to give ideas, HOW ground water in a catchment can be contaminated. (Human activity!, see p.1604/Lines 8-12) Only then can you guess, if spring water can be contaminated as well or not. Water quality seems to me to be out of scope of this manuscript, in general.

p.1603, line 10 Explain, why and how teenagers should know about the natural philosophy of the Ancient Greeks. Reference to antique knowledge seems to me to be out of scope.

p.1606, lines 17-21 That may have been difficult to the students, as they did not have an understanding of basic physical/hydrodynamic principles. Relate this text to Sct. 8.3., where you explain these basic principles.

p.1607, line 3 A Sct. 8.2. should treat the content of the 2nd trait.

Begin of Sct. 8.1. and 8.2. Refer to the worksheet.

p.1608, line 23 What is a "sandpit digression" ?

Table 1 What does "water-blocking" mean ?

Table 2, 3rd Category Water does not flow horizontally, but along hydraulic gradients.

1. Does the paper address relevant scientific questions within the scope of HESS? → yes 2. Does the paper present novel concepts, ideas, tools, or data? → yes 3. Are substantial conclusions reached? → partly 4. Are the scientific methods and assumptions valid and clearly outlined? → yes 5. Are the results sufficient to support

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the interpretations and conclusions? → partly 6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? → not applicable 7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? → yes 8. Does the title clearly reflect the contents of the paper? → no 9. Does the abstract provide a concise and complete summary? → yes 10. Is the overall presentation well structured and clear? → yes 11. Is the language fluent and precise? → yes 12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? → not applicable 13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? → yes 14. Are the number and quality of references appropriate? → yes Is the amount and quality of supplementary material appropriate? → par

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