

## AUTHOR REPLY ON COMMENT REVIEWER #2

Nicholas Kinar (Referee)

Referee comment on "A snapshot sample on how COVID-19 impacted and holds up a mirror to European water education" by Benjamin M. C. Fischer and Alexandru Tatomir, *Geosci. Commun. Discuss.*, <https://doi.org/10.5194/gc-2022-5-RC2>, 2022

---

Review by Dr. Nicholas J. Kinar University of Saskatchewan

This is a landmark paper that clearly indicates how the COVID-19 pandemic affected educational hydrology-related initiatives in a European context. The historical importance of this paper cannot be understated, since the authors carefully and methodologically indicate why changes occurred and how the pandemic both identified and created rifts and challenges for both instructors and students. The paper indicates that fieldwork and other in-person opportunities were influenced and provides the start of a foundation for other papers related to geoscience communication. This is a good paper that I anticipate citing in the context of my own work, and I recommend only some minor revisions before publication. I thank the authors for documenting and identifying challenges and opportunities; this is an excellent paper that is a good contribution to the research on the scholarship of teaching and learning over the past few years.

Dear Reviewer #2, Dear Nicholas,

Thank you very much for your kind and constructive feedback. We are extremely happy that you appreciated our manuscript. We agree with you some of the language used was rather colloquial and we will rephrase specific terms to clarify the manuscript. Please find below our responses to the individual comments and suggestions (review comment in **blue font**, with our response in black font).

Best regards,

Benjamin Fischer and Alexandru Tatomir

The authors should consider defining in the abstract what is meant by “holds up a mirror” to educational opportunities.

Author response: We agree. From the title, it might not be immediately clear what is meant with the expression “holds up a mirror”. As suggested, we will add an explanation in the abstract as

*... The aim of this paper is to communicate the results and hold up a mirror to water education, i.e., reflect on how the teaching of hydrology and water-related sciences changed due to COVID-19 and what can we learn to improve future water education.*

Line 26: A “spirit of optimism” is not clear. Please re-write this sentence to indicate what is communicated by this term.

Author response: To clarify we rephrased the sentence as

*Next to all the negative aspects related to COVID-19, we could observe also positive aspects, such as the hydrology community exploring novel teaching formats, sharing teaching material, and discussing experiences in online blogs and social media.*

lines 35-36: What are the types of challenges as per Wagener et al. (2012)?

Author response: We rephrased the sentence as

*To address these current and future water related challenges university-level water education is needed (Wagener et al., 2012).*

line 54: What is meant by “flooded by jargon”?

Author response: We rephrased the sentence as

*Contemporary water education has a high complexity, involves multidisciplinary topics (Wagener et al., 2012) and uses specific terminology and definitions (Venhuizen et al., 2019).*

line 91: “make the hydrology alarm bells ring” is unclear and please re-write this sentence.

Author response: We agree. The expression “alarm bells” is colloquial and not very clear. We rephrased the sentence as

*The cuts have “reached crisis proportions in many universities” (Nash et al., 1990; Eagleson, 1991; Wagener et al., 2012) and are a worrying development for hydrology education (Kleinhans et al., 2010; Vidon, 2015; Blume et al., 2017).*

Section 2 Methods: What was the survey methodology used for survey design? Gideon (2012) might be useful to cite here. Gideon, L. (Ed.): Handbook of survey methodology for the social sciences, Springer, New York, 520 pp., 2012.

Author response: Thank you for the valuable literature recommendation. Our project idea and survey was based on the survey performed by Fischer (2020) focusing on Sweden. Based on this survey we extended and adapted our survey questions to investigate how COVID-19 might impact

European water education, focusing on 1) common teaching methods and classroom assessment and examination techniques in pre-COVID-19 times and 2) how did these education methods and techniques change during COVID-19. With this in mind our goal was to reach a large target audience with as many hydrologists involved in university education across Europe ranging from, Ph.D. students to lecturers/teachers, (assistant) professors, course administrators, and researchers. To have a non-biased representative outcome, a random sampling method would be preferable reaching a high number of participants from the total population (Gideon, 2012). However, to follow such a sampling methodology there are general challenges see also Gideon (2012) e.g., (I) unbiased, minimize the sample error, low response, spatial coverage and population representative, and specific to our study (II) what is the total population of individuals identifying them self with hydrology and water-related sciences (members of WMO, IAHS or EGU Hydrological Sciences are likely not representing the full population covering Europe, gender, different roles in education), (III) how many of the former are involved in teaching at university level and (IV) how to reach this population within a certain time frame to represent the Covid-19 Zeitgeist? Due to these challenges we decided to adopt a snowball sampling approach by contacting our network through e-mail with the link to the survey and the request to distribute the survey within the respective department. Drawback of this approach is off course the limited statistical value and potential bias. However, better some data compared to no data. Seen the few respondents we tried to be cautious with statements and not oversell the results of our study. Despite the low number of respondents, we still think that our study is relevant forming first impression on how water education was impacted Covid-19 from the combination of survey results giving a first impression on teaching practices and challenges during Covid-19, reviewing literature of common practices and challenges in water education before and during Covid-19, and the community effort communicated on the internet to help and learn from each other's experience to continue water education during extreme events like Covid-19 and beyond.

To clarify the sampling methodology, we extend the method section and provide more information on the survey methodology as

*Based on this survey Fischer (2020) we extended and adapted our survey questions to investigate how COVID-19 might impact European water education. The survey consisted of three different sections 1. Information on the respondent, 2. Water education in preCovid-19 and 3. Water education during Covid-19 (Table 1), consisted of in total 30 questions (Table A1) and should have taken approximately 10 minutes to answer. The survey was set up as a web form using Google Forms (a web application to create and share online forms and surveys, Google LLC). To have a non-biased representative outcome, a random sampling method would be preferable reaching a high number of participants from the total population (Gideon, 2012). However, to reach a large target audience, consisting of as many hydrologists involved in university education across Europe from teaching and course administrative staff working in European universities including*

*student assistants, Ph.D. students, lecturers/teachers, (assistant) professors, course administrators, and researchers, within a certain time frame to represent the Covid-19 Zeitgeist we adopted a snowball sampling approach by contacting our network through e-mail with the link to the survey and the request to distribute the survey within the respective department. The survey was sent by email to more than 200 contacts of the wider network of the authors, all part of different Universities in water education across Europe (Berlin, Göttingen, Stuttgart, Bucharest, Hamburg, University of Zürich and ETH Zürich, University of Freiburg iBr., Tu Delft, VU Amsterdam, Wageningen, Florence and members of the EU-Cost “WATER isotopeS in the critical zONe” consisting of more than 110 colleagues and further to 5 random people). In addition, in the e-mail there was a request to spread the survey within the respective departments. The email with a link to the form was sent in November 2020 with a reminder in March 2021. In addition, a post with the link to the survey was posted on the Facebook Hydrology group. The authors of this group did not participate in the survey.*

line 124: What is “googleForm”? Is this the Google Forms product from Google?

Author response: Google Forms is indeed a Google product. To clarify we change the sentence as stated in the previous response to section 2 methods.

line 146: What is meant by “response rate” in this context? Is this a percentage as per the total number of universities or people who received the survey?

Author response: In the submitted version of the manuscript we did not specify, in the method section, that the e-mail to the wider network contained the request to spread the information within the respective department. We included this now in the method section as

*In addition, in the e-mail there was a request to distribute the survey within the departments.*

As stated before, the total population of hydrologist in water education is unknown. Since the e-mail was potentially spread also within universities or departments the total number of recipients of the survey is unknown. Hence, it is not possible to calculate the percentage. We, therefore, rephrased the sentence as

*Only twenty-eight respondents answered the survey, some European countries are missing and only a few universities per country responded to the survey.*

line 164: What is meant by “state-of-the art”?

Author response: Instead of “state-of-the art” we rephrase this sentence as

*Seibert et al. (2013) showcased the common pedagogical approaches up to the year 2012 state-of-the-art in water education and Kleinhans et al. (2010); Wagener et al. (2012); Vidon (2015) and Blume et al.(2017) warned that more practical components are needed.*

line 212: What is meant by “CATs”? Do these involve “clicker” hardware and software?

Author response: We will provide more information in the introduction (oldline 73) what CAT’s are as

*Next to traditional methods in classroom environments, novel teaching methods are explored in university education. Classroom Assessment Techniques (CAT) are more frequently used to assess pre-knowledge, activate students, increase learning awareness, give student feedback and gauge student performance during or after a lecture (e.g. exit ticket, polls, quizzes, muddiest point, peer review using analog (e.g. piece of paper) or digital tools (e.g., clicker, mentimeter, kahoot) (Goldstein, 2007).*

line 266: Please provide more context on Bloom’s taxonomy. Not all readers are immediately familiar with this taxonomy.

Author response: We provided more context to the Blooms taxonomy as

*Such activities promote learning, by not only consider the lower cognitive domains of Bloom’s Taxonomy (a.k.a., Bloom’s Taxonomy of Learning Objectives, which identifies six cognitive levels from simple to more complex behavior including knowledge, comprehension, application, analysis, synthesis, and evaluation/creation (Gogus, 2012)) but also stimulate the higher cognitive levels by synthesizing, evaluating and discussing water concepts which facilitate to produce new original work.*

line 268: What is meant by “damage” in this context?

Author response: We agree the word “damage” in this context is not clear. We change the sentence from

*“Even more, it could be a solution to repair the damage in hydrology and water education by making practical and exotic teaching formats accessible for all hydrology and water students.”*

to

*Even more, it could be a solution to repair the damage in hydrology and water education, i.e., scaled-down practical training, by making practical and exotic teaching formats accessible for all hydrology and water students.*

The authors should provide all of the survey response data as Supplementary information so that the readers of the paper can better understand how the survey was conducted.

Author response: In case the manuscript will be accepted, the anonymized response data will be made available as supplementary information to the readers.

Figure 4: What is meant by “exotic” teaching methods? The difference between methods (traditional, practical and exotic) should be clearly outlined in the text.

Author response: The word “Exotic” was defined in L156 “ ... “exotic” and less practiced teaching formats in water

education. ...” . To clarify we rephrased the sentences as

*Peer teaching, role-play, group discussion, and video recording seem the less common practiced teaching formats in water education and therefore can be considered more “exotic”.*

All figures involving word clouds: Please discuss in the text how the word cloud contributes to the presentation of the research in the paper. What is the meaning of larger words relative to smaller words.

Author response: We rephrased and extended the sentence in L134 from “*More qualitative open questions were represented as a word cloud or included as text.*” to

*More qualitative open questions with multiple responses were discussed in the text or represented as word clouds. In a word cloud, the respondents’ answers are summarized as text, with the font size increasing and color changing from gray to orange as the words become more frequent.*

## References

- Blume, T., van Meerveld, I., and Weiler, M.: The role of experimental work in hydrological sciences – insights from a community survey, *Hydrol. Sci. J.*, 62, 334–337, <https://doi.org/10.1080/02626667.2016.1230675>, 2017.
- Eagleson, P. S.: Opportunities in the Hydrologic Sciences, National Academies Press, Washington, D.C., <https://doi.org/10.17226/1543>, 1991.
- Fischer, B. M. C.: How did Swedish water education got affected due to Covid19 measures?, *SHR Mon. Flash*, 2020.
- Gideon, L.: Handbook of survey methodology for the social sciences, Springer, 2012.
- Gogus, A.: Bloom’s Taxonomy of Learning Objectives, in: Encyclopedia of the Sciences of Learning, edited by: Seel, N. M., Springer US, Boston, MA, 469–473, [https://doi.org/10.1007/978-1-4419-1428-6\\_141](https://doi.org/10.1007/978-1-4419-1428-6_141), 2012.
- Goldstein, G. S.: Using Classroom Assessment Techniques in an Introductory Statistics Class, *Coll. Teach.*, 55, 77–82, <https://doi.org/10.3200/CTCH.55.2.77-82>, 2007.
- Kleinhans, M. G., Bierkens, M. F. P., and van der Perk, M.: HESS Opinions On the use of laboratory experimentation: “Hydrologists, bring out shovels and garden hoses and hit the dirt,” *Hydrol. Earth Syst. Sci.*, 14, 369–382, <https://doi.org/10.5194/hess-14-369-2010>, 2010.
- Nash, J. E., Eagleson, P. S., Philip, J. R., Van Der Molen, W. H., and Klemeš, V.: The education of hydrologists (Report of an IAHS/UNESCO Panel on hydrological education), *Hydrol. Sci. J.*, 35, 597–607, <https://doi.org/10.1080/02626669009492466>, 1990.
- Seibert, J., Uhlenbrook, S., and Wagener, T.: Preface “Hydrology education in a changing world,” *Hydrol Earth Syst Sci*, 17, 1393–1399, <https://doi.org/10.5194/hess-17-1393-2013>, 2013.
- Venhuizen, G. J., Hut, R., Albers, C., Stoof, C. R., and Smeets, I.: Flooded by jargon: how the interpretation of water-related terms differs between hydrology experts and the general audience, *Hydrol. Earth Syst. Sci.*, 23, 393–403, <https://doi.org/10.5194/hess-23-393-2019>, 2019.
- Vidon, P. G.: Field hydrologists needed: a call for young hydrologists to (re)-focus on field studies, *Hydrol. Process.*, 29, 5478–5480, <https://doi.org/10.1002/hyp.10614>, 2015.
- Wagener, T., Kelleher, C., Weiler, M., McGlynn, B., Gooseff, M., Marshall, L., Meixner, T., McGuire, K., Gregg, S., Sharma, P., and Zappe, S.: It takes a community to raise a hydrologist: the Modular Curriculum for Hydrologic Advancement (MOCHA), *Hydrol Earth Syst Sci*, 16, 3405–3418, <https://doi.org/10.5194/hess-16-3405-2012>, 2012.