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Citation Details

Rangecroft, S., Rohse, M., Banks, E. W., Day, R., Di Baldassarre, G., Frommen, T., ... & Van Loon, A. F. (2021). Guiding principles for hydrologists conducting interdisciplinary research and fieldwork with participants. *Hydrological Sciences Journal*, 66(2), 214-225.

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To cite this article: Melissa Haeffner (2022) Discussion of “Guiding principles for hydrologists conducting interdisciplinary research and fieldwork with participants”, Hydrological Sciences Journal, 67:7, 1145-1148, DOI: [10.1080/02626667.2022.2060109](https://doi.org/10.1080/02626667.2022.2060109)

To link to this article: <https://doi.org/10.1080/02626667.2022.2060109>



Published online: 04 May 2022.



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DISCUSSION



Discussion of “Guiding principles for hydrologists conducting interdisciplinary research and fieldwork with participants”

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ABSTRACT

Rangecroft *et al.* (2021) offer a set of principles for conducting interdisciplinary research and fieldwork with participants from a hydrologist perspective. In this invited paper, I present some thoughts from a social scientist’s perspective, not to disagree with their points but to add to them. Specifically, I use my sociology background and interdisciplinary experiences to reflect on qualitative evaluative criteria, power dynamics in the scientific community, barriers to interdisciplinary research, and approaches to overcome obstacles. Individual researchers can educate themselves about other disciplines, and there are also opportunities for institutional change on the part of universities, funders, and journals to support interdisciplinary work. I am enthusiastic about the emerging hydrology–social science collaborations I am witnessing. Indeed, I hope that more of my social science colleagues will see the unlimited potential of studying water systems with hydrologists and engineers, as I have.

ARTICLE HISTORY

Received 27 June 2021
Accepted 15 October 2021

EDITOR

A. Castellarin

ASSOCIATE EDITOR

H. Kreibich

KEYWORDS

interdisciplinary; social science; qualitative research

Introduction

Calls for interdisciplinary research are ubiquitous (Wickson *et al.* 2006, Brown *et al.* 2010, Brandt *et al.* 2013, Castree *et al.* 2014). However, difficulties often remain obscured behind these general calls. Getting interdisciplinary projects started, completed, funded, and published is fraught with barriers at every turn. Rangecroft *et al.* (2021) have assembled an impressive, high-calibre team to design a list of best practices for hydrologists working with social scientists to overcome some of these hurdles. I applaud Rangecroft *et al.*’s (2021) forthrightness in stating that interdisciplinary research is hard but rewarding. I agree with their assertion that “collaborative discussions and research between the social and natural sciences can significantly enhance the research design and process, producing holistic outputs” (Rangecroft *et al.* 2021, p. 221). I have witnessed the same in my own research and fieldwork with participants.¹ I am not an expert in all social science fields or methods, but I use my experience and background here to heed Rangecroft *et al.*’s call “for other interdisciplinary scientists to share their experiences with others to help further guidance on these important considerations” (2021, p. 223). As far as advice for going forward, individual researchers can educate themselves about different disciplines, but institutional change among universities, funders, and scientific journals is essential for promoting interdisciplinary research.

Qualitative evaluative criteria

In terms of individual education, we spend years learning how to evaluate scientific rigour in our own disciplines, but rarely learn how it is assessed in others. Rangecroft *et al.* (2021, p. 222) say “whilst there might be discrepancies in the data obtained from the different methodologies, this does not mean that one approach and its results may be ‘valid’ and the other not . . .” Rather, we can evaluate research on its own merits rather than by how it “lines up” with other approaches. For example, while quantitative research prioritizes reliability, validity, and generalizability, qualitative standards privilege trustworthiness and authenticity (Creswell 2014). Evaluating qualitative research using qualitative metrics honours the contributions of qualitative work to provide historical and social contextualization that is crucial to understanding hydrological model outputs.

Trustworthiness means that the research is credible, confirmable, dependable, transferable, and reflexive (Marshall and Rossman 2014). Similar to internal validity, authors must demonstrate that the information they present is a *credible* representation of the individual or community. There are several techniques qualitative researchers use – triangulation is one of them, where the author presents corroborative data from different sources or uses multiple methods to answer the research question. Studies must also demonstrate *confirmability*, or sufficient confidence that the data speak for themselves and not the biases of the researchers. To demonstrate they meet this criteria, social scientists might document an audit

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¹Sally Rangecroft, Melanie Rohse, Eddie W. Banks, Rosie Day, Giuliano Di Baldassarre, Theresa Frommen, Yasunori Hayashi, Britta Höllermann, Karen Lebek, Elena Mondino, Maria Rusca, Marthe Wens & Anne F. Van Loon (2021) Guiding principles for hydrologists conducting interdisciplinary research and fieldwork with participants, *Hydrological Sciences Journal*, 66:2, 214–225, doi:10.1080/02626667.2020.1852241.

trail detailing the data collection process and analysis. Similar to reliability, qualitative studies must be *dependable*, or show that the findings are consistent over time (Guba and Lincoln 1989). To account for this, a researcher might incorporate a code–recode technique in which they code (or look for themes in) the data, and recode it after a hiatus to compare agreement between the two coded sets. While quantitative research prioritizes generalizability, the value of small-n studies lies in their *transferability*, or the lessons learned that might be useful in understanding other cases. A common technique to establish transferability is by using thick description, or writing about the context in great detail so that other researchers can identify what is useful in order to apply their findings to other cases. *Reflexivity* is a standard that requires self-reflection on the part of the researcher regarding their own individual biases as well as the societal preconceptions they bring to their research. To demonstrate reflexivity, authors might include a positionality statement that describes their philosophy or theoretical background, and its potential influence on the study at hand.

Qualitative data, first and foremost, belong to the participants. After all, their perceptions, opinions, and characteristics are theirs to choose to give to researchers or not. Therefore, qualitative researchers must also attend to *authenticity*, including being fair regarding how well the participants' views are honoured and true to how stakeholders understand their own reality. Authenticity can be evaluated by involving stakeholders in the research process, checking interpretations for errors, continuously confirming consent throughout the process (rather than only at the beginning), disseminating findings for broader impacts, and systematically following up to assess outcomes (Guba and Lincoln 1989).

To do all of this, qualitative-based research articles might be substantially longer than quantitative studies. To properly present the information for readers to evaluate the trustworthiness and authenticity of the study, articles may take different forms than the traditional introduction, methods, results, discussion, conclusion format preferred by hydrology journals. One can see how it might be difficult for hydrologists to read or peer review social science articles and why hydrology journals might not want to publish them. This presents a barrier to information exchange between natural and social sciences, but one that can be overcome. Journals can create special issues and invite interdisciplinary-based articles; they could seek out reviewers who can evaluate one aspect of a mixed-methods approach while another reviewer focuses on another piece. Journals that want to start conversations between researchers might broaden the types of articles they accept.

Standards and ethics

Rangecroft *et al.* (2021) also choose as one of their main principles *strict adherence to the highest standards of research ethics when involving stakeholders in research*. The authors outline the basics of the how and why to maintain confidentiality and anonymity, obtain consent from both individuals and communities, commit to fairness as an ongoing process, and consider cultural differences around ethics from country to country. Usually, the university institutional review board

(IRB) reviews research designs involving participants, and formal training is required to meet basic standards. However, these are only guides and should be critically examined. This is where social scientists trained in critical theory can add value to support culturally sensitive research design. For example, the IRB in the United States officially uses the phrase “human subjects research.” The terminology “subjects” is offensive to many people since it reinforces notions of colonialism and being controlled as a “subject” of the state. Also, to be the subject of something is to *be* discussed as opposed to being the one *who discusses*, taking away a person's agency to be a part of the discussion. Using this language might dissuade already reluctant potential participants. This is one example of when language can lead to lower response rates and samples that are biased towards certain cultures while excluding others. Community-engaged research (CENr) is a methodology that moves away from the “participant as subject” frame and towards a more equal partnership in building healthy communities. Some social scientists specialize in such methods and can aid in the design of ethical research protocols. True engagement with communities requires more time and effort than unidirectional consulting or informing, and needs to be budgeted for accordingly.

Furthermore, not all scientific data have been collected or used in ethical ways, and some communities are rightfully sceptical of researchers. D'Ignazio and Klein (2020) remind us that data are not neutral or objective and it is important to be mindful of our presence as researchers when building trust with partners and participants. Many Indigenous nations have organized internal review boards to protect their members from the harms of data extraction for the benefit of others. Working with Indigenous peoples and working on Indigenous lands and waters requires extra training, and it is advisable to hire (and compensate) Indigenous social scientists who are well versed in decolonizing methodologies when working with tribal communities (Smith 1999).

Power dynamics in the scientific community

Rangecroft *et al.* (2021) point out that there may be power dynamics at play among researchers within interdisciplinary collaborations. To add to what they already presented, there is evidence that interdisciplinary researchers are more likely to be early-career scholars (Rhoten and Pfirman 2007). The disproportionate expectations of work intensification and neoliberal priorities on early-career faculty contribute to uneven workloads between senior and junior researchers (Caretta *et al.* 2018). Early-career researchers have less influence and fewer funding sources than senior faculty and may feel constrained to speak up out of fear that doing so might hurt their tenure case. It is also interesting that research shows interdisciplinary researchers are more likely to be female (Leahey 2006, Abramo *et al.* 2013). Gender discrimination, sexual harassment, and other abuses of power in academia have been widely documented (Gutiérrez y Muhs *et al.* 2012, Franco-Orozco and Franco-Orozco 2018, Mansfield *et al.* 2019, Niemann *et al.* 2020). Interdisciplinary researchers need to do triple work to establish themselves in their chosen field, become familiar with a second discipline, and build

bridges across these disciplines. For early career and women researchers, they have to do all this while also battling social discrimination. This may put them in a precarious position unless senior faculty deliberately seek out and uplift less established scholars.

There are also power dynamics at play between scientific disciplines. Rangecroft *et al.* (2021) focus on how hydrologists can learn from social scientists. This is a necessary step that Wesselink *et al.* (2017) say must follow the choice to collaborate – making hydrology and social science equal partners. Consider that Overland and Sovacool (2020) found that the natural sciences received 7.7 times more funding than the social sciences on all topics related to climate change between 1990 and 2018. Jaffe (2014) also found a bipolar distribution in journal citations, with higher rates in the natural sciences than social sciences. It is clear that the natural sciences have more power than social science in academia today. Sociohydrology research, which attempts to consider the human dimensions of water systems (Sivapalan *et al.* 2012), remains heavily dominated by hydrologists (Xu *et al.* 2018). One may ask: if it is indeed dominated by hydrologists, is it truly interdisciplinary? At the same time, Rusca and Di Baldassarre (2019) note that both hydrologists and social scientists must reflect on their role in producing and reproducing asymmetrical relationships. Natural and social scientists alike should think about what we want the future of coupled human–water systems research to look like. What are the spaces of overlap and how can we learn from each other?

My personal experience working in interdisciplinary research

Personally, I have witnessed a greater effort by natural scientists to bring in social scientists as true co-collaborators (for example, a hydrologist invited me to write this commentary). In one project, natural scientists trusted me to lead them through deep qualitative analysis, which they considered “foreign” and “alien” (Haeffner *et al.* 2022). When I first suggested the research design (a collaborative autoethnography), they immediately asked me if it could be replicated, something I had never been asked before. They asked me “Is this data?” referring to their interview answers and reflection journals. I, on the other hand, almost exclusively use personal perceptions as data and had never questioned its legitimacy. They were used to studying others; they were not used to studying themselves. What saved the study was the fact that we were part of a leadership workshop and we started off with a commitment to learning from each other. It took several years and several revisions to complete a paper which was a culmination of existential, metaphysical conversations about what we know (*ontology*), how we know it (*epistemology*), what methods we use to test our theories (*methodology*), and our value systems (*axiology*). In the end, we were able to define a shared purpose across disciplines, commit to respect and humility by facing our own biases, and persevere despite insufficient resources. It might not be necessary for all hydrologists to engage in that particular method, although they might find some value in being a participant in social science research to see what it is like, and social scientists would do well to personally invite them. Social scientists should likewise join natural scientists in their field research. I, for one, enjoy stomping

around riverbeds with my hydrology colleagues (Nielson *et al.* 2018). Opportunities such as these are why I do research. I hope more natural scientists invite social scientists across all disciplines to their projects and vice versa. I see this happening in many spaces, but they are often initiated by individual researchers rather than institutionalized by university departments (although Rangecroft *et al.* 2021, p. 223 see a trend in this direction). Rangecroft *et al.*'s (2021) paper would be a welcome reading assignment in core college courses to introduce students to the practicality of working across disciplines as the new standard.

In another project, a marsh restoration science team allowed me to assemble an Advisory Group of stakeholders and rightsholders that was not part of the original research design, but one I thought would add authenticity and trustworthiness to our results. We deliberately chose specific experts who lived in the sites we were studying who could proofread our research design to ensure it was culturally sensitive for our target audience. We were also conducting focus groups in areas where we did not have previous connections and formed the Advisory Group to establish trust, help us recruit participants, and evaluate our interpretations of the data. I also asked the natural scientist researchers to facilitate the focus group discussions. This helped the natural scientists trust the social science data and to see how human perceptions relate to their data (in this case, social and ecological metrics of restoration success). Again, the successes of this project were the direct result of the willingness of the natural scientists to engage with social data collection.

Paths forward

Anecdotally, I see both social scientists and hydrologists as interested in forging new collaborations to advance water science. The 2021 Sociohydrology Conference in Delft, Netherlands attracted over 300 global researchers from hydrology, engineering, and the social sciences. At other conferences I've attended, I noticed that the hydrologists tended to go to the hydrology sessions while the social scientists attended the social science sessions. I was pleasantly surprised to find the audiences mixed at the Delft conference. This gives me hope that scientists are eager to work through their initial resistance to other disciplines and transcend the worn-out dualities that have siloed academia in the past. This might be because of the particular people involved, but I do see evidence that scientists everywhere are tired of the “same old, same old.” The editors of *Nature Sustainability* (2021), for example, recently wrote “some scholars have started to wonder if water studies research has become a bit, well, stagnant.” Meanwhile, scholars working on interdisciplinary research in sociohydrology and hydrosocial studies have been embarking on exciting new research on the historical context of groundwater development (Mukherjee 2020), the social psychology of water use (Daniel *et al.* 2021), the connection between shifts in regulatory regimes and global water markets (Pacheco-Vega 2019), the social consequences of water mismanagement (Wurl *et al.* 2018), and how legacies of racism and classism impact the lived experience of drought (Savelli *et al.* 2021). With the focus on justice that hydrosocial studies bring, (Zwarteveen and Boelens 2014), I am hopeful that we can advance water

science towards more just and sustainable futures. Conversations can continue through conferences like Delft or through commentaries like this paper.

I agree with Rangecroft *et al.* (2021) that some tensions between the sciences can be overcome; I also think that these tensions can give rise to new learning experiences and innovation. After all, watersheds link urban and rural ecologies and economies. Food–energy–water nexuses are global assemblages. The agency of rivers shapes human settlements and migration. Human manipulation of water resources redistributes risk and wealth. Deep understanding and potential solution-building require both individual researcher interest and institutional change.

There is plenty of work to be done.

Acknowledgements

I thank Jenia Mukerjee for her encouraging comments on a previous draft. I am grateful to and impressed by the four reviewers who took the time to read my paper and respectfully suggest what to clarify for the hydrology audience.

Disclosure statement

No potential conflict of interest was reported by the author.

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