# Chapter 13
# Methodological Ethics Considerations in Science Education Research: Symmetric, Authentic, Material, Adaptive and Multidisciplinary


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## 13.1 Introduction

Following the previous chapters focusing on methodological considerations related the ethics with research in and about science education, this afterword aims to synthetize and reflect on some common or related issues raised in these chapters. It will first propose two dimensions for which the focus of the filed is shifting: the sharing of responsibility and the invasiveness of data. It will then conclude that these shifts are signs of maturity in the field and show some alignment, or parallel developments, with developments in science education research and current society.

### *13.1.1 A Shift of Responsibility Toward More Complex and more Equitable Relationships*

The first important dimension discussed by the authors is the relation between researchers, participants and stakeholders for which it is proposed that the balance of responsibility and benefits could be shifting away from the researcher to create more complex and more equitable relationships.

In their chapter, Andrée et al. (2020) insist on the importance of symmetry in participatory science education research. This symmetry principle applies primarily to teacher-researcher collaboration for the teaching interventions but can also be expanded to ontological, epistemological and methodological values commitments at play. The proposed shift toward symmetry between teacher and researcher could produce more engagement of teachers in research activities as well as more

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involvement of researchers in teaching practices. This greater collaboration should eventually lead to more appropriate responses to problems related to teaching practice both in theoretical and concrete ways.

It is interesting to note here that this symmetry principle applied to teacher-researcher interactions can also be considered for the teacher-student interactions as proposed by Tabak and Baumgartner (2004) for inquiry-based science learning and that research suggests that this leads to more pedagogical efficacy. This parallelism between the recent evolutions of ethics related to science education and the evolution of science education itself is not really surprising and may be interpreted as an indication that something more general is going on.

In another chapter, Adams and Siry (2020) focus on the importance of living authenticity in science education research and propose how to enact an authenticity criteria that extends the usual ethics considerations to encompass all stakeholders and recognize subjectivity and context-dependent structures that mediate research outcomes. This aims to increase the potential benefits from their experiences, from a subjective and contextual point of view, while they are participating in a research project. This proposed shift toward authenticity could produce research projects with more understandable outcomes but also make individuals more informed, more understanding of others, more stimulated by research and more engaged toward change.

These outcomes related to applying authenticity to research in science education are not unlike those related to applying authenticity to science education (Braund and Reiss 2006; Roth 2012) and even to other disciplines (Rule 2006). Once again, some parallelism can be observed between recent evolutions of ethics related to science education and the evolution of science education itself.

Pushing to encompass even more, Scantlebury and Milne (2020) propose a post humanistic approach to ethics that includes all non-human material entities when questioning education research practices, methods, data analysis and interpretations. Science education research with this approach is intrinsically contextual, dynamic, relational and should take into account generally how humans and matter are entangled in knowledge production but also more specifically how teachers, students, researchers, material settings and instruments are entangled in producing learning science activities. This proposed shift toward materiality could produce more complete descriptions and understandings of what matters in science education research processes. In this context, as human and non-human entities become more and more entangled, equilibrium between benefits and risks in ethical decisions has to change by considering, for example, that researchers are always part of the experiment and cannot make completely external decisions or that responsibility could be shared in some cases with machines with the corresponding risks.

Once again, this evolution of ethics about research in science education can also be considered for science education itself. For example, Snaza et al. (2014) propose to apply post humanism to education by considering the entanglement of humans and technologies that is becoming more and more important. This could eventually lead to a fundamental learning displacement from human to human-machine, human-animal or even human-machine-animal collaborations. This is a major shift

that somehow encompasses the all the more equitable propositions of precedent chapters in the sense that researcher, participant and stakeholder are entangled in their relation to all physical realities and beings and that all relative responsibilities should be acknowledged accordingly.

### *13.1.2 A Shift of Focus Toward Continuous Micro-Level Data*

Another important dimension discussed by the authors is the extent and the potential invasiveness of micro-level data to be continuously collected, mostly visual, that makes the researcher a privileged witness that should also develop a greater ethical respect of participants' privacy. In some cases, new types of data such as those related to neuroscience raise issues that even require a development of ethics.

In their chapter, Hilppö and Stevens (2020) insist of the students' ethical agency in video research. They propose that the rapid development of various recording technologies has created new opportunities that redefine the conventional boundary marking what people can know about each other in a way that accentuates the researchers' obligations of respectful and diligent treatment of this knowledge, especially in research with children. To address this concern they show how children indicate their awareness of the audience and create privates spaces for interactions not to be recorded. Ethical symmetry in this context commands to conduct research the same way with adults or with children and consequently to explicitly and respectfully renegotiate boundaries of the research. This shift toward invasiveness of technologies balanced by awareness of children's implicit choices could lead to a continuous renegotiation of consent which is a major methodological challenge related to ethics but also a major challenge to society where technologies are also becoming more and more invasive.

Afterwards, Otrel-Cass (2020) uses a material ethics approach in visual science education research. She insists on the fact that, while researchers aim to set a priori codes for good ethical conduct, they cannot decide who a person is by giving them a universal definition. Some people do not object to being filmed while others do. Some see benefits in explaining and justifying researcher interpretations, others do not. Their interests or reluctances in collaborating are based on their histories and the values they place on different activities and researchers need to negotiate those with care. Ethical considerations in this context cannot be fixed a priori and should adapt continuously to individuals and to situations. As pointed out by the author, this shift toward adaptability and responsiveness related to ethics with potentially invasive visual data could produce globally more trust: trust between researcher and students, trust between researcher and parents, and even trust between children and parents.

Although the shift towards micro-level data from video-ethnograhies has important consequences in terms of ethics, there are also other developments of data production in science education research challenging practices of ethical reflection, in particular that of neuroscience. These psychophysiological and neuroscience data

are more private and more sensible because they have unique and profound ways for peering into the body and into the brain (Shamoo 2010) and they raise some ethical issues.

First, even if it has been usually recognized that neuroscience research can contribute to the science education field (Ansari et al. 2012; Masson and Brault Foisy 2014; Masson et al. 2014; Blanchette Sarrasin et al. 2018; Smyrnaiou et al. 2016; Riopel and Smyrnaiou 2016), this is still a subject of passionate debate (Bruer 2006; Horvath and Donoghue 2016). This fundamental contribution of neuroeducation is of course necessary for the corresponding data to be useful at all. These possible benefits have to be ethically balanced with the possible risks. For example, there has been concerns related to dangers of misinterpreting or misusing the corresponding findings because of their highly technical and confusing nature (Alferink and Farmer-Dougan 2010). Another ethical issue is the invasiveness of such technologies that also needs to be considered very seriously. As pointed out by Ansari et al. (2012), recent availability of non-invasive methods to image the brain reduces these risks and makes it possible to measure school-taught skills in authentic contexts.

Considering more generally ethical approaches to neuroeducational research, Howard-Jones and Fenton (2012) propose an interdisciplinary stance that focuses on three main areas. The first area concerns conducting research at the interface of cognitive neuroscience and education. The comparison between the two fields leads to propose that physical risks are mostly alike but that psychological risks differ slightly in the area of incidental findings where educational researchers don't always have the same expertise. More differences are observed when comparing the social and educational risks because the participants are usually more engaged and their voice is usually more heard in educational research. Consequently, because of its high complexity, neuroeducation could lead to less implication of participants than other educational research and this social risk has to be ethically balanced with the possible benefits. The second area of ethical issues to neuroeducational research is interpretation and communication of findings. The entanglement of many disciplines in the neuroeducation field makes it difficult not to propagate neuromyths and other misuses. To avoid them, it is proposed that higher quality standards and interdisciplinary expert collaboration could be ethically required for research communication in neuroeducation. The third area is policy making for which many emerging and difficult ethical issues have been identified such as cognitive enhancers, neural infant screening and genetic profiling. These cannot be resolved with existing set of ethical principles from contributing disciplines and will require more interdisciplinary expert discussion and more public consultation and debate.

## 13.2 Alignment with some Challenges of Current Society

All the precedent propositions focusing on methodological considerations related ethical issues with research in and about science education can be interpreted primarily as a sign of maturity in the field: they all extend research ethics from a more

classical and general stance (macro-level, researcher-centered, prior consent) and simple unilateral relationship to a more actual and specific stance (micro-level, participant-centered, continuous renegotiation, multidisciplinary) and equitable relationship. This can be viewed as reassuring from a non-specialist point of view as it implies an evolution toward more awareness and sensitivity from the researchers' community and leads to decentralization and sharing of power and responsibility. This evolution of methodology ethics in science education research is in alignment with the evolution of science education itself. These propositions are also in alignment with challenges of the current society as they try to address, in the context of respectful research ethics, the important issues related to the omnipresence and invasiveness of technologies in individuals' life. This invasiveness can be observed with data from computers and phones, social media and videos, but also from psychophysiological and neuroscience data that are linked to the emerging field of neuroeducation. One can hope that these new ethical issues will lead to fruitful interdisciplinary discussions and collaborations and that these could in turn serve as inspiration to public consultation and fruitful debate.

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