Chapter 3
Reflections on Research Ethics in Historically Oriented Science Education Research in Canada

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3.1 Introduction

In recent times, discussions of ethics have become much more prevalent in academia and popular culture, so much so that representations of the term have become common place. These reviews are an assessment of the integrity of research; in thinking about research ethics we are more often than not considering research that addresses live human beings and/or other living creatures. This research is sometimes scientific in nature, quite often quantitative, and frequently qualitative in nature. It can also ask direct questions of research participants. In the past, health care research frequently provided ethical review protocols for all different types of research as van den Hoonard notes (van den Hoonaard 2011). These biomedical protocols continue today to ensure that all risks to subjects are weighed and considered before the research is conducted. That these health-related protocols and approaches are an important part of research ethics is clear. In recent times however, new directions have emerged in research ethics in the field of science education. As the then new editor of *Research in Science Education*, Stephen Ritchie, presciently noted in 2008.

> Traditional stances on research ethics in education followed medical models that emphasized informed consent and privacy (e.g., Howe and Moses 1999). As researchers strive to enhance the impact of their work on students and teachers of science, I would expect a movement away from conservative methodologies. Accordingly, the relationships between researcher and other research participants will become more challenging. (Ritchie, 2008, pp. 1–2.)

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K. Otrel-Cass et al. (eds.), *Examining Ethics in Contemporary Science Education Research*, Cultural Studies of Science Education 20,
https://doi.org/10.1007/978-3-030-50921-7_3

Along with the changing models for science education ethics review, we want to introduce historical research since we believe that interesting aspects to do with research ethics can be gained by examining this field. Thus, we focus particularly on research ethics in relation to historical methodology. This differs from the biomedical approach and directs us to look to the past and find sources of past events; things that may have happened in the last ten years, the last century, the last millennium or beyond. In the fields of science and science education, this type of research provides a link to past developments in the classroom and in the field. Scholars such as Zeller and Simon have shown the way in their work on the history of science (Hoffman 2013; Simon 2013; Zeller 2000, 2017).

Concomitantly, when historians look at primary source documents, they must do so with a somewhat skeptical and critical eye. As science education researchers we must ask ourselves then; are biomedical models and approaches to research ethics also a fit for this field as we undertake historically oriented science education research? This chapter proposes to answer this question in the following way: it will argue that the biomedical model of research ethics review is not appropriate for this type of research. In support of this view, the chapter examines research ethics review policies, definitions and protocols in science education in the context of Canada. The reason for examining the historical context of Canadian science education research is exemplary. Each country presents its own research histories and to deconstruct them allows identifying very unique trajectories. However, this development is also set in the greater context of historically oriented research in science education since research is an international endeavour. The chapter will subsequently discuss the specificities of historically oriented research in this field and delineate the different kinds of research data sources, whether these are primary source documents, or data from science education projects. The chapter will conclude with a reprise of the discussion about biomedical ethical review in science education research that is historical in orientation.

3.2 The Current State of Research Ethics Review in Canada and the Literature

3.2.1 Current State

When trying to gain further understanding of the biomedical perspective key questions need to be addressed in terms of establishing the current state of research ethics review in Canada and understanding the research ethics rules in science and humanities disciplines. These are the following: what is the overall existing framework for research ethics review in Canada? Also, what is the perspective of the literature on this topic? What role has the biomedical model played in this?

To understand the influence of the biomedical model, one must start with the structure of research ethics governance in Canada. The policy oversight at the

highest level is comprised of the Three Councils. The more commonly named "Tri-Council" governs ethical research practices and the responsible conduct of research in Canada (Panel on Responsible Conduct of Research 2016). This is a federal government organization that consists of the Social Sciences and Humanities Research Council (SSHRC), the Natural Sciences and Engineering Research Council (NSERC) and the Canadian Institutes of Health Research (CIHR) (Canadian Council of Academies & C.C.A. Expert Panel on Research Integrity 2010). In recent years, there has been a worldwide trend to tighten research integrity and this has been the case both in Canada and in other advanced industrialized states such as Germany (Canadian Council of Academies & C.C.A. Expert Panel on Research Integrity 2010; Mayer and Steneck 2012; Steneck et al. 2015; Zimmerman 2015). Under the auspices of SSHRC between 1994 and 1998, the "Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans" (abbreviated to TCPS) was created. It is a guide for university-based Research Ethics Boards (REBs) to use in terms of deciding whether research is ethical (Gontcharov 2011; Heslegrave 2012; Janovicek 2015). The original TCPS came about with the biomedical model of review very much in mind. In the history of research ethics in the United States this model originated with a focus on medical patient privacy. As Schrag defines it, there are a variety of foci of institutional review boards that reinforce the biomedical model. He speaks of four key components in defining biomedical model research: "1. Researchers know more about their subjects' condition than do the subjects themselves. 2. Researchers begin their work by spelling out detailed protocols explaining what hypotheses they will test and what procedures they will employ to test those hypotheses. 3. Researchers perform experiments designed to alter subjects' physical state or behavior, rather than simply gathering information through conversation, correspondence, and observation. 4. Researchers have an ethical duty not to harm their subjects. (Schrag 2010)." Ells and Gutfreund also provide a succinct definition of the biomedical model; "The 'biomedical model' for research is hypothesis driven; that is, researchers generally begin with a formal hypothesis, make use of experimental designs and quantitative data, and engage in deductive reasoning with the aim of confirming the hypothesis (Ells and Gutfreund 2006, 370)."

This focus on a biomedical approach and hypothesis testing resulted in a revolt in the early 2000s on the part of social science researchers, educationalists, humanities researchers and historians in Canada (Janovicek 2015). One of the organizations that led this revolt was the Canadian Association of University Teachers (CAUT) and they took exception to some of the power of collectives over research projects as Grant notes (Grant 2016). One area that these scholars took exception to was the area of privacy. As Canadian historians Franca Iacovetta and Wendy Mitchinson state, "our legal obligations as researchers to protect the privacy of individuals in the past can lead us to write the marginal into history by writing their names and faces out of it (Iacovetta and Mitchinson 1998; Janovicek 2015)." Consequently, in this regard, the difficulty of writing history, and dealing with issues of privacy and confidentiality remains. In contemporary times, groups of Canadian historians have continued to be attuned to ethical issues and have made statements with regard to how ethical practice plays a role in their research, notably, for

example, the Canadian Historical Association (CHA) (Canadian Historical Association 2018). Additionally, as van den Hoonaard (2011) underlined in his book length examination of ethics review, the gap between the biomedical model and social science research is often extreme. He underlined this in his exposé of three case studies that looked at ethnographic research of the deaf-blind, street people and nursing homes; research that was not anonymous and relied on knowing the subject of the research (van den Hoonaard 2011, p. 63). Knowing the subject of the research was critical to the successful completion of the research in this circumstance. TCPS 2 in its current iteration came out in 2010 (updated in 2014 with a companion document) in an attempt to address the issue of the biomedical approach (NSERC and SSHRC 2014). While somewhat successful in speaking to the question, it still has its critics (van den Hoonaard and Tolich 2014).

Earlier, science education researchers also looked at the initial iteration of the TCPS and found it lacking in several key areas. These researchers were very critical of two main issues. Firstly, they disagreed with the original one-size-fits all, overly risk-aversion to legal exposure approach of the TCPS and the early institutional REBs. Additionally, they did not like the deeply probing questions that called into question disciplinary research designs. This research group concluded that science education researchers needed to be more proactive in the development of research ethics policy and review; otherwise, the *big-stick* approach to research ethics was unlikely to change in the near future (this was the view in 2008, TCPS was revised, as noted, in 2010 and 2014) (Anthony et al. 2009).

Notably as well, there is increasing recognition by science educators and academic communities that more must be done in terms of educating for ethical process and the correct application of policies and programs such as TCPS 2 as Stockley, et al. note (2016). As ethical review will be with every scholar in the field of education moving forward, ethical education must be addressed as part of one's doctoral education and must be explicitly mentioned in one's dissertation. Scott's work is one early example that illustrates the greater awareness and use of research ethics protocols by doctoral students in the early twenty-first century (Scott 2007).

3.2.2 The Contributions of Different Scholarly Literatures to the Dialogue on Educational Research Ethics Policies and Protocols

In addition to the above-mentioned group of historians, it is important to examine whether scholars from several disciplines and research fields have looked critically at research ethics review and questioned why use the biomedical model. This section addresses highlights of some of their perspectives. As these research fields do also contain historical perspectives it is important to include their viewpoints as well.

The biomedical approach and research ethics review has not been well discussed in the field of the history of education. The evidence of reflection is slim. In her recent article on research "North of 60", McGregor (2015) speaks to the question. Particularly, in her case, the challenge of research in Canadian Inuit communities was that it required ethical approval from several levels of government, Indigenous communities, and institutional ethics boards and the requirements for these ethics boards were often at odds (McGregor 2015; c.f. Nickels et al. 2006). Raptis (2010) in her encyclopedia entry on documentation notes the problematic nature of restricted access documents. Archival personal records that are restricted must be anonymized before they can be used.

In the field of Indigenous studies, questions of research ethics review and appropriate types of protocols present a more lively discussion. Research in this field is often at odds with a scientific/biomedical model. Scholars in this field look at questions about First Nations, and the Indigenous peoples of Canada, including their history. Following the very horrific and tragic historical events of Residential Schools, the more recent establishment of the Truth and Reconciliation Commission (TRC) and the Aboriginal Healing Foundation have focused a strong light on research ethics and Indigenous people in Canada (Battiste 2008; DeGagné 2012). While this is a topic too broad to cover in this analysis, it is important to signal its significance.

Scientists and science education researchers around the world and in Canada have also become increasingly concerned about ethical considerations and integrity in their teaching, research and data collection (Schoenherr and Williams-Jones 2016). There has been an awareness over a long period of time that the direction of science education research is important and that science education can have deep impacts on culture and what science teachers do in the classroom shapes societal views (Bazzul 2013; Frazer and Kornhauser 2014). In more recent times science education researchers have discussed ethics in a variety of contexts as Bazzul notes (2016, pp. 24–26). In the early 2000s, science educators were also concerned about the broader implications of their teaching and the ethical responsibilities of science graduates as well as their need to be schooled in the broader socio-political currents that impact the scientific endeavour (Hodson 2010). Nielsen echoes this in his discussion of "supplementing regular science teaching with socio-scientific issues; that is, social, ethical, and political issues that have conceptual ties to science (Nielsen 2013, 373)." In his view, how students articulate evidence in socio-scientific discussion is equally important to science knowledge (Nielsen 2013).

In contemporary times as well, the editors of the primary journal or as the editors describe it, the "mouthpiece" of science education research in Canada, *The Canadian Journal of Science, Mathematics and Technology Education* have retrospectively reflected on the direction of science education research in Canada. They note the various approaches to research; quantitative, mixed-methods (of which the contributions are few), and qualitative research including action research, ethnography, theory building, interpretation, and narrative based research (Pegg et al. 2015). Less was said however, about the ethical implications of science education research in the editorial reflection. Ethics was examined as part of classroom practices as

opposed to research (Pegg et al. 2015). Other new works on science education in Canada speak to teaching ethics in the classroom, but not the implications ethics review for research (Tippett and Milford 2019). With the paucity of reflection in this area, it signals the need for more and new questions. This is a good opportunity then to look at historically oriented science education research, some of the challenges imposed on this field by the biomedical model of research ethics review, and how this fits into the broader picture of research ethics models.

With exception of Indigenous studies, research ethics protocols and research ethics review boards have seen only limited commentary by science educators and other scholars in Canada. This lack of commentary is in part because of the focus on "doing" research in their fields, as opposed to looking at it more obliquely through a research process focused lens. van den Hoonaard and Hamilton's (2016) work are the almost singular exception to the lack of critical analysis of research ethics review processes in Canada. Only a few scholars have explored this area, and this may be the case because critical reflection on practice is not often done. Additionally, for many, research ethics applications are a relatively new experience.

3.3 Specifics Regarding Research Ethical Standards

3.3.1 Science Education and Historically Oriented Research Methods and Archival Sites

Having examined the selected literature and the contexts of ethically based research in science education research and in other fields in Canada, we turn now to exploring the practice of data collection by utilising archives and the archive itself. It is clear from the earlier discussion that the biomedical model is difficult to apply to science education research. This exploration then looks first at science education research methods. Then, it turns to historically oriented methods, the use of archives, and the use of primary source documents.

3.3.1.1 Qualitative Research and Science Education

Distinct from biomedical research methods, science education researchers use qualitative and quantitative methods, such as surveys and interviews as some of the methodologies in the conduct of their research. Vogrinc and his colleagues describe in depth the wealth of methodological approaches that are currently used in science education research (Vogrinc et al. 2019). They write that the issue of data collection is also important, since:

> … data collection [one] is not limited to one source or one technique only. Apart from the data acquired by interviews and observation, usually also different documentary sources are used, such as personal documents (a birth certificate, an employment record, a passport,

> letters, photos …), different records produced in the process of data collecting, transcriptions of tape recordings, video material, etc. It is important emphasize that only the triangulation – the pluralism – of data collection techniques and their mutual combination can provide for linking the findings of individual phenomena or aspects into a meaningful integrity (Vogrinc et al. 2010, p. 2).

The data is then coded, and this is central to the analysis of documents as Bryman notes (Bryman 2004). While Vogrinc and his colleagues write about personal data, in the science classroom and science education research this can be expanded to "classroom observations and artifacts" as data as Carrier notes in her study of scientific literacy (Carrier 2013, p. 11.). Further, rich research possibilities exist for the analysis of students' scientific vocabulary, their fluency with scientific terms, and their growing awareness of socio-scientific issues in the elementary, and secondary classrooms (Leeman-Munk et al. 2014, p. 4).

It is the researcher's responsibility to protect the individual and to uphold high standards of practice in science education research. Vogrinc and his colleagues conclude that science education researchers have a variety of ethical issues to address in their research:

> The general issues that need to be thought of are: informed consent, confidentiality, avoiding harm, integrity and professionalism. In research, ethical issues must be considered at each step in the research process. Ethical principles dictate: (1) what measurement techniques may be used for certain individuals and certain behaviors, (2) how researchers select individuals to participate in studies, (3) which research approach may be used with certain populations, (4) how studies may be carried out with individuals, (5) how data are analyzed, and (6) how results are reported (Vogrinc et al. 2010, p. 6).

These principles are very important for research with human subjects, but the question remains how applicable are they for historically oriented research? Which ethical approaches are significant here?

Historical case studies into the history of science and science education topics are where the question of ethics and the suitability of the bioethical model of research comes to the fore. For science education researchers, looking at the history of science and the history of science education through case studies is essential as these studies provide other views into potential ethical problems in their research and the teaching of research ethics (D'Angelo 2012; Pimple 2007). For example, in Herrid's work, several case studies are presented. These include "A Rush to Judgement," about a psychology lab and research protocols, through to "Bad Blood: The Tuskegee Syphilis project," a historical examination of an unethical clinical study using volunteers from Tuskegee University between the 1940s and 1970s (Herreid et al. 2012). Similarly, in the Canadian context, the analysis of cases on research ethics is a critical first step for researchers doing historically oriented science education research.

The question of ethics and the suitability of the bioethical model of research is additionally present for science education researchers who are working on historical biographical studies of science educators, policy analyses of science education, and historical research on the teaching of science and science curriculum in the classroom. In terms of biographical case studies, Hankins in an early article writes about

the evolution of history of science biographical case studies (Hankins 1979). One rich source of curriculum documents regarding the history of science education is the Ontario Historical Education Collection at the University of Toronto. It provides primary source science education curriculum documents and primary source assessment documents as well (University of Toronto Libraries 2019).

Research ethics in historically oriented research is additionally closely tied to the evolution of archives. But, from the outset much of the biomedical review model is unsuited for these archives and archival searches as this evolution is not in any way tied to generating experiment designs, or the proof of hypotheses. Rather, archives in recent years underwent an upheaval driven by archivists and researchers who examine archival policy. In Australia for example, there is a discussion of "archive mania" and Derrida's "archival fever" (Biber and Luker 2016). Additionally, outside academia, lawyers among others, have become much more attuned to the use of archival sources and in re-examining old cases long forgotten but now resurrected with the use of archival records (Biber and Luker 2016). Much debate regarding the role of ethics as it is linked to archival documents is thus very relevant in contemporary times. McNeil notes that the archivist's role has been reimagined not only to serve as a trustee of documents and to ensure the completeness and security of the initial documents following their accession to the archives; but also to create archival codes of ethics, to protect of the privacy of individuals, and to protect their lives with regard to public exposure (MacNeil 1991). The refocus in the direction of privacy in the archival space is of critical import to an understanding of research ethics in science education in Canada. This focus on privacy does not directly speak to the biomedical model of research ethics review, it is important to see this as an adjunct and an evolution in archival thinking.

Further, it is important to understand the ostensible "archival divide" when we look at the applicability of biomedical research ethics protocols to historically oriented research (Blouin and Rosenberg 2012). This divide between researchers and archivists complicates questions of research ethics and historically oriented science educational research. The history of archives, their position of authority, their historically intense secrecy, their role in questions of diplomatics, and in general their role in societies, is long, dating back to medieval Europe and before (Blouin and Rosenberg 2012).[1] Archives and archivists, as noted earlier, defined new missions as the twentieth century wore on. The old mantra of "keep everything" gave way to new guiding principles. Instead, key questions now include what to collect, what to keep, when can people see the documents, and who should see the documents (Blouin and Rosenberg 2012)? Additionally, who would or should share the documents, as Nelson notes in his piece (Nelson 2009). One thing that was increasingly clear was that the integrity of archival records, and subsequently having a code of ethics associated with this, was absolutely critical (Cappon 1982; Nelson 2009). Further, the question of "enduring value," became one that archives, and archivists

[1] N.B. Diplomatics is the study of the veracity and authenticity of works as opposed to diplomacy. Diplomacy is the day to day conduct of international relations.

asked regarding primary source documents. Which documents should be kept? Archivists and historians also need to probe the dark side of archival policy, historical research and writing and look at a further question; which documents should be destroyed (Blouin and Rosenberg 2012)?[2]

Additionally, this divide bears added scrutiny in terms of research ethics as archivists move in the direction of a more quantitatively centered, potentially more biomedically oriented approach, greater scrutiny in records management, and greater integrity of the records (de Chadarevian 2016). There is a recognition in the archival community that historians and those undertaking historically oriented research constitute, still to this day, the major users of their resources (Anderson 2004). After surveying archivists and historians, Anderson, in his study, demonstrates that historians' information gathering techniques are also becoming more sophisticated and diverse. Additionally, historians' and those undertaking historically oriented research expectations around the detail of finding aids are becoming more challenging. These scholars are demanding more at a distance information that they can access through the Internet and the World Wide Web (Anderson 2004). Simultaneously, as noted however, in terms of research ethics review, archivists are also becoming more restrictive in what collections are available to the users of their collections. The whole of the archive is no longer the territory of the historian (if it ever was), many things are now heavily restricted and frequently require access to information requests in order to be examined and read.

3.3.2 Data Sources, Types of Information and Ethics

Having addressed the challenges concerning archives it is important now to look at research data, in this case primary sources and how the biomedical review model is applicable (or not) to this data. Primary sources constitute the nuts and bolts of historically oriented science education research. These documents, notably written documents and the photographs, are very important in determining the quality of the writing and research that will emerge. In this section we look at some of these sources. These have a growing impact on the kind of data that are now looked at by researchers. Therefore, we now turn to examining this data.

[2] This is done generally under a view to prune collections and keep that which is archival eye most significant. The more extreme version of book burning is another issue throughout the twentieth century as well. Sometimes due to war and insurrection, the archives are displaced as Lowry amongst others notes in his collection of essays. And archives can drag in the unsuspecting historian.

3.3.2.1 Written Sources

Historical data, as opposed to primary data collected through qualitative or quantitative methods (e.g. observations, interviews, surveys), comes primarily in the form of documents and these are central to the majority of historical writing projects (Bombaro 2012). In many ways it is similar to some of the other documentation science education researchers would collect using qualitative methodologies. As Bombaro and other historians have noted, historical primary source documents are bits of evidence including diaries, journals, government documents, artifacts, and images that are created firsthand by the person witnessing the historical event taking place (Bombaro 2012). Several issues arise with primary source documents. These will be briefly examined, but it is clear that a biomedical approach to ethical review might not be the right fit for this data.

The interpretation of historical documents is one challenge. Biomedical review models are challenged in this environment. Firstly, there is a possibility of bias with the interpretation of documents. When authors and historians examine primary source documents as McCullagh notes, bias can appear in a variety different way in the writing of historical documents, including through historical inference, historical explanation, historical description and historical interpretation (McCullagh 2000). Biomedical review models generally are not receptive to these approaches with their emphasis on formal hypotheses, experimental design and quantitative data. McCullagh additionally notes that some theorists feel that bias is unavoidable in sources. Ethically speaking this poses challenges. He argues further that the views and meanings of historians direct every aspect of the explanation of events in the past (McCullagh 2000). Consequently, for some theorists, this means the end of history as a discipline. Additionally, central is the notion that historians choose primary sources that interest them and consequently there can be no better, nor no worse representations of the past (McCullagh 2000). McCullagh also states that primary source documents simply need to speak on their own. The more voices from the past on a topic; the more perspective one gets, and a better picture of past events is thus rendered (McCullagh 2000). In terms of applying the biomedical review model here, it does not fit to these issues.

Further to this challenge, there is the challenge of multiple voices in many sources. Historians' writing and how primary sources are viewed should instead be seen through the presentation of opposing views. This contrasts with the idea of having simply a consensual view of the past as presented through primary source documents (Burke 2001; McCullagh 2000). In Burke's view, having a multiplicity of sources potentially eliminates the question of bias (Burke 2001).

3.3.2.2 Photographs

Photographs and films as historical data sources have been used in science education classrooms and the application of the biomedical ethics review model to these sources is inappropriate (Kafai and Gilliland-Swetland 2001). Science education

researchers undertaking historically oriented investigations using these materials also face the prospect of ethical review. Dussel's and also Daston and Galison's works underline that photographs and visual media have their own set of ethical questions and issues. Daston and Galison in particular look at objectivity in the making of scientific images (Daston and Galison 2010; Dussel 2013). The scientist/photographs' ability to present data in the photographic medium is often beset with issues that derive additionally from the nature of the "objective" devices capturing the image. Also, historical photographs are challenged by questions of interpretation and this is what the discussion moves to next.

Archival preservation of photographs and films has also become also increasingly critical as these media age. As Blouin and Rosenberg note, there are many questions around photographs. Central to these questions are issues such as the nature of the subject. Was it captured *as such* naturally? Or was it staged? What was the nature of the equipment used? What was the photographer trying to convey (Blouin and Rosenberg 2012)? Photographic archivists have long argued that archives need to look more closely at photographs and ask many questions (Blouin and Rosenberg 2012).

Questions of ethics and privacy are among the factors that were not questioned prior to the 1960s when photographs were used as data taken by science education researchers undertaking historically oriented research. Tinkler refers to this in her work;

> In recent years there has been a dramatic shift in perceptions of the rights of individuals to privacy. Fifty years ago, when Townsend undertook his study of residential care for the elderly, he encountered no restrictions and his photos were taken with little regard for the self-respect or wishes of the elderly people he depicted. This was not unusual at the time; documentary forms of photography, including academic studies, have a history characterized by a lack of regard for the people that are photographed (Tinkler 2013, p. 196).

Ethical reviews also come to the fore in terms of legal restrictions on photographs. Darling (2014), in her article on this topic, addresses the importance of researchers and others preparing for what may come in terms of graphic photographs (i.e. scenes of intense violence, death, etc.). While science education researchers in all probability will not use such images, it is important to know about these types of pictures. Darling's experiences underline the difficulties of seeing photographs without adequate preparation and without a sense of the context (Darling 2014; cf. Maynard 2017). Photographs can also be altered. Photographs help construct reality. Photographs can also be ambiguous. The more layers a photograph possesses, the greater this ambiguity and concomitantly, the greater the challenge of the researcher to accurately analyze and present the photographs as a primary source documents (Evans et al. 2018).

Two issues are very important; the providence of photographs, and the documentation of photographs (Vervaart 2014). Vervaart writes on a series of issues that science education researchers need to take into account in all types of research, historically oriented or otherwise; what equipment was used in obtaining the photo, why was a particular image selected, were there alterations made to the image, what are the details of the image, were annotation tools used to explain the image, and

lastly, what are the details of the analysis (Vervaart 2014). Additionally, as Chouliaraki and Blaagaard note, the relationship between the researcher, the photographer and the image are critical (2013). Moreover, from the standpoint of the Canadian Tri-Council, issues of privacy and the sensitivity of the content of the photograph are also important in evaluating an ethical review protocol for photographic documentation (SSHRC Ethics Special Working Committee 2008).

Many of these questions come to the fore in Bullock's work (2014). Bullock, in his self-study of teacher education, as a historian-physicist researcher, talks about the analysis of video data using different approaches, the lens of the viewer, the lens of the researcher and the lens of the science teacher educator. While ethics was not a central part of his analysis, he noted "that the use of video in my teacher education classroom has been worth the additional ethical complexity of completing such a study (Bullock 2014, p. 45)."

3.4 Conclusion

In this chapter, we have argued that the biomedical model of research ethics is not appropriate for historical research undertaken in the field of science education. Through defining the biomedical research model, it is clear that it is very hypothesis driven and applicable to the health sciences. It is equally clear that national research organizations (i.e. SSHRC) and institutional research boards have taken a long time to distinguish and differentiate between different types of research for which ethical review would be necessary. To their credit, in recent years they are making some progress that would satisfy some of the critiques of the biomedical approach. Yet, there is still more to be done. In understanding the difference between a hypothesis driven framework and historical research, it is helpful to examine some of the sites of data and the nature of historical primary source data. In terms of science education research, the origin, the nature, and the type of source data is very important to science education researchers undertaking historically oriented research. Given the nature of data, biomedical research ethics principles are very difficult to apply in this field. Data collection is significant and requires triangulation regardless of which research method the science education researcher follows. In general, however, data sources such as primary sources are not able to be easily assessed using a hypothesis testing, experimental design approach as advocated by many biomedically inspired research ethics review boards as Schrag (2010) describes them. Instead, historical researchers let the documents speak. Using the example of Canadian science education research, we found nested and historically traceable practices. Under the current regime of research ethics in Canada, there is a very strong emphasis placed on making sure that individual privacy and confidentiality is preserved. In many contexts this is of great advantage in the sense that as individuals, Canadians do not want their personal data exposed. At the same time, it also raises issues that in terms writing scholarly history, as Iacovetta and Mitchinson (1998) note; the marginalized are simply eliminated from these histories as they are

never identified. The nature of sources; primary source documents, and access to restricted documents are critical in this regard, bearing in mind the rights of each individual to privacy. Each of these different types of sources comes with an array of challenges and areas where sensitivities are important in terms of research ethics.

Looking then at these arguments we can in the end conclude that especially the issue of how research ethics is assessed and what protocols are used is vitally important to science education researchers in Canada and worldwide. That relying on these protocols in general is reasonable and beneficial has at no point been doubted in this chapter. But in order to do so, these protocols need to fit to the specifics of science education research in all its facets – including historical methodology. Therefore, the biomedical model is important as one example and definitely one not to follow, but to learn from, as science education researchers strive to develop excellence in their own research ethics protocols. It is also important to see the potential in the history of science and the history of science education research in this regard. It is important to open up science education to further historical research. This chapter has argued for more work to broaden our horizons for instance through the unique insights stemming from historical research. The investigation and conduct of more historical studies in this area of research is very much necessary going forward. There is still much work to be done.

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