Citizenship Education:

A Platform to Engage Secondary School Science Students in Socio-Scientific Issues

By

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Abstract

Citizenship education is essential for students to understand the interconnected world they live in, and their role in that world. This study presents a different lens on citizenship education: through the intermediate/senior (I/S) science curriculum in Ontario schools. Using a theoretical framework aimed at defining citizenship education in terms of its applications to socio-scientific issues (SSI), this study used semi-structured face-to-face interviews with two Ontario secondary I/S science teachers in order to explore their teaching practices in terms of citizenship education. The findings of this study produced four themes. The first theme revealed that teacher experiences informed understandings of citizenship education. The second theme explored how those understandings influenced teacher practice. The third theme suggested that authentic tasks, which situated learning for students, were reportedly more effective at engaging students in SSI. Lastly, it was inferred that a supportive administration team improves citizenship education implementation in the science discipline. However, challenges related to departmental pushback in terms of what content and activities to deliver, along with the content heavy nature of senior level science courses proved to be a barrier for teachers. In light of this research, a recommendation for faculties of education is to better engage future teachers in citizenship education in order to make educators more comfortable educating for citizenship in science. Future research should continue this study’s focus on science teachers’ practices of citizenship education, especially with in the public-school system.

Keywords: citizenship education, science education, socio-scientific issues, situated learning
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Chapter One: Introduction

1.0 Introduction: Research Context

Concepts and ideas of citizenship education have existed for two thousand years and reflect the assumptions, experiences, concerns and the political/socio-cultural contexts of the time periods in which they were constructed (Evans, 2009). Due to the impact of globalization on the 21st century, there have been changes in societal norms and population diversity, as well as in education. Education has taken on a much more dynamic relationship among teachers, students and the wider school community. To respond to this changing dynamic, citizenship education has become an integral component of many educational frameworks and school values. Lim (2008) emphasizes that citizenship education aims to focus its pedagogy on creating an initial understanding of existent global issues, and accordingly, encouraging students to take on an active role to address such issues. Therefore, it is essential that students be prepared to become “agents of change rather than just passive observers of world events” (p. 1074).

In 1999, the Ontario Ministry of Education (OME), introduced a compulsory Grade 10 Civics course and 40 hours of community service as requirements for graduation (O’Sullivan & Vetter, 2007). These changes to the curriculum were meant to raise civic engagement of young people and encourage participation in community and political life. Overall, this can be seen as Ontario’s first attempt at providing students with informed, purposeful and active forms of citizenship. Subsequently, in 2008, the OME revised its curriculum to incorporate the citizenship education framework (Ontario Ministry of Education, [OME] 2013). While this framework provides social science teachers with the opportunity to educate their students around what it means to be a responsible, active citizen in and outside of the school community, it was primarily developed for the Canadian and World Studies curriculum in secondary schools.
The OME, also in 2008, revised the Science, Technology and Society (STS) curriculum, to the now Science, Technology, Society and Environment (STSE) curriculum. The intention of the STSE curriculum is to promote scientific, technological, and environmental literacy for students (Ontario Ministry of Education [OME], 2008a, 2008b). STSE also advocates for the transformation of social attitudes and actions, by incorporating opportunities within the science curriculum for decision making, holistic problem solving, a consideration of ethics, and sociopolitical action (Steele, 2014). While this can be considered as the Ministry’s attempt at better incorporating citizenship education into the science curriculum, no direct link is made nor is a framework, similar to that of the social studies curriculum, highlighted. Additionally, there is always a question of efficacy and teacher practice with current curriculum parameters in place.

1.1 Research Problem

The science classroom is classically perceived as a place where students learn through the sole delivery of content knowledge. However, considering recent research and 21st century pedagogy, students benefit considerably from a pedagogy that incorporates a content that is also relevant and applicable. Students must become aware that many of the issues that face people today often involve some scientific knowledge (Davies, 2004). Issues such as genetically modified foods (GMOs), energy consumption, energy sources, genetic engineering, to name a few, have all become pressing scientific matters discussed in the news. Therefore, it is important to engage students in ‘hot topic’ ideas by providing them with opportunities to develop an informed understanding of science both inside and outside of the classroom (Davies, 2004). This is what Sadler (2009) refers to as situated learning, which suggests that the nature of knowing and learning does not develop independently. Rather, “as individuals participate in environments and engage with the communities that form these environments, they begin knowing and
learning” (2009, p. 2). In his commentary in a special issue of the *Canadian Journal of Science, Mathematics and Technology Education*, David Blades (2015) makes the compelling argument that integrating citizenship education into the science classroom will further the development of peer to peer interactions. Therefore, with these social skills, students will be better equipped and enabled to examine relevant social issues in science such as food growth, delivery, and management of global climate change. By giving way for the science classroom to explore social issues and problems related to science, termed socio-scientific issues (SSI), students ultimately become a part of a socio-scientific discourse (Sadler, 2009). In other words, the process of learning science, that is so intimately linked to the central concerns of citizenship, should be a student driven inquiry (Davies, 2004).

SSI help to embrace this idea by giving students the opportunity to search for answers or solutions that are not singular in nature, nor dependent on simple algorithms, but rather solutions and answers that need to be negotiated and considered from all points of view (Sadler, 2009). In addition to the development of scientific knowledge, SSI help to strengthen skills associated with teamwork, problem-solving, and media literacy (Ideland, Malmberg, & Winberg, 2011). Sadler (2009) highlights three different aspects, introduced by other authors, to be considered when teachers and students engage in SSI discourse. First, it has been suggested that SSI provide a framework for the exploration and application of “ethical principles and the cultivation of character” (p. 12); second, the complex interplay between economics, ethics and scientific tension should be negotiated; and third the development of critical scientific thought, referred to as skepticism. These three aspects contribute to the overall importance for science education to help learners identify themselves as willing and able to engage in socio-scientific discourses (Onwu & William, 2011).
However, while the STSE curriculum advocates for the transformation of social attitudes and actions in science (Ontario Ministry of Education [OME], 2008a, 2008b), I have found two concerns that require attention and further thought in terms of citizenship education advocacy. First, the STSE curriculum places a majority of its focus on SSI related solely to the environment. In a review of two books regarding citizenship education and its relationship with science, Zembeylas (2005) furthers the notion that the STSE framework places a heavy emphasis on environmental applications and neglects to engage active student participation in other areas related to science and citizenship. Secondly, OME documents claim to provide numerous opportunities for teachers to integrate the STSE framework into their lessons (e.g., OME, 2008a). However, motivation for teachers to incorporate citizenship education into their already crowded science curriculum may be in question. Citizenship education integration is often left to the teacher’s discretion, which is likely to be influenced by a series of factors, including their comfort with the topic (Sperling & Bencze, 2010). Additionally, one must consider the teacher’s motivation and creativity in teaching citizenship education through the socio-scientific lens. The STSE curriculum provides sample questions and links to SSI, but is not clear in its process or end learning goal for the student. The question of, is conversation enough, comes into play. As Guo (2014) states, “both teacher educators and teacher candidates need the opportunities to learn how to set lesson goals and objectives and choose appropriate curriculum content and pedagogical approaches to promote global citizenship education” (p. 16). Therefore, by speaking to secondary school science teachers who engage their students in SSI, one may develop a better sense of the energy and effort that goes into the creation of socio-scientific discourse (Sadler, 2009).
1.2 Purpose of the Study

The shifting global context arguably demands that educators help students develop the knowledge, skills and attributes related to active and engaged citizenship. Therefore, the purpose of this qualitative research study was to explore how intermediate/senior (I/S) or grades 7-12 science teachers understand and describe citizenship education, through SSI, within their classroom. For the purpose of this study, citizenship education integration in science will be generally defined through science teacher understandings and motivation, teaching practices, and the supports and barriers promoting or hindering practice. I aim to share these findings with Ontario schools, policy makers and other stakeholders in educational research communities in order to further inform educators about the benefits and significance of citizenship education in the science classroom and to promote active citizenship amongst students through an engagement with SSI.

1.3 Research Questions

The central question guiding the study was: what are the experiences of Ontario I/S science teachers who integrate citizenship education in their classrooms? The subsidiary questions further guiding the study were:

- What motivates I/S science teachers to include citizenship education?
- How do I/S science teachers understand citizenship education and its relationship with the science curriculum?
- What practices do I/S science teachers reportedly use when educating for citizenship through SSI, and how do they justify them?
- What barriers and supports to integrating citizenship education (e.g., administrator, colleague, student and parent responses) do I/S science teachers report?
1.4 Background of the Researcher/Reflexive Positioning Statement

As a student who went through the Ontario education system, I always valued what I learned in the classroom, specifically in science. However, I remember wanting more in terms of how the scientific content applied to the real world. My only recollection of engaging with SSI and citizenship is through an overemphasis of issues related to the environment, specifically deforestation and climate change. This left me thinking that scientists focused their work on issues of environmental concern. As I entered university, my passion for science grew, but it grew through a desire to learn about real world applications of science, rather than a desire to learn about the internal workings of a cell. Graduating with an Honours Bachelor of Science, having specialized in Global Health and Nutritional Science, my studies always engaged with SSI through the lens of active citizenship. Taking part in my university’s Health and Wellness faculty, I actively participated in student led, campus community events that aimed to educate students in a wide range of areas ranging from mental health to the disproportionate access of health care globally.

Choosing to pursue a professional career in education and teaching, I decided that the teacher researcher in me would devote her time to engaging the younger generations in matters of citizenship education, particularly in science. Citizenship education to me is a way by which educators can help their students think more critically about their roles in society, and supplement a content driven science curriculum with socio-scientific discourse. I believe my learning experiences in high school science would have been enriched through a curriculum that did not solely advocate a life that is more 'green'. Giving students the opportunity to learn about, and arrive at a realization that, issues concerning science are not distant in terms of space, but rather many of these issues, ranging from water treatment to medication access, are very much a
reality for Ontario citizens. Therefore, as someone who is actively engaged in citizenship education research through the science discipline lens, I am concerned that the Ontario’s STSE framework may not promote all facets of what makes an informed and engaged citizen.

1.5 Overview/Preview of the Whole

To respond to my central research question, I have conducted a qualitative research study using purposeful sampling to recruit and interview two Ontario I/S science teachers. In Chapter Two, I present a theoretical framework to contextualize and help provide a working definition of citizenship education, within the context of science education. In Chapter Three, I review the literature in the areas of citizenship education, and pedagogies for integrating citizenship education into science classrooms. In Chapter Four, I elaborate on this study’s methodology. In Chapter Five, I report my research findings and discussed their significance in light of the existing research literature. Finally, in Chapter Six, I identify the implications of my research findings for my own teacher identity and practice, and for the educational research community more broadly. I also articulated a series of questions raised by the research findings, and point to areas for future research.
Chapter Two: Theoretical Framework

2.0 Introduction to the Chapter

For the purpose of this study, I have developed a theoretical framework to guide the data collection and analysis of this study. This framework is informed by two bodies of literature Hébert (2009) and Westheimer and Kahne (2004) that contextualize definitions of citizenship education related to the use of SSI. This framework will be explained in light of an initial discussion concerning the definition of citizenship education in the 21st century. First, I begin by conceptualizing the role of citizenship education in an era of globalization. Then I compare and contrast local and global forms of citizenship education, discussing whether their theoretical complexities are needed in terms of understanding citizenship education. Thirdly, I present my own working definition of citizenship education by which this study will reference when discussing its relation to the I/S science curriculum. This framework will help to analyze and interpret literature in Chapter Three and findings in Chapter Five.

2.1 The 21st Century: Conceptualizing the Role of Citizenship Education

Educating for citizenship has become an integral component of educating for the 21st century (Guo, 2014). Guo describes education in the 21st century as placing a demand on teachers to be more than knowledge-based educators, but rather to be teachers who are both culturally and pedagogically competent. The students these teachers educate will be the ones entering the work force and engaging in decision-making that should be based on informed and ethical practices (Hébert, 2009). Therefore, as the world becomes interconnected through globalization, the 21st century will engage in what Guo (2014) describes to be a changing educational landscape. Citizenship education ultimately provides a platform by which teachers address issues of globalisation, racism, diversity and social justice in order to create learning environments that are equitable for all students.
In order to grasp and adapt to the changing educational landscape, educators are often encouraged to develop an understanding of citizenship education, and more specifically the idea of being a citizen. Understanding citizenship is a difficult task simply because there is no definition of citizenship that has not been contested (Westheimer & Kahne, 2004). According to Westheimer and Kahne, this lack of clarity arises from competing citizenship frameworks that categorize citizenship into two categories of civic virtues and civic practice. Civic virtue relates to the ways one embodies being a citizen; civic practice deals with specific interactions one has with other citizens and the larger community. Educating for citizenship employs the idea of civic practice more so than civic virtue because it reinforces the issues discussed in class as relevant to their participatory action at the community or international level.

To better understand citizenship education from a civic practice perspective, it is necessary to highlight school programs that implement participatory action. One study (Westheimer & Kahne, 2004) examined how various school-based programs, implemented at the intermediate level, promoted personal responsibility and participatory citizenship to enhance student civic engagement. A core assumption of the participatory citizen is that in order “to solve social problems and improve society, citizens must actively participate and take leadership positions within established systems and community structures” (p. 266). One program had its students investigate the idea of micro-politics through a community-based initiative that looked at government funding. The authors reported that students became surprised at the level of impact their project had on the community. Therefore, citizenship education in the 21st century was defined in Westheimer and Kahne’s study as a form of civic practice that allows teachers to engage their students in real world issues. Through this engagement, teachers are able to present the heart of citizenship education, which is civic responsibility (Hébert, 2009).
2.2 A Difference between Citizenship Education and Global Citizenship Education?

Educating for citizenship is often described as developing active, socially-aware students who understand that the issues facing their communities are a part of a greater scheme (Tupper & Cappello, 2012). These issues can be further extrapolated to their country, and even the global world. This is what global citizenship education advocates. Therefore, citizenship education and global citizenship education are interdependent methods of practice that aim to challenge students in the same way (O’Sullivan & Vetter, 2007). The goal of citizenship and global citizenship education is to help students engage with course content beyond the classroom. Banks (2004) states that the major goals of global education “should be to help students understand the interdependence among nations … to clarify attitudes toward other nations and to develop reflective identifications with the world community” (p. 300). Yet, an in-depth reading of the literature reveals a debate over the importance, or lack thereof, of distinguishing between citizenship education and global citizenship education. Whatever the outcome of this debate, teachers are, in practice, combining global education with citizenship education (O’Sullivan & Vetter, 2007).

Despite contested definitions of what global citizenship is, within the past few decades educating for global citizenship has become a part of mandated curriculum in a number of countries including Costa Rica, Argentina, Singapore, the United Kingdom, the United States, Hong Kong and Canada (Leduc, 2013). Evans et al. (2009) write that the outcomes of global citizenship education include “1) opportunities to understand the nature of globalised, interdependent systems and global and transnational governance; 2) opportunities to nurture world mindedness, a sense of membership or kinship with all of humanity; 3) opportunities for in-depth understanding of global issues 4) opportunities for deepened understandings of
diversity, cross-cultural understanding, and social justice; and 5) opportunities for participatory pedagogies that encourage the cultivation of critical capacities for critical understanding, engagement and carrying out responsibilities as a global citizen” (p. 23). Yet, these outcomes are very similar to what citizenship education advocates. Viewing global citizenship and citizenship education as distinct does not focus on the core learning goals (discussed in section 2.4) which aims to educate students to become socially-aware and engaged citizens, whether the issues are of a local or global nature. Therefore, it is essential to move beyond the debate centered around the theoretical complexities in distinguishing the gray areas between local and global forms citizenship, and focus on teacher practices around educating for citizenship (O’Sullivan & Vetter, 2007).

2.3 A Working Definition of Citizenship Education in Science

Literature shows many overlapping and related definitions of citizenship education, as discussed in the above sections relating local and global forms of citizenship. For the purpose of this study, which explores citizenship education teachings in the I/S science curriculum, through the use of SSI, I have developed a definition that will be used for the remainder of this study. Two pieces of literature have informed this definition: the discussion of civic practice by Hébert (2009), and the description of a ‘participatory citizen’ offered by Westheimer and Kahne (2004). Westheimer and Kahne describe that in order “to solve social problems and improve society, [students] must actively participate and take leadership positions within established systems and community structures” (p. 266). Additionally, Hébert (2009) mentions the necessity of civic practice (mentioned in section 2.1) that allows teachers to engage their students in real world issues. Through this engagement, teachers are able to present the heart of citizenship education, which is civic responsibility. Therefore, the working definition of citizenship education, in
science, used in this study is a pedagogical practice that is meant to connect local and global issues to content within the science classroom, through socio-scientific issues, to foster student action and awareness around their social responsibility as students/citizens.

2.4 Learning Goals of Citizenship Education

It is important to consider the idea that education for citizenship should be concerned with more than developing a well-rounded person who can make informed decisions later in life. Rather, citizenship education also aims to instill the ideas of rights, responsibilities, duties and entitlement in terms of citizenship (Lim, 2008). Responsibility is a key learning goal of citizenship education and is therefore categorized into two types of responsibility being individual and collective responsibility (Hébert, 2009). Individual responsibility focuses on individual moral qualities or characteristics whereas collective responsibility deals with being responsible to a larger group of individuals or community (Hébert, 2009).

Evans et al. (2009) emphasizes the collective nature of responsibility and presents eight broad, overlapping learning goals regarding citizenship education locally and globally. These eight learning goals are also referred to as core learning goals which are outlined in Figure 1. Overall, it appears that these learning goals attempt to encourage participatory action while at the same time linking these actions to the responsibility of being a citizen. Although these learning goals are idealistic, it is important to understand that the implementation of each of these goals is dependent upon the unique instructional practices of teachers, and therefore of the school (Leduc, 2013). If the goal of “privilege, power, equity and social justice” were examined, for instance, one may notice a divergence, in the literature, between mandated curriculum content and learning outcomes (Molina-Giron, 2013, p. 27).
The Canadian system of education gives each province the task of updating or renewing their curriculum policies regarding social, democratic and moral knowledge. The development of the Social Studies curriculum fulfilled the need of citizenship integration in the classroom across a majority of the provinces (Hébert, 2009). At the intermediate level, citizenship is further discussed in History courses or Histoire et éducation civique in Québec (Hébert, 2009). The curriculum documents emphasize the idea of an ‘informed, active, and responsible citizen’, which follows along with the idea of a collective form of responsibility primarily due to that fact that students will work together and contribute to the larger community (Hébert, 2009).

A study (Tupper & Cappello, 2012) conducted in Saskatchewan looked at grade 10 students and their understanding of what good citizenship embodies, focusing on learning goals associated with citizenship education. Two urban schools were chosen for the study, where their students were required to complete three social science credits by choosing from History, Social Studies or Native Studies. Course content of all three subject areas included the goals of citizenship education, with similar objectives being to make students relate issues discussed in
class to real world issues. Researchers asked the students to create visual collages to depict their ideas of what ‘good’ citizenship was. This image-based research used visuals as a method of understanding a student’s subjective experiences with course content in relationship to citizenship education. Giving the students a week to complete the collages, each student was asked to comment on why they chose the images they did for their collage in order to determine commonalities and/or differences amongst student responses (Tupper & Cappello, 2012). Tupper and Cappello (2012) found that three ideas emerged from conversations with students. These three ideas revolved around respect for people/relationships, fairness, and helping others. Such ideas of citizenship were then found to match the the commonsense understandings of citizenship, that are found embedded in the learning goals of the school curriculum (Tupper & Cappello, 2008). The commonsense understandings of citizenship refer specifically to the definitions of citizenship outlined in the curriculum. As a result, students will often attempt to give examples and develop an understanding of citizenship that follows the predetermined definition. The researchers found that students were limited in their understandings seeing as they developed superficial ideas that prevented a deeper discussion of citizenship and the importance of collective action and responsibility (Tupper & Cappello, 2012).

The above case study presents an entry point into how student understandings and learnings of citizenship education are developed from teacher pedagogical practices. Learning goals are dictated by teacher design and lesson planning, but a teacher’s philosophy of teaching can be said to correlate to lesson design. This relationship helps to draw potential connections regarding how teachers come to understand citizenship education, broadly referred to as teacher identity formation (Britzman, 2003), and as a result how those understandings, often shaped by experiences, inform teacher practice.
Chapter Three: Literature Review

3.0 Introduction to the Chapter

In this chapter I reviewed the literature in the areas of citizenship education and its use in the I/S school context, highlighting science teacher practices. More specifically, I reviewed how citizenship education is and should be integrated, specifically into the secondary science curriculum, in order to develop better connections between classroom content and real world SSI. To follow, I reviewed literature on how science teachers understand citizenship education and why some science teachers choose to educate for citizenship. I highlight international and Canadian studies in order to offer a broader scope of the literature. Additionally, in order to draw further comparisons between disciplines in terms of pedagogy, I included case studies of citizenship education integration in the science, and social studies curriculum. Ultimately, this review aims to shed light on the practices, barriers and supports experienced by intermediate/senior teachers who use SSI to educate for citizenship.

3.1 Citizenship Education and Science?

Thus far, various studies have been carried out on citizenship education integration in the social sciences curriculum at both the junior and intermediate levels. However, little has been found about integration in the science curriculum. It is important to first understand the overarching ideas associated with citizenship integration, and the popular areas of research already in place which focus on the social science stream as the preferred method of enacting participatory action. By presenting these ideas, one begins to see that not all students will have access to citizenship education, especially the students who pursue the sciences over the social sciences. In fact, attempts to link school science education with citizenship are not new (Jenkins, 2006). Education for citizenship first began with the General Science movement of the first half
of the last century and has moved to more recent initiatives in Canada, the US and the UK around learning for the 21st century (Dewey, 1910; Hurd, 1958; Jenkins, 2006).

Science education, which is arguably content-driven, provides students with the basics of science; it may not engage its students to care for and, in particular, take action (Roth & Desautels, 2004). The current convention of separating science, technology, social studies and mathematics into different courses with specific learning goals prevent students from realizing the interconnectedness of each course. In other words, the constructivist method of pedagogy, historically associated with teaching science, hinders the development of a progressive science curriculum (Hodson, 2003). Hodson identified the Science for All movement as the first non-traditional investment in exposing more students to science in the later years of education. Therefore, it is apparent that an evident shift from the traditional to a reformed science education, which integrates citizenship education, exists.

3.1.1 Citizenship Education in Science through SSI

The science classroom is classically perceived as a place where students learn through the sole delivery of content knowledge. However, considering recent research and 21st century pedagogy, students benefit considerably from a pedagogy that incorporates a content that is also relevant and applicable. While the OME developed a STSE approach, formally known as STS (science–technology–society), to address the educational shift around science and society (Hodson, 2010), SSI present a different lens where citizenship education is better highlighted. In a case study analysis of STSE, Steele, Brew and Beatty (2012) describe four key elements associated with STSE. First is the concept of sustainability and the environment; second comes the push to have students understand political decision-making processes; the third element combines science education with ethics; the fourth and final element deals with having students
become aware of the political and social context around science and technology. Although no explicit mention of citizenship education can be found in the above four elements, one assumes that the teacher is meant to infer, from ministry documents, how to integrate citizenship into STSE. Steele, Brew and Beatty (2012) analyzed a Grade 9 unit on Earth and Space Science in terms of citizenship integration via STSE. Consider the following excerpt:

D1.2 assess some of the costs, hazards, and benefits of space exploration (e.g., the expense of developing new technologies, accidents resulting in loss of life, contributions to our knowledge of the universe), taking into account the benefits of technologies that were developed for the space program but that can be used to address environmental and other practical challenges on Earth (e.g., radiation monitors and barriers, sensors to monitor air and water quality, remote sensing technology, fire-resistant materials).

(Ontario Ministry of Education, 2008, p. 54)

It becomes clear that STSE focuses a rather large portion of its content on informing students around technological advances, and their subsequent positive impact on the environment. However, simply informing students does little to engage them in active forms of citizenship education. It often becomes the case that what students do in the classroom should be applicable to their immediate and future lives, rather than directly engaging students in issues that matter (Roth & Desautels, 2004). As mentioned above, the use of SSI give students the opportunity to search for answers or solutions that are not singular in nature, nor dependent on simple algorithms, but rather solutions and answers that need to be negotiated and considered from all points of view (Sadler, 2009).

3.1.2 Science and Citizenship for Intermediate/Senior Students
A majority of the curriculum documents target secondary school students, specifically within the social sciences, in order to promote citizenship education. On page 12 of the Canadian World Studies ministry documents for grades 11 and 12, a Citizenship Education Framework is presented (2015). This framework emphasizes that it is important for students to understand that they belong to many communities and that they are all citizens of a global community (Ontario Ministry of Education, 2015). Developing this understanding can be better executed at the secondary school level where students have the appropriate cognitive patterns to understand the role of an active citizen (Roth & Desautels, 2004). Although specific to the Canadian World Studies curriculum, the ideas of fostering active participation, identity, attributes and structures (Ministry of Education, 2015), can be applied to the science curriculum at the secondary level for many of the same reasons. A review of the literature shows very little work being done regarding teacher uses of citizenship education in science at the secondary level. However, one can infer that participatory action in the science class may increase student motivation to learn abstract concepts associated with science. Increasing motivation is essential as students move from primary to intermediate levels of education, because the motivation to continue with science falls short in comparison to the social sciences (Hodson, 2003).

3.2 The Reality: Practices of Citizenship Education & Science

Science programs that integrate citizenship education will need to be wary of the universalism that is often associated with traditional science courses (Jenkins, 2006). The reason being that not all SSI can be considered globally important since many are specific to certain locations. Therefore, educators will need to consider the interests of students, whether culturally- or religiously-speaking. In addition to educators, legislators and policy makers, especially those in education systems that have a centrally approved curriculum, will need to consider the unique
student body of each school district. I therefore present a series of case studies involving teacher practices that infuse the science curriculum with citizenship education, using varying degrees of SSI. A review of the literature presented few studies that specifically focused on I/S science teacher practices of citizenship education. Therefore, the following case studies extend beyond Ontario and Canada, due to the scarcity of research in Ontario on science and citizenship integration.

Referring to the SSI approach, Hodson (2003) elaborates on the practicality of teaching relevant issues in the science classroom. This issues-based approach to citizenship education exists globally. For instance, Hodson reported on the work of science teachers in Botswana, South Africa, who viewed science education as a vehicle with which they could help reduce the spread of HIV/AIDS. Through the promotion of environmental awareness and healthy life styles, these educators created issues-based science lessons that would help educate younger generations regarding their role as active citizens with a health based mindset. This study showed that the issues based approach to citizenship learning is not a Westernized form of pedagogy, but rather a universal one that can be catered to meet the unique and diverse needs of communities globally. The practices put into action by these science teachers are exemplary of the fact that issues relevant to the community can be woven into course content and even made the focal point of the science classroom experience. This is supported by the work of Sperling and Bencze (2010) who emphasized activism as one of the major elements in citizenship education, and claimed that science education should be integrated with citizenship education to cultivate responsible citizens.

In Toronto, Sperling and Bencze (2015) conducted a three-year long youth participatory action study in an after-school setting, engaging teenage girls from low-income areas. The study
had many components to its research context, due to its collaboration with a community-based organization (CBO). In addition to the CBO’s role as a food bank, the organization delivers informal education programming for teenage girls in low-income, high immigrant neighborhoods. This CBO provides a food-based curriculum that addresses concepts linked to food security such as gardening, government policies, and workshops around prenatal nutrition and healthy eating to foster engagement from community members. Focusing on ecojustice education, the study addressed socio-scientific issues and inequalities through a localized and culturally oriented food-based curriculum, with science content and concepts as its backbone. Being an informal teaching space, the researchers aimed to understand how this informal setting provided opportunities for engaged citizenship for the teenage students. After taking part in the after-school programming, including the workshops and gardening initiatives, the study found that participants began to see themselves as active members of the community, who developed and held legitimate opinions around issues pertaining to food security. This form of ecojustice education is exemplary of SSI as an authentic issue based activity, described by Roth and Desautels (2004), who emphasized the importance of student learning and work being put into action. Although this study looked at citizenship engagement with science outside of the classroom, there are definite connections that can be made inside the classroom. One such connection is the idea of presenting vitamin and mineral metabolism and intestinal functionality in the grade 12 biology nutrition unit through the lens of food security and ecojustice education (Ontario Ministry of Education, 2009).

Sperling and Bencze (2010) completed another study exploring the ways in which students in a seventh-grade science class used studies in waste management to take part in active citizenship. The teacher assigned an action project, or personal change project, to students who
could work individually, in a team, at home, with their families or in collaboration with the community. The project aimed to teach students about the local processes, products and initiatives involved in waste management. The project lasted over an 8-week period where progress was tracked through classroom discussion, student logs and peer-to-peer presentations. Each student used a specific, measurable, attainable, realistic and timely (SMART) plan guideline at the start of the 8-week period (Sperling & Bencze, 2010). The authors analyzed the results of the study using two citizenship-based frameworks which was meant to first assess the level of STSE (science, technology, society and environment) involved, and secondly categorize citizenship into elements of personal responsibility, participatory action and justice oriented citizenship. Two prominent themes emerged which were (a) participatory (action) active citizenship and (b) the desire to continue with this action beyond the project’s completion. One student reported the following in an interview: “It helped the environment, but it also helped us. It teaches discipline and to set goals, and you also get to record it down. And it does teach you to be responsible” (p. 261). A second student stated that “I liked it because I knew that I wasn’t the only one who was fulfilling my Action Plan. I was getting other people to help as well, and save, maybe not conserve more, [but] at least try and get involved or make the effort” (p. 261). Both students felt empowered through their ability to make an impact as a result of their heightened sense of knowing and responsibility. This mirrors the results from the study mentioned below, by Roth and Desautels (2004), presented around active citizenship and science. Additionally, similar to the case study around food security and ecojustice education (Sperling & Bencze, 2015), the key to achieving a successful interaction between scientific discourse and citizenship education in this case was to enact authentic issues based activities for students (Sperling & Bencze 2010; Sperling & Bencze, 2015; Roth & Desautels, 2004).
Research by Schweisfurth (2006) looked at how teachers in Ontario schools used global citizenship education in connection to curricular demands. Using a multiple case study approach, through documentary analysis, observation and interviews, the study found that teachers with a passion for citizenship education saw the revised Ontario curriculum as supporting their efforts (Schweisfurth, 2006). Using both the indoor and outdoor settings, teachers were able to use the expectations creatively to justify their approaches towards citizenship education. The only area of discomfort encountered by these groups of teachers was a feeling of being the odd one out with regards to their co-workers who did not practice citizenship education. Each of the teachers observed in the study were formally a part of a University of Toronto-based programme around citizenship education. One example discussed was within a Canadian and World Issues class, where the topic of climate change was analyzed. This topic was explored using The Interconnected World Organizer which is a chart that had students examine the political, social/cultural, environmental and economic levels of climate change. The study suggests that although authentic activity presents immediate thought and inquiry around citizenship education, not all teachers need to go above and beyond to instil the same values of participatory action and responsibility in students.

Roth and Desautels (2004) conducted a three-year ethnographic study in a Canadian community on the West Coast, in order to develop a better understanding of SSI in the community. The study looked specifically at an event organized for grade seven students who presented their scientific findings regarding the construction of watersheds, and their associated health impacts, to a panel comprising of citizens of the community and scientists in the field. Using audio and video recordings with transcripts, the study found that through a mutual exchange of information between students, scientists and the larger public community, students
took on the role of active citizens. Participating in both a policy setting and the decision making process, the students benefited greatly from, what the authors call, authentic activity. The idea of an authentic activity is meant to provide students with a sense of ownership. For instance, the students in this study took ownership in sorting through research and developing findings regarding the decision in constructing a watershed. The findings suggest that by instilling a sense of ownership, students are more likely to be invested in the SSI and unconsciously form attitudes that fall with active citizenship. Yet, the authors warn that teacher simulations of such activities fail to be authentic seeing as there are no stakes and consequences associated with decisions made. Nonetheless, one can argue that simulating activities for science students, regarding key issues, is far better than losing out on teaching opportunities that motivate students to be active members of the community.

3.3 Teacher Understandings & Challenges

Delivering a successful curriculum that integrates citizenship education is based heavily on the teacher understanding of citizenship education as a pedagogical framework, and how it is relatable to course content. One of the biggest struggles in terms of educating for citizenship is the variety of ways in which ‘citizenship education’ can be interpreted (Milona-Giron, 2013). Due to this lack of clarity in defining citizenship education, teachers may feel overwhelmed by the lack of professional development around educating for citizenship; therefore, it is critical that subject specialist teachers understand the complexity of citizenship (Sim, 2008).

Many teachers see the importance of citizenship education, but they lack the confidence in their pedagogical skills to educate effectively (Guo, 2014; O’Sullivan & Vetter, 2007; Schweidfurth, 2006). This lack of confidence has been documented in studies which have found that very few teachers enter the profession with a thorough knowledge for providing
differentiated learning to meet the unique diversity found in Canadian classrooms (Desveaux & Guo, 2011; Goddard, 2013; Schneider, 2007). Recalling the definition provided in Chapter Two, where citizenship education was defined as a pedagogical practice meant to connect local and global issues to content within the science classroom, through the use of socio-scientific issues, in order to foster student action and awareness around their social responsibility as students/citizens, one often finds that teachers, both new and experienced, still struggle to effectively incorporate these practices of SSI into the classroom predominantly due to a misinterpretation of what citizenship education is, as well as sticking to what teachers are accustomed to (Evans, 2006).

Evans (2006) conducted a three-year qualitative study and purposively sampled specialist secondary school teachers to determine how they characterized and understood the pedagogy of citizenship education in formal secondary school settings in Ontario and England. The rationale behind this study came from the growing recognition amongst educational researchers that what teachers say and do have direct influences on what students learn. Through a series of interviews and class observations periods, Evans found that both Canadian and British teachers put less emphasis on skill sets associated with civic literacy, but the Canadian teachers placed a heavier emphasis on exploring diverse beliefs and values. However, an issue of congruency arose seeing as assessments strategies focused more on knowledge rather than skills acquired by students. This assessment of knowledge defeats the purpose of citizenship education, where learning outcomes associated with participatory action and responsibility can only be assessed through skill set acquisition. It was also noted that in both cases, pedagogical practices remained within the classroom, with very little use of community based practices.
Evans’ (2006) research makes one predominant point where an uncertain gap exists between theory and practice of citizenship education. To call the gap uncertain is an understatement since many of the studies discussed thus far have suggested that teachers present citizenship education based on what they know, not on theory. Whether the teacher is aware that their practice aligns with some or all of the learning goals associated with citizenship education is yet to be determined. O’Sullivan & Vetter (2007) attribute the uncertainty of the gap between theory and practice to be a result of a lack of uniformity in global (citizenship) education curriculum. This results in educators having to develop their understanding of what exactly global education means and how it might be implemented.

Another challenge presented in the literature shows that curriculum documents will often teach strong citizen formation through predetermined definitions. However, these definitions often neglect the real differences that exist among students (Tupper & Cappello, 2008). The documents do not necessarily invite students into a debate regarding the complexities and challenges of being a citizen in a country such as Canada, or the contested nature of citizenship itself (Tupper & Cappello, 2012). Even when teachers express confidence and motivation regarding the teaching of citizenship education, the admin in schools often presents barriers to its implementation (Pedretti et al., 2008). Supports aren’t necessarily in place and at present, documents do not adequately equip teachers to be confident in their practice of teaching for citizenship.

3.4 Conclusion

Unfortunately, there is no universal agreement between policy makers and education scholars regarding the best way forward in educating for citizenship, specifically through the field of science. For some, as in the 21st Century Science initiative in the UK, relating school
science to what might be called informed citizenship is enough (Guo, 2014). Using mainly debates, presentations, and discussions about pressing science issues may serve well for students, until educators can agree on better, more feasible methods of instruction to get students learning outside of the classroom. Yet, this approach may fall short seeing as school science is only being regarded as a way to provide students with skill sets that aid in preparation for a future life, but are not directly contributing to an active participation in a community (Roth & Desautels, 2004).

The biggest challenge presented by the literature is that there is a gap in the knowledge between how teachers interpret citizenship education and how they implement it in the classroom. Additionally, very few studies have explored citizenship education’s feasibility and application within science classrooms by teachers. A majority of the literature focuses its work on the social science stream, which of course is an easier means to integrate citizenship education into. This chapter suggests that teachers, and even schools, have different interpretations of citizenship education. There was minimal direct literature describing science teacher specific practices related to citizenship education, and socio-scientific issues, therefore allowing this study to contribute to the apparent gap in the research.
Chapter Four: Research Methodology

4.0 Introduction (Chapter Overview)

In this chapter I describe the methodology used to conduct my research, the rationale for these methodologies, and the connection to my research purpose and questions. I begin by identifying and reviewing the research approach and procedures used, along with an analysis of the data collection instruments used. I then elaborate, more specifically, on participant sampling and the recruitment process. Additionally, I will explain data analysis procedures and review all the ethical considerations applicable to my research study. Relatedly, I identify a range of methodological limitations, but I also speak to the strengths of the methodology. Lastly, I close the chapter with a brief summary of significant methodological decisions and my rationale for these decisions given my research purpose and questions.

4.1 Research Approach & Procedures

This research study will be conducted using a qualitative research approach involving a literature review, and semi-structured face-to-face interviews with two Ontario secondary I/S science teachers. Qualitative research has been viewed for a number of years as an established alternative to quantitative research and is particular to its contributions to the field of social sciences, education, psychology, health science and the like (Flick, 2007). Rather than focusing on numerical interpretation and developing generalizable data, qualitative research involves an interpretive, naturalistic approach to the world where researchers study a topic in a natural setting in order to interpret the topic in an everyday life context. However, much controversy surrounding qualitative research stems from its interpretative over statistical nature. Quantitative research excels at drawing statistically significant connections between two variables and showing the strength of such associations (Barbour, 2008). Qualitative research focuses on
elucidating these associations and determining their relative influences on individuals within a larger population: that is, on exploring experiences rather than generalizing findings (2008). Thus, qualitative research aids quantitative research by providing a fuller picture of the research and explaining “how the macro (i.e. social class position, gender, locality) is translated into the micro (i.e. everyday practices, understandings and interactions) to guide individual behavior” (Barbour, 2008, p. 10).

Additionally, qualitative research deems all perspectives expressed by participants within a study to be important. The perspectives of the powerful, which were deemed more valid than the powerless, is no longer at the center of qualitative research (Taylor, Bogdan & DeVault, 2015). Qualitative researchers will consider the perspective of a student just as important as the perspective of a teacher. By considering different perspectives and vantage points, qualitative research allows for various study outcomes. Peshkin (1993) grouped the outcomes of qualitative research into four categories being description, interpretation, verification and evaluation. The study found that research outcomes often blended across these four categories suggesting that qualitative methodology allows for a fuller, more naturalistic (Taylor, Bogdan & DeVault, 2015) understanding. Therefore, qualitative research produces relevant knowledge which can then contribute to solution development for practical problems (Flick, 2007).

Furthermore, qualitative research benefits from its subject to researcher relationship where vital information is gathered through genuine understanding. Carr (1994) outlines that the subject to researcher approach allows participants to be fully aware of their role in the study and therefore are more inclined to contribute. Conversely, quantitative research, aimed at understanding the facts, often entails very little contact with respondents in order to avoid bias or direct involvement in the study. This subject to researcher approach creates detachment to the
extent that quantitative studies often classify participants as objects or mere sources of data (Carr, 1994).

This study explored citizenship education and its role in the science classroom, and therefore relies heavily on the qualitative approach of research. How a teacher classifies or understands citizenship education cannot be determined through detached questioning methods. Why a teacher is motivated to use citizenship education in the science classroom relied on an examination of teacher experiences, which were shared with myself. The source of information for my research relied heavily on teacher interviews that explored their experiences and perceptions, which quantitative research leaves uninvestigated. Therefore, this qualitative research will explore how, why and if citizenship education can be implemented through the scientific lens.

4.2 Instruments of Data Collection

Methods are tools, techniques, or procedures used in order to generate data (Jackson II, Drummond & Camara, 2007). Having described qualitative research as naturalistic, researchers implement strategies focused on delivering outcomes that capture how people live out their daily lives (Taylor, Bogdan & DeVault, 2015). These strategies involve participant observations and various interviewing techniques, broadly labelled as qualitative interviewing. Qualitative interviewing draws upon the everyday practice of asking and answering questions, while also engaging with the everyday identities of the questioner/answerer and the interviewer/interviewee (Seale, Gobo, Gubrium, & Silverman, 2004). The qualitative field classifies interview into three groups, commonly referred to as a three-part taxonomy: structure or fixed-response, semi-structured and open ended interviews (Freebody, 2003). The primary instrument for data collection used in this study was the semi-structured interview protocol. The semi-structured
interview contains structured and unstructured portions which use both standardized and open-ended questioning techniques (Walliman, 2011). These questions are predetermined, but allow for flexibility based on how the interview unfolds. This flexibility extends to the interviewer in order to investigate important emerging themes and to the participant so that lived experiences, pertaining to the study’s research, can be elaborated on (Jackson II, Drummond, & Camara, 2007). Moreover, this format of questioning allows for the interview to align with the interviewer’s research focus and questions, while also leaving room for participants to elaborate and even re-direct attention to areas unanticipated by the interviewer. The semi-structured interview also allows the interviewer to gauge the quality of responses in order to determine if questions are understood, need clarification or require further prompts (Walliman, 2011). As a result, the data collected from the semi-structured interview gives the interviewer a fuller picture to incorporate into their research study.

While interviews can be done via focus groups, case studies, or the telephone, I have chosen to conduct my semi-structured interviews face-to-face. With the freedom and a sense of trust established with the participants, face-to-face interviews allow for the interviewer to visibly identify how the participant is handling the interview. This allows the interviewer to allocate more time to specific questions of interest to the interviewee or reorganize questions in order to match conversation flow. Therefore, I organized my interview protocol (found in Appendix B) into five sections with each section focusing on a specific topic of citizenship education in science. The first section, Section A, begins with questions geared at understanding the participant’s background information and social positioning on citizenship education. Section B moves into questions concerning teacher exposure to citizenship education before, during and after teacher’s college. Section C centres its questions around the extent of teacher practices in
science around citizenship education. Section D aims to understand the challenges and/or supports science teachers encounter when educating for citizenship. The interview concludes with Section E, which brings the interview full circle in order to elaborate on the feasibility of citizenship education in science. Examples of questions include:

- Do you believe there is a place for citizenship education in the intermediate/senior science classroom, specifically grades 7-12? Why or why not?
- How do you think students would benefit from discussing topics pertaining to citizenship education within the intermediate/senior science classroom?
- What advice would you give to pre-service teachers wishing to engage their students in real world issues/citizenship education with Ministry mandated scientific content?

4.3 Participants

In order for a qualitative study to present representative findings, effective sampling techniques, whether purposive or theoretical, should reflect the diversity within the group of people or phenomena being studied (Barbour, 2008). Therefore, this section will present the sampling criteria I have established in order to recruit participants. Secondly, I discuss the means by which I found and recruited eligible teacher participants for this study. Lastly, this section will present and introduce each of the two recruited participants.

4.3.1 Sampling criteria. The following criteria were applied to teacher participants:

1. Teachers must have a minimum of five years of teaching experience in Ontario.
2. Teachers must have completed teacher education within Ontario, Canada.
3. Teachers must have, or are currently, teaching Academic or Applied level science courses, across grades 7 to 12 (intermediate/senior).
4. Teachers must be working within York Region, the GTA, or Peel areas.
5. Teachers must be actively demonstrating citizenship education, on some level, in the science classroom.

This research study will use selective sampling, that is purposive and therefore based on the above five criteria. For my interview to shed light on my research questions, I require teachers who attended teacher’s college in Ontario, as well as have been teaching in Ontario for at least five years. The reason for this is to determine the extent to which teachers were exposed to citizenship education in teacher’s college. As well as, teachers need to be employed in 2010 or previously in order to provide a sufficient base for teacher participants to draw experience from. In 2013, the emergence of 21st Century Learning took effect and it is necessary for this study to see the shift in school culture, as 21st Century Learning looked at addressing citizenship education. The focus of this study is on the intermediate and senior grade levels (secondary schools) in order to see the effects of citizenship education on students who are able to take part in community initiatives, partnerships and the like, which require older more mature students. For teachers teaching grades 9 to 12, I interview teachers who are currently teaching academic or applied level courses in science, in order to see variation in citizenship education practices, and student response. I have also limited my sample to teachers who currently engage in some level of citizenship education, within science, in order to determine teacher understandings, motivation and practices of citizenship education.

4.3.2 Sampling procedures

Randomized sampling procedures are well known and defined, but are not appropriate for a qualitative study (Marshall, 1996). Quantitative studies benefit from randomized sampling methods because studying a random sample allows for generalizability of results for a population. However, in this qualitative study, where complex issues pertaining to human
behavior are studied, generalizable results are not beneficial (1996). Marshall (1996) eloquently compares randomizing a qualitative study to that of randomly asking someone to repair a car, rather than asking a garage mechanic; asking the mechanic is similar to seeking out participants that will produce richer insight and understanding for the researcher, and the study.

Qualitative researchers generally use three broad approaches when sampling. These three approaches are convenience sampling, judgement sampling (also known as purposeful sampling), and theoretical sampling (Marshall, 1996). Although these three approaches do overlap with one another, the research questions, data analysis style, and interpretation will determine which approach takes prevalence over the other. Broadly speaking, the qualitative researcher must consider the context of the study and the broader picture, that is the spatial, situational, and temporal aspects of participants. This will impact the type of sampling approach used. Convenience sampling selects the most accessible participants and requires little time, effort and money. Although this form of sampling may result in poor data collection, components of convenience sampling often surface in qualitative studies (Marshall, 1996). Judgement sampling is the most common sampling technique where the researcher actively selects the most productive sample of participants which align with research questions. The third approach, theoretical sampling, selects sample participants to elaborate on a chosen theory that emerged from beforehand data research (Marshall, 1996).

For the purpose of this research study, I have chosen to use the judgement/purposive sampling technique. With my research focusing specifically on lived teacher experiences, my sample needs to purposely represent teacher experiences especially within the field of citizenship education and science. This allows my data collection to better align with my previously stated research questions and purpose. However, due to the small-scale nature of this study, my
sampling approach will also utilize convenience sampling seeing as I am immersed in a community of teacher colleagues and mentor teachers. Therefore, to recruit participants I have attended professional development conferences, graduate research conferences, teacher education programs and subject-area specialization organizations, such as the Science Teacher Association of Ontario (STAO). I also contacted school boards, non-for-profit education based groups, and the like to provide them with an overview of my research study, which includes participant criteria and contact information for willing candidates.

4.3.3 Participant Bios

Two participants were recruited for this study. Pseudonyms have been used to maintain the anonymity of both participants. Participant one was Shelly, who has fifteen years of relevant teaching experience, and was certified in Ontario. She displayed considerable knowledge in the field of citizenship education, often referring to it as global citizenship education. At the time of the interview, Shelly was employed by the independent school system, and teaches enriched levels of grades 7, 8 and 9 science courses, and the grade 11 biology class. Through the interview, Shelly’s expertise in environmental education was repeatedly referenced as the reason why she was passionate about integrating citizenship education in science.

Participant two was Erin, who has almost ten years of relevant teaching experience, and was also certified in Ontario. Erin referred to citizenship education as leadership education due to the manner in which the school as a whole implemented citizenship education. At the time of the interview, Erin was employed also by the independent school system, but from a different school than Shelly. She was teaching academic levels of grade 9 science and math, along with grade 10 math. Erin mentioned that she had previously taught academic levels of grade 11 chemistry. Erin commented on her training in thinking and inquiry based approaches to science.
as serving her well in assisting with her ability to integrate citizenship education in science.

4.4 Data Analysis

It is ideal to complete each step in a research study before moving onto the next step; however, this is not reality for a majority of researchers. When conducting a qualitative data analysis, defined as interpreting and producing findings to gain a fuller picture of the phenomena being studied, the process is iterative and repetitive rather than linear (Barbour, 2008). When analyzing data, many researchers attempt to make their analysis as systematic or scientific as possible, but qualitative data requires a certain element of artistry to interpret and develop understandings (Walliman, 2011). Although qualitative data analysis is still in the early stages – and will likely never be defined once and for all – many authors have suggested a three-step process which first involves data reduction, then data display, followed by drawing some sort of conclusion to verify the study.

Data reduction involves processing large amounts of information in order to simplify complex information into patterns that can be easily represented. This first step of simplification uses coding, clustering and summarization techniques. Creating sub groups of information will organize the data through the development of typologies and taxonomies (Walliman, 2011). This classification system is the start of the coding system that looks for common themes and divergences in the data which are relevant to the research questions. Coding compartmentalizes data, using labels or tags, to prevent data overload when developing conclusions for the study. The coding process requires the researcher to review, select, interpret and summarize the information without distortion (Walliman, 2011). There are two types of coding where one form is used for the retrieval of text sequences relevant to the research, and the other used for developing a theory (Walliman, 2011). Yet, regardless, the codes developed depend on the nature of the study and the type of participant involved in the study. Therefore, it is important to
develop codes that are not ambiguous and open for discussion, but rather allow for information to fit into one code.

In addition to the coding process, null data was examined. Null data refers to what my teacher participants did not directly speak to. This serves as valuable information because it allows me to determine the extent of a teacher’s understanding of citizenship education and how they view it in the science classroom. Therefore, for the analysis of my data, I first coded my data based on related terms, which were then categorized. These categories were then analyzed and interpreted to produce themes which guided discussion in Chapter Five.

4.5 Ethical Review Procedures

Regardless of the study, whether qualitative or quantitative, ethical considerations around research always revolve around safety and the protection of human rights (Carr, 1994). One of the most important documents provided to participants, within a research study, is the consent letter (located in Appendix A). Informed consent means that no individual should be involved in the research as a participant without being made aware of the study’s purpose and without being provided the chance to refuse participation in the study (Flick, 2007). I have included a consent letter, found in Appendix A, for my participants which provides an overview of the study, addresses ethical implications, and specifies expectations of participation (one 60-minute semi-structured interview). The consent letter also asks participants for their consent in being interviewed, as well as audio-recorded.

Lastly, I ensured that all participant identities remained confidential and any identifying markers related to their schools or students were excluded. This was done by using pseudonymous names for each participant, and only describing the grade levels taught, along with other relevant factors. As well as, since the interviews were audio recorded, all data
collected form the interview was stored on my password protected computer and will be
destroyed after five years. The only other person with potential access to this information was
my research course instructor.

4.6 Methodological Limitations and Strengths

The methodology of this study has both limitations and strengths. The limitations of this
study pertain to teacher-based interviews and a small sample size. Given the ethical parameters
that I was approved for, my research only involved interviews with teachers, and consequently it
was not possible to interview students or parents, or to conduct surveys or classroom
observations. Although the largest drawback of qualitative research is its inability to generalize
results (Jackson II, Drummond, & Camara, 2007), involving other members of a school
community, such as students, would have been beneficial in understanding the role citizenship
education in science. With the overall aim of qualitative studies being to shed light on complex
issues and provide answers to the why and how questions (Marshall, 1996), incorporating
student interviews and observation during a lesson would have allowed for richer findings.

Due to the limited number of teachers interviewed in this study, while the findings can
inform the topic at hand they cannot generalize the experiences of teachers on a broader level.
This study’s small sample size could produce findings based on a particular predisposition
developed by the researcher, suggesting a low population validity (Carr, 1994). Although, if the
sample is well-defined using clearly established recruitment criteria and interview questions, the
researcher can develop findings that are not skewed entirely by bias (Carr, 1994).

Qualitative research and inquiry presents many strengths that quantitative research is
unable to. By interviewing teachers face-to-face through open and close-ended questioning
methods, I was able to go into more depth and obtain further information which an anonymous
survey could not deliver. The semi-structured interview process also allowed teachers to speak about what matters most to them when it comes to the topic of citizenship education and science. In this way, interviews validated teacher voice and experience, and are an opportunity for them to make meaning from their lived experiences. The interview between teacher and researcher allowed for a genuine understanding of the topic due to enhanced communication and clarification of roles (Carr, 1994). Additionally, the interviews served as an opportunity for teachers to reflect on their own practices and to articulate how they conceptualize particular topics in theory and practice. This is especially true because one of my research questions focuses on teacher understandings of citizenship education in the science classroom. These understandings are often confused or only surface level, therefore the semi-structured interview served as a reflection for the teacher participant and perhaps as a means for providing a fuller picture of their own ideas and thoughts (Jackson II, Drummond, & Camara, 2007).

4.7 Conclusion

In this chapter I discussed the research methodology used in my research study. The chapter began with a brief discussion of my research approach and procedure by elaborating on the value qualitative research presents, and contrasting it to quantitative research. I then moved into a discussion of the data collection instruments used, where semi-structured face-to-face interviews were identified as the principle data source. Next, I presented the recruitment criteria for my teacher participants along with a brief synopsis of their professional backgrounds. Recruitment procedures were presented which involved a discussion of different sampling techniques available in qualitative research. I identified that this study would use a combination of purposive and convenience sampling. Following this came a discussion of data analysis where coding techniques were highlighted as a method for finding common patterns and themes across
the findings. The chapter also elaborated on the ethical considerations qualitative research requires such as consent, member-checks, data storage, comfortability with questions and the right to withdraw from the study. To conclude, I reviewed the methodological limitations and strengths of the study where sample size and diversity of participants presented themselves as key limitations. Strengths of this study included a direct researcher to participant interview where teachers were able to elaborate on questions they find to be relevant, while also providing the researcher with a new way to think of the research. In Chapter Five, I report on the findings of the research.
Chapter 5: Research Findings

5.0 Introduction to the Chapter

Chapter One spoke to the necessity of citizenship education extending its parameters to include the science curriculum as an avenue to engage students at the secondary, grades 7-12, level. While the STSE strand of the science curriculum offers and avenue for citizenship education integration, socio-scientific discourse of SSI are seldom introduced. In Chapter Two, citizenship education was defined in terms of its applications to SSI. Chapter Three, through a review of the literature, suggested that teachers, and even schools, have different interpretations of citizenship education. There was minimal literature describing science teacher specific practices related to citizenship education, and SSI, therefore providing a reason for this research, which was to ultimately contribute to a gap in research. Chapter Four discussed the research methodology behind recruiting participants and analysing the data which emerged from recorded interviews with the participants.

The following chapter explores the prominent themes that emerged through an analysis of the data collected from interviews with the participants of this study. Both interviews were conducted with secondary school science teachers who work in Ontario independent schools. Throughout the analysis, I was constantly mindful of my research question – ‘how do Ontario secondary school science teachers integrate citizenship education into their classrooms?’ – while examining teacher practices, supports and barriers for implementation. In the discussion, connections are drawn between participant experiences, perceptions and the literature review. The identified themes were organized into the following sections: 1) Teacher understandings of citizenship education, 2) how understandings influence teacher practice, 3) the use of authentic activities to create lived experiences, and 4) how administrative support and collegiality aid
implementation, with some challenges. Each theme will be discussed below, and participants’ responses will be considered in relation to existing literature. This chapter will conclude with a reflection of the findings presented.

5.1 **Teacher backgrounds and experiences inform understandings of citizenship education**

Both participants in this research study spoke of their unique and diverse backgrounds prior to entering the teaching profession, as well as their professional development experiences with citizenship education across their teaching years. Teacher background is defined here as the years of education, volunteerism or work spent before said teacher became employed by a school board. Teacher experience is defined here as the professional development (PD) opportunities, related to citizenship education, which said teacher engaged with during employment.

Through discussion with each participant, I found that the background and experiences of each teacher have influenced and guided how they understand and defined citizenship education. Therefore, I begin by first highlighting each participant’s background and experiences, showcasing key areas as contributing to their understanding of citizenship education. I will then provide excerpts from the interviews where each participant provided a definition of citizenship education. From this, I will argue that understandings of citizenship education depend greatly on a teacher’s affiliation with the area, as well as how their role as science teachers shape that understanding.

Working as a certified Ontario College of Teachers (OCT) teacher for 15 years, participant Shelly emphasized that her work and education prior to certification contributed greatly towards her teaching philosophy. When asked if her undergraduate and graduate studies impacted her teaching, Shelly answered definitively with a “Yes, very much so.” In addition to her years of teacher assistant (TA) experience, she spoke at length about her undergraduate
summer field courses. She described these field courses to be “like immersion language, but like in science. And I love the environment, I love the collegiality, and it wasn’t just amongst the students, it was the teachers.” She then highlighted that she was always engaged in her field courses, describing it as “total flow, psychological flow where you were just engaged…To be outside, collect the numbers and see it tie in with the literature.” This level of academic rigor, coupled with heavy engagement, can be said to tie in with the nature of science (NOS), or philosophy of science, which Shelly and other members of the science department purposefully teach to. NOS is taught specifically to help students, in science, understand the scientific research process in order to differentiate between a reliable vs non-reliable study, and what Shelly pointed out as helping her students be “better parents, better consumers, better voters, and better citizens.” This commentary relates to 21st century learning competencies, which suggests that Shelly sees a connection between teaching NOS and engaging students in critical thought to help prepare those students for their role in society; a role that is not within the confines of a school community.

Erin, working as a certified OCT teacher for almost ten years, had different experiences from Shelly but also discussed how the years before teaching impacted her teaching philosophy. Teaching a wide array of subjects within the math and sciences, Erin described her passion for teaching as something that developed from when she was a little girl. Attending a research-intensive university for her undergraduate degree, she focused her studies in human biology, and considered career options in physiotherapy. However, Erin valued the time she spent working, while in school, as a swim instructor for many consecutive summers, and being a member of the Volunteer in Schools program. Erin described that with her science background, she “liked seeing kids improve and develop…and really valued that”. Valuing improvement and
development as learning outcomes, Erin, like Shelly, emphasized the importance of skills and tools, relating these skills and tools to Ontario’s shift towards the development of 21st learning competencies.

When asked specifically about 21st century learning, both teacher participants emphasized that many of their PD experiences revolved around the concept of 21st century learning. Shelly explained how she was aware of 21st century learning well before the school adopted it as one of their core mission values, because of her involvement in the National Association of Biology Teachers (NABT). Erin similarly learned about 21st century learning due to her involvement with the iThink critical thinking consortium, held at the Rotman School at the University of Toronto. This consortium worked with educators to teach them how to engage their students in thinking about the scientific research process, while stressing the importance of asking questions to develop comprehensive scientific ideas. Additionally, each participant described 21st century learning as a school-wide approach to citizenship education. Shelly described her school as focusing on global citizenship, whereas Erin commented on the fact that her school labels citizenship education as ‘global leadership education.’ While both schools use different terms to describe how they engage their school community in active forms of citizenship, this should not become a debate centered around the theoretical complexities in defining and differentiating between global and non-global citizenship education (O’Sullivan & Vetter, 2007). The reality is that the term ‘citizenship education’ will undergo constant change in its definition because the term is reliant on the space in which it is used. Both Shelly and Erin, as you will read, describe noteworthy teaching practices of citizenship that engage their students in critical thought of SSI.
Both participants were later asked to discuss their understanding of the relation between citizenship education and 21st century learning. Shelly suggested that 21st century learning and citizenship education are dependent on one another through her statement that “you can’t do one without the other one happening.” Shelly emphasized that her students, once equipped with the proper skills and tools, wanted to use those skills and take action on issues discussed in class. Erin similarly commented that many of her school’s PD sessions focused heavily on the idea of global leadership, and commented that “instilling these skills, knowledge, ways of thinking, ways of looking at issues with our students and in our classes,” is an important concept of 21st century learning. Therefore, a prominent theme emerging from an analysis of Shelly’s and Erin’s teacher background and experiences shows that they understand citizenship education to be linked to the skills and tools that teachers provide their students. Shelly’s university experience through engaging field courses and Erin’s participation in iThink around the formation of an idea, contributed significantly to not only how they understand citizenship education, but also around how they define it.

In Chapter Two, I defined citizenship education as a pedagogical practice meant to connect local and real world issues to content within the classroom, in order to foster student action and awareness around their social responsibility as students/citizens. When asked to define citizenship education, both teacher participants gave varied responses. Shelly suggested that citizenship education is “giving people the tools and the knowledge to be better citizens, and that includes parent, voter, consumer or non-consumer, and just like human being.” Erin gave a different response:

I would say citizenship education would be about having our students having a global understanding because our students do not live in isolated areas. They are going to have
jobs that could be all over the world. So giving them the opportunities to be more knowledgeable about things that happen around the world, making conscious, ethical decisions, and not being close-minded. Giving them the tools to be successful in anything they do.

Comparing the two responses, it appears that Shelly is taking on a community-centered view of citizenship education, whereas Erin speaks specifically to the role of the student in the globally interconnected world. In section 5.2, these two views will be further delineated in terms of specific approaches to teaching science. However, what is common to both definitions are the use of the words ‘tools’ and ‘knowledge.’ Although, very little work has been done regarding teacher uses of citizenship education in science at the secondary level, the mention of equipping students with the tools and knowledge to be successful (Erin) and better citizens (Shelly), seems to be the grounds by which science and citizenship education can be linked. Additionally, I mentioned above that both teachers valued teaching the scientific method/research process to help their students develop critical thought around science beyond the classroom. Therefore, the backgrounds and experiences of both teachers influenced an understanding of citizenship education. Therefore, it appears that the experiences of both teachers have shaped an understanding of citizenship education that is rooted deeply in providing students with knowledge and the tools to use that knowledge. Recall the study by Hodson (2003) on the work of science teachers in Botswana, South Africa, who viewed science education as a vehicle with which they could help reduce the spread of HIV/AIDS. Hodson (2003) reported that these teachers were able to provide their students with knowledge regarding how HIV/AIDS is transmitted, while also giving them the tools to practice healthy lifestyles. Labelling this form of teacher practice as an issues-based approach, the findings above developed suggest that utilizing
SSI through socio-scientific discourse is essential to integrating citizenship education into secondary level science.

5.2 Understandings of citizenship education’s influence on approaches to teaching science

While the backgrounds and experiences of teachers influence their understandings of citizenship education in science, what is even more crucial is what the teacher does with that understanding in the science classroom. When asked to discuss their teaching practices within the science classroom, both participants gave examples of in-class activities done with students to engage students with SSI. Sadler (2009) described SSI as an exploration of social issues and problems related to science, thereby allowing students and teachers to take part in socio-scientific discourse. From these activities, I discovered that each teacher had specific rationales for why they structured the activity in the manner they described. Therefore, before discussing how teacher practices modelled citizenship education in science, this section will draw parallels between understandings of citizenship education and the rationale, or approach, taken by the teacher participants when creating, and structuring in-class activities.

5.2.1 Creating the hook to give students invested interest in socio-scientific issues

In both cases, Shelly and Erin emphasized that they need to have their students develop some sort of interest in the SSI being discussed. This came in the form of a ‘hook’. Participant Shelly spoke at great length about the necessity of the ‘hook’ when introducing an activity or task, especially one that engages students with SSI. She described two types of hooks, where one focuses on the interest factor, and the other hook “where you get the kid to feel.” When explaining a task centered around an investigation of water quality, she focused the investigation on local issues, such as water quality within Aboriginal reserves because, and I quote,
When you explain to them [the students] that this in Canada, this isn’t some you know quote unquote Third World country, and I realize that it’s not a happy term but it’s not in a developing country or less developed country. This is Canada, we should be taking care of people in our country before we start pointing fingers at other countries. Because we have this very strong sense of us and them, and I want to break down that ‘them’ barrier.

This shows that Shelly has a strong motivation centered around acknowledging stereotypes that often develop in schools, where Westernized notions of us and them place international global issues at the center of investigatory activities. While no explicit mention of teacher motivations for using citizenship education in science classrooms exists in the literature, Shelly’s comment agrees with the research done by Jenkins (2006). Jenkins (2006) makes the claim that the science curriculum needs to be sensitive to the interests of the students, which will often be situated locally. Therefore, creating a hook for students to engage in SSI should be locally relevant in order to encourage students to develop an invested interest in the issue, thereby hooking them into the role of a critical thinker, reflecting on their role as a citizen.

Additionally, for her grade 8 students, Shelly emphasized the importance of having her students feel an affective domain. Before assigning the investigation task, Shelly simulated an activity meant to engage her students in the questions of “well that’s not fair, so…, how does that happen…, and what would it be like to…” This was meant to give her students an invested interest in the investigation, rather than working to passively complete the task. This invested interest was created by crafting a simulation based activity where students imagined that one well of water serviced and entire area. Different communities (groups of students) were set up around the class at different locations, with the well of water (bucket of water) placed in the middle. Students drew straws to determine the type of equipment they would use to collect the
water. The equipment ranged from a teaspoon, to a 1-L jug to 1 cup measuring tools. Setting up the simulation to be like a race, students were expected to collect as much water as they could with the tools given. Shelly commented that her students were quick to realize the activity was not fair, which then followed with a conversation about who is this not fair to and relating it back to the investigation on water quality in Aboriginal reserves. Shelly stated that “if [students] feel it, then suddenly you’ve got them; you’ve totally hooked them. When you add that feeling aspect, I think it helps bring that citizenship thing in because, functionally citizenship is caring for other people.” This simulation activity, prior to the investigation, was purposefully chosen by Shelly because as she said in the interview, her “hidden agenda is that affective domain to get [students] in and start caring about other people. Feeling empathy, not sympathy, but empathy.” Here, Shelly shows yet another example of a hook which appeals to the emotions of students in terms of what is ethically right or wrong.

Therefore, it appears that citizenship education in science benefits from the use of a hook, whether it be based on emotional interest or not, in order to create invested interest. This is what Sadler (2009) refers to as situated learning, which suggests that the nature of knowing and learning does not develop independently. Rather, “as individuals participate in environments and engage with the communities that form these environments, they begin knowing and learning” (Sadler, 2009, p. 2). It is important to help students realize that their time spent studying science is not purely based on understanding scientific knowledge, but rather how that knowledge has been applied, and thus shaped the lives, both positively and negatively, of many so close to home. Situating a student’s learning through a hook will allow the student to move beyond a surface level understanding of the SSI.
5.2.2 Recognizing the power of the teachable moment

Not all lessons are planned to engage students in citizenship education, but when the opportunity, or teachable moment, arises, teachers should seize that opportunity. Discussion with teacher participants revealed that the practice of citizenship education does not always come from purposeful or planned activities. It may sometimes occur when the teacher in the classroom seizes the opportunity to engage in issues that come up in the classroom, which may not always be content-related. Shelly mentioned that citizenship education relies on the teacher noticing if a student is having an issue. This goes as far as stopping a planned lesson in order to address the issue if said issue is made public to the class. Shelly mentioned an instance when homophobic slurs were used in the classroom. She explained that it is equally important to seize that teachable moment. Don’t just say ‘oh well I have to get on with my lesson about photosynthesis, we can talk about homophobia later.’ No, we need to talk about it now. You need to talk about it now, because the hook has happened. It wasn’t planned by you, but it’s happened so you need to jump on that. And you know photosynthesis, you can do that as homework later, if it’s not in class, but you need to jump on and take advantage of that.

This creates a wonderful parallel to the discussion of hooking students in. Although the hook created in the example given by Shelly is not a SSI one, this should not take away from the impact the hook can create within the science classroom. Citizenship education addresses not only the ways we educate our students, but it also involves teacher action. By exemplifying such practices, for instance, taking the time to acknowledge discrimination in the classroom - the teacher becomes a living embodiment of active citizenship.
The teacher, being a role model, is bringing to the classroom ideas and practices that students may learn from in order to help their development as participants or citizens of society. Evans et al. (2009) highlights the role of the teacher as one of the seven teaching and learning practices associated with citizenship education. However, Bickmore (2014) argues that despite stated commitments and motivations to engage in citizenship education, teachers often respond to uncomfortable situations in classrooms in limited and generic ways. These two pieces of literature support the idea of the teacher as a role model where ‘calling out’ a student because of their inappropriate comments, as Shelly mentioned, creates a teachable moment of sorts. While not all teachers may feel comfortable to engage in situations that are uncomfortable to them, the outcomes of doing so indirectly benefit teaching practices such as engaging in citizenship education. Therefore, it is important that citizenship education be practiced and understood in thoughtful, action orientated manners in the classroom by both teachers and students, whether planned or unplanned, and for PD opportunities to be available to address such instances.

5.2.3 Citizenship education as one layer of practice of many when teaching secondary school science

As the interviews progressed, it became clear that citizenship education was not explicitly taught by these teachers as an aside to the science content, but rather is infused into the classroom experience. When comparing the science curriculum to other subject areas, Erin mentioned that “you could pick any topic and make sure those pieces are integrated into it, whereas I feel I have my topic [science] and I have to pull things in that could work.” She gave the example of teaching verbs and speech in a French class where it is easier to teach a topic of interest like citizenship education, while incorporating content like verbs and speech. In science, she explained it to be the opposite, where the topic is predetermined, ranging from chemistry, biology, physics to a study of the universe. Erin is justified in her comparison, and presents
something new. Perhaps, one could say that citizenship education should be a lens by which science teachers educate through, shedding light on connections between curriculum content and SSI.

Shelly also commented on her struggle to integrate citizenship education into her classes more frequently. Like Erin, Shelly provided a similar analogy commenting on how citizenship education should be practiced in the science classroom. She explains the process of planning a lesson, activity or task like building layers on a pearl, by stating:

I still go through this process of okay this is lesson I have to go through, and then you know it's like the curriculum expectation is that grit, like the pearl thing. The curriculum expectation is that grit, how am I going to do this, what kind of lab, what kind of overhead am I going to use? That’s one level. What kind of action, cooperative learning can I put onto it? What kind of lab activity, demo you know. And I think, one of those layers, somewhere, and the order of which one happens first varies, but putting citizenship education, or interpersonal skill, or something like that that's one of one of the layers on the pearl. The bigger the pearl, the better the pearl. Right! Even if, it’s sort of a bit dodgy, like the layers are not complete, eventually with practice you make that happen.

Shelly spoke about the action piece, being the second layer of the pearl in the above quote. The larger the pearl, the more enriching and engaging the lesson is, and although the pearl may appear imperfect at the start, eventually with practice, the layers will smoothen out producing a perfect pearl with citizenship education as one layer of many.

Erin gave an in-class example of a task she had her grade 9 science students carry out. The task was to design a method by which you could safely get to the moon because the earth
was no longer a suitable place for humans to live. The theme of the lesson revolved around sustainability and having the students consider what the word suggests and how this thought process can be used to create a truly sustainable method to get to the moon. Working in teams, Erin scaffolded the task by walking her students through the scientific design process, using skills from her iThink PD sessions, allowing her students to work from the most unlikely idea to the most polished one. This activity was meant to have a twofold learning outcome, where students engaged with the concept of sustainability and what it means to have limited resources and time, as well as the science behind thinking, developing and building a prototype. This is a prime example of an activity that indirectly introduces a SSI, and hooks the students in, while at the same time building from curriculum expectations. Sustainability is a key issue that is the responsibility of all people, and teaching it within the science classroom makes it all the more real for students. However, Erin was wary to label this example as a form of citizenship education, making the comment “I do all these things, but I don’t know if it all connects.”

Both participants reported that in science, citizenship education does not lend itself well to be treated like a standalone unit. It should not be treated separate from inquiry based and/or collaborative teaching strategies. Many of the examples given by both Erin and Shelly showcased all three strategies. Citizenship education involves the use of many of these pedagogical practices in order to help deepen student critical thought and thinking when it comes to seeing their role in society on a local and global level. Therefore, the use of SSI created an avenue by which citizenship education can be woven into science. SSI allow students to search for answers or solutions that are not singular in nature, nor dependent on simple algorithms, but rather solutions and answers that need to be negotiated and considered from all points of view (Sadler, 2009). In addition to the development of scientific knowledge, SSI help to strengthen
skills associated with teamwork, problem-solving, and media literacy (Ideland, Malmberg, and Winberg, 2011). Citizenship education, as one of many layers in a science lesson, allows for the potential to create authentic, engaging tasks that help build enriching experiences for students.

5.3 Secondary school science benefits from the use of authentic activities which create lived and enriched experiences for students

While creating a hook is useful for engaging the student and giving them that first level of interest in the subject matter, both participants noted that there needs to be something more; something that links to the curriculum content. This link is the creation of an authentic activity, which is defined here as something that allows students to develop a sense of ownership when engaging in the activity (Roth and Desautels, 2004). In both cases, each participant followed up their hook with an activity, they called an assignment. What was interesting between the two participants was that Shelly carried out her task within a classroom setting, whereas Erin assigned a task that was part of a larger yearlong project carried out by all grade 9 students, across disciplines. Therefore, this section will first begin with an analysis of the differences and similarities with regards to school wide versus classroom implementation of citizenship education in science, as well as comment on the authenticity of each. Then, I look at how the activities were assessed, and accordingly comment on each teacher participants reasoning for the assessment method chosen.

5.3.1 School wide vs classroom implementation

When speaking about their practices, it became clear that one practice was centered around the classroom, and another centered around a year long project that involved all members of the school community. Both practices are equally important to discuss and shed light on in terms of applicability and feasibility. Shelly spoke of a two-part activity relating to the topic of
water systems for her grade 7 aged students. After the hook (mentioned in section 5.2.1) with the water bucket challenge, Shelly had her students sort through a purposefully chosen federal government document on water quality and reserves. She carefully guided her students through the document, seeing as it was complicated and did not want her students to be turned off by it. This was meant to scaffold the work and prepare the students for conducting their own research for sources that came from the media companies like the Canadian Broadcasting Corporation (CBC) or similar outlets, as well as sources from an Indigenous author, in an Indigenous community. This research process aimed at engaging the students not only in freely available literature around water quality on reserves, but also allowed them to look at potential biases that may exist between media sources and Indigenous experiences. Shelly commented that “You know media literacy is sort of everybody’s job, but it’s not really usually perceived as science’s job. But understanding reliability of resources, I can claim that.” Shelly demonstrated that within the science classroom, she could provide her students with the opportunity to not only search through academically rigorous materials, but transform that sense of ownership, in research, into a discussion of bias. Shelly was able to, in a single activity centered around the issue of inequitable access, guide her students from a discussion of science to a discussion of media literacy, to a discussion of how opinions are formed.

Erin presented a different approach to an activity for her grade 9 science students, one that was part of a yearlong project assigned to all grade 9s. The school, for the past three years, has implemented this project where students are grouped and given a specific challenge related to the school’s focus on leadership education, also referred to as citizenship education. Erin specified that the 2016-17 project was titled “change makes sense” where each group was required to come up with an idea and design a product that would help local businesses, or the
school community, become more sustainable. Each group consisted of 5-6 students, with each student having a specific role in research, design, marketing etc…, meant to provide each group with different perspectives to consider when working through the project. Groups were randomly assigned, but included at least one student in business and another in drama classes. This specific detail was a requirement of the project guidelines. However, every student in the group was taking a class in science, English and geography. In science, the students focused on the design process of the prototype, taking into consideration key aspects of design in terms of scientific inquiry and laboratory methods. In addition to class time, student groups were given five days off the timetable, where in their groups, students worked independently as a group or engaged in workshops or field trips meant to scaffold the project. For example, Erin mentioned that the first day off the timetable was used to launch the project by having the students take part in a scavenger hunt centered around innovators in the field of community sustainability. This was meant to have the students consider what innovation was and how to apply it, and chose an area of innovation that speaks to their group. The ultimate goal of the project was for the groups to pitch their idea or prototype to a panel, on a stage, while being filmed, simulating what the school calls “Puma’s Den”. Erin commented, that prior to the implementation of Puma’s Den, this project was done on a much smaller scale within a business class stating that it was “as good as it was, it was very artificial, because it was like just find a product.” The cross-disciplinary aspect was non-existent, and students were not able to truly engage in the design process through trial and error that benefits from a yearlong investigation. Erin commented that the students surprised themselves with the end result and become invested in the process.

Comparing Shelly’s activity to Erin’s, one can see that the process and discussion piece are crucial to the outcome. In both practices, students openly discussed with one another real
world topics, whether it be water quality or environmental sustainability, and show understanding through critical thought. Shelly entered her students in a poster contest regarding the lack of schools in an Indigenous community, Akwataskpat, in order to further the discussion of bias and representation in media, seeing as many of the schools were run down by toxic waste or dump. The students had to research the components of their poster, and developed beautifully animated and colored works that Shelly described as being totally owned by the students. This sense of real ownership, and accomplishment can be compared to the final pitch Erin’s grade 9 students had to deliver at the end of the 2016-17 school year. Therefore, in both cases science benefited from giving the students time to discuss, design and process SSI, through authentic activities.

The difference, being the length of time spent on each activity also presents an interesting thought. Puma’s Den is a wonderful way of creating a multidisciplinary approach where students are able to learn about citizenship education through many subject areas, while having one goal in mind. This multidisciplinary action takes place over several months and mimics real world instances of think tanks, research or focus groups. Shelly’s activity, while on a smaller scale, presented the multidisciplinary aspect as well by tying in literacy and the visual arts, but I do believe that this activity could be one component of a much larger project. Shelly’s school does engage in a similar design and pitch model, called the Global Ideas Institute, but because it is a separate commitment outside of school and specific to the grade 12s, perhaps a larger scale project spanning the entirety of the course could help engage the younger students in something they would eventually take on in grade 12.

Moving beyond the superficial layer is important in science and citizenship. Literature shows that it is important to consider where an activity, with transformative pieces to it, fits into
the grander scheme of lessons in a science unit (Banks, 2008). In other words, Banks is promoting teachers to consider why a certain activity is chosen over the other? What outcomes is the teacher aiming to get out of the activity? In the examples described, both teachers wanted to move away from a lesson that was one-dimensional and superficial. They were dedicated to teaching the science content, but through the lens of citizenship education, while giving their students the opportunity to engage in critical thought and processes and build a sense of ownership. Therefore, what links science and citizenship is the creation of the authentic activity.

5.3.2 Assessment practices value the process rather than the outcome

When asked to comment on how their tasks and activities were assessed, both teacher participants glossed over the area by emphasizing that the process of the activity was a much more valuable outcome. Erin commented, when speaking about her hook with the moon activity, that her area of focus with her grade 9 students is not so much what the students design, but it is more the process they have gone through and teaching them that you need to work as a team. Erin also emphasized that this hook was teaching her students 21st century competencies of communication, leadership and teamwork without the students even realizing. The moon activity was meant to be a conversation piece where Erin could walk around and discuss with each group their thought processes as well as what key factors related to sustainability they were considering. She looked at this activity as more of an assessment for learning (meant to provide a student with comments on how they understand content) rather than of learning (a final graded mark given to a student). This is focus on assessments for learning give students the room to be truly creative with their projects rather than fretting over the end mark that often dictates student work.

Shelly similarly described the focus of her hook activity, being the water bucket challenge, as something meant to stimulate conversation. The conversation focused in on the
idea of bias and formulating opinion, as previously discussed. Her lesson, being three parts with
the hook, the research process and then the poster contest piece, all served to produce what
Shelly described to be a “really rich lesson”. She stated that one of the challenges of citizenship
education in science is creating a really rich lesson, commenting that “you don't just want sponge
cake, you want fruit cake, you want big meaty chunks of nuts and fruits soaked in rum.” In terms
of assessment, Shelly commented that she seldom gives worksheets alone, for students to
complete, memorize and hand in. She would rather use the worksheet in addition to some sort of
cooperative learning, to develop interpersonal skills. Like Erin, Shelly is drawing connection to
the 21st century learning competencies that arise from lessons that put the student at the center of
the learning process. However, although the discussion around bias would resurface as questions
on a written test, Shelly described her lesson, specifically the water challenge and the research
component to be formative assessment, also known as assessment for learning rather than of. It is
the realization process of what is being done in class is not merely a simulation, but something
that is real and fundamental. Erin also said that a majority of the activities surrounding
citizenship education and the use of SSI in the classroom are meant to be formative in order to
maintain consistency between science sections. Although the school’s agenda revolves around
citizenship education, not every teacher within the science department will perform similar tasks
or activities. This is the reality of teaching, and therefore, for Shelly, it makes more sense to
focus on having the students think and discover the process of critical thought than assigning
marks that not all students would have the advantage of experiencing.

Returning to Erin, the prototype for Puma’s Den is marked however. Seeing as this
project occurs year long, the assessment strategy broke up the marking categories so that each
subject area, French, science, English etc. are represented. Erin spoke to the fact that she is
responsible for marking the research process, materials used, procedure and other components, almost like marking a lab investigation. She does this for all the grade 9’s, seeing as she is the only grade 9 science teacher in the school. By providing a familiar marking scheme, the students are aware of the criteria and can accordingly enhance their performance across the year. However, it seemed that students were motivated by the project alone, and not so much on allocation of marks. This could be attributed to the emphasis on academics that both Erin’s and Shelly’s schools highlight as their key focus. Therefore, the argument could be made that the students are intrinsically motivated to engage in tasks, rather than relying on marks as a motivator.

Evans (2006), shows that an issue of congruency arises when teachers enforce classic assessments strategies, focused on knowledge rather than skills acquired by students, when assessing activities related to citizenship education. This assessment of knowledge defeats the purpose of citizenship education, where learning outcomes associated with participatory action and responsibility can only be assessed through skill set acquisition (Evans, 2006). In both cases, Shelly and Erin showed thoughtful assessment strategies that aimed at gathering evidence to showcase the skills their students achieved. For Erin, it is the yearlong engagement with the design process that gave her the ability to provide authentic marks when marking the final product. For Shelly, having her students take part in a province wide contest and tracking their understandings of water quality on reserves through open discussion, provided students with a richer form of for learning, that of learning would ever create.

5.4 Supportive administrators and colleagues allow for science to be linked to citizenship education, but barriers do exist which hinder implementation at the senior level

Although these findings have shown that citizenship education is currently being practiced in the science classroom, it may only be implemented because of certain supports in
place. When asked to comment on these supports, Erin and Shelly stressed the importance of collegiality within the department, as well as support from administrative personnel. Therefore, this section will first speak to the school wide support of citizenship education across all disciplines, the extent to which it is being practiced and then shed light on barriers that hinder implementation at the senior levels in science.

Both schools have woven into their mission statements the idea of creating socially, responsible citizens that are aware of their role in society. Although labelling these as global citizenship education and leadership education, Shelly and Erin both spoke to characteristics of their practices that fit into the definition of citizenship education spoken of in Chapter Two. Therefore, it was expected that when asked about how supportive admin were, both teachers felt well supported. Erin commented that “they [the admin] want us doing more and more. They will bring people in to help us!” This was evident through Erin’s earlier comments that a majority of PD sessions focus on creating a school atmosphere conducive of incorporating citizenship education into all classes. For Shelly, she described the administration as expecting staff to engage students in citizenship education, but the level to which the admin is aware of such practices may not be at par with their support for the practice. Shelly spoke of one Vice Principal (VP) in the school who was someone she would go to and speak with about new initiatives or resources she became aware of during her practice, as well as different things she is trying in her classroom. She did highlight, that this VP had a science background, and therefore she felt more inclined to speak with him because the conversations could be more science centered rather than discussing a general idea of citizenship education. Therefore, these findings are contradictory to the literature which suggests that even when teachers express confidence and motivation regarding the teaching of citizenship education, the admin in schools often presents barriers to its
implementation (Pedretti et al., 2008). Although my findings are contradictory, this could be attributed to the fact that both participants teach within independent schools who do have greater access to resources that can help support citizenship education implementation.

Although a strong push from the admin, to implement citizenship education across classes, is present in both schools, support within the department is also necessary. Shelly stated that “[The science department] talks about different lessons that we do, we collaborate on making lessons, and sometimes they’re my idea or our idea.”. This demonstrates that ideas are formed collaboratively between teachers so that consistency is maintained across subject section areas. This provides equal opportunity for all students to benefit from the merits of citizenship education within science. However, without a collaborative process, the likelihood of accepting differentiated practices within science decreases. For example, when speaking to the fact that she is currently teaching a course she hasn’t taught in six years, Shelly commented that she was expecting pressure from the rest of the team to teach the units in a specific manner. Departmental pushback is a common barrier that teachers face when trying to incorporate something new to a course that has been taught in a specific way for an x number of years. Shelly also suggested that although the pressures exist, if appropriately presented to colleagues, acceptance is more likely.

Erin mentioned that since she is the only grade 9 science teacher, she has more flexibility seeing as she is in control of all practices and assessments across all 3 section areas of grade 9 science. Although she does seek help from other members of the science department when planning her lessons around the research design process for the prototype, Erin also commented that she seeks support from a team of grade teachers, which Erin described as anyone that teaches grade 9, is on the grade 9 team. This grade 9 teacher team was responsible for developing the global leadership project. The global leadership project that Erin is speaking to is
the yearlong project. This is unique in that most teachers seek support from their departments in terms of teaching content and the like. However, in this case since the project is multidisciplinary, collegiality across departments is necessary and brings in differing perspectives, that I believe, enhances student learning within each subject area.

When asked to discuss implementation practices of colleagues, both teacher participants were limited in their responses. Shelly attributed this to the fact that she doesn’t have the time to go and watch her colleagues carry out their classes. A majority of the sharing happens in the staff room where unique teaching practices are verbalized. Erin mentioned that since senior science classes are very content driven, the extent to which citizenship education can be implemented is limited. Although one physics teacher, in the department, is trying to incorporate more of the 21st century competencies into their classroom, through hands on inquiry and technology, Erin was unsure of its level of authenticity. Therefore, I suggest that based on my findings that integrating citizenship education within senior level science classes might present more challenges to the teacher than at the intermediate level. I suggest this seeing as both participants interviewed here spoke to their experiences within intermediate level science classes, as well as a majority of the literature presents studies at the intermediate level such as those mentioned in Chapter Three, by Sperling and Bencze (2010) and Sperling and Bencze (2015) which highlighted students in grade 7 and teenage (unspecified ages) girls respectively. However, this is not to say that senior level science classes cannot incorporate citizenship education. For example, Erin mentioned that the grade 12 students at the school work individually on a capstone project focused on a topic of their choosing that must connect to two courses they are taking. While this capstone project does hold potential for investigation of SSI relating to citizenship, this depends on student choice.
5.5 Conclusion

I came in with the notion that citizenship education could be easily practiced if a teacher had the passion to educate science in such a manner. However, through a review of the literature, discussion with participants and an analysis of these discussions, the practice of citizenship education involves many considerations, and is one of many layers contributing to the creation of a rich and engaging lesson. To summarize, this chapter presented findings through four main theme sections. The first theme examined how teacher experiences and schooling informed their understanding of citizenship education. The second theme explored how teacher understandings of citizenship education influenced their practice. The third theme suggested that using authentic tasks that situated learning for students were better able at engaging students in SSI. Lastly, this chapter highlighted that a supportive administration team, coupled with positive collegiality amongst teachers, can improve citizenship education implementation in the sciences. However, challenges related to departmental pushback in terms of what content and activities to deliver, along with the content heavy nature of senior level science courses, proved to be a barrier for these teachers.

Therefore, both participants in this study revealed useful practices, which focused on equipping their students with the knowledge and tools relating to citizenship education. These practices promoted a process of learning that engaged students in scientific content and issues through discourse and situated learning. These findings will be discussed in terms of their broad and narrow implications in Chapter Six. Additionally, I will provide recommendations and note potential areas for further research in the area of citizenship integration at I/S levels of science.
Chapter Six: Conclusion

6.0 Chapter Introduction

The following chapter will further examine the experiences of two intermediate/senior science teachers with regards to implementation practices of citizenship education in science. This chapter will briefly revisit the findings and their significance, as explored in Chapter Five. From these findings, this chapter will aim to highlight both the broad and narrow implications of implementing citizenship education in science through SSI. Following these implications will be a discussion of recommendations regarding how to better science teacher and student experiences with citizenship education. The chapter will then conclude by indicating areas for future research, which could potentially contribute to the existing body of literature around citizenship education within the Ontario context. The end of this chapter will reflect on the significance and goals of this study.

6.1 Overview of Key Findings and their Significance

In Chapter Five of this study, findings were discussed and developed into four central themes regarding the central research question of how do Ontario secondary school science teachers integrate citizenship education in their classrooms? Two participants from the independent school system were recruited using the purposive sampling method, and interviewed with a set of pre-determined questions. The findings were analyzed, and moments of convergence and divergence with the literature were discussed, along with the identification of supports and barriers experienced by teacher participants. The following themes emerged from the analysis.

(1) Teacher backgrounds and experiences guide understandings of citizenship education.

Both teacher participants, Shelly and Erin, expressed that their backgrounds and experiences
influenced their understanding of citizenship education and its place in the classroom. Teacher background was defined as the years of education, volunteerism or work spent before said teacher became employed by a school board. Teacher experience was defined as the professional development (PD) opportunities, related to citizenship education, which said teacher engaged with during employment. The understandings developed by each participant were then linked to how they developed the knowledge, research, design and tools necessary to allow students to participate in an investigation of SSI related to citizenship at the local and global level.

(2) Understandings of citizenship education influence approaches to teaching science. When asked to discuss their teaching practices within the science classroom, both participants gave examples of in class activities done with students to engage students with SSI. From these activities, I discovered that each teacher held specific rationales for why they structured their activities in the manner they described. Both teachers emphasized the necessity in creating a hook to give their students an invested interest in the SSI being explored, while allowing their students to develop the affective domain that is closely linked to citizenship education. Additionally, one participant spoke of the teachable moment as being a vehicle by which organic conversation with students in the science classroom can be used as a platform to explore issues relating to citizenship education. Lastly, this theme also brought to light the idea that citizenship education is one layer of many when creating a lesson or unit plan for students in secondary school science.

(3) Secondary school science benefits from the use of authentic activities which create lived and enriched experiences for students. This theme brings forward the value of authentic tasks and activities, where students are given the opportunity to engage in critical thought and processes and build a sense of ownership. Teachers repeatedly mentioned that they wanted to
situate their student’s learning in tasks and activities that looked beyond testing or the creation of surface level knowledge. Therefore, the teachers employed assessment practices that valued the process over the outcome, so that students felt comfortable focusing on how they engaged with the tasks and activities rather than being engaged for the grade. It was also found that a school wide implementation of citizenship education allowed students to engage in issues based learning more holistically through the cross-disciplinary approach.

(4) Supportive administrators and colleagues allow for science to be linked to citizenship education, but barriers do exist which hinder implementation at the senior level. Although these findings have shown that citizenship education is currently being practiced in the science classroom, it is only being done because of certain supports in place. When asked to comment on these supports, Erin and Shelly stressed the importance of collegiality within the department, as well as support from administrative personnel. Without a collaborative process, the likelihood of accepting differentiated practices within science decreases. Departmental pushback is a common barrier that teachers face when trying to incorporate something new to a course that has been taught in a specific way for an x number of years. Additionally, Erin mentioned that since senior science classes are very content driven, the extent to which citizenship education can be implemented is limited. Although one physics teacher, in the department, is trying to incorporate more of the 21st century competencies into their classroom, through hands on inquiry and technology, Erin was unsure of its level of authenticity.

6.2 Implications

The following section will explore both the broad and narrow implications of this study. Based on findings from Chapter Five, this section will first explore the implications which contribute to the broader educational community, in terms of practices related to citizenship
education in science. To follow, narrow implications will be presented and explored in order to draw relation to teacher personal identity and practice. Overall, this section is meant to situate the findings of this study within practice, while also providing a platform by which the next section will build recommendations from.

### 6.2.1 Broad: The educational community

This section will explore the broad implications of this study regarding teacher practices and experiences with the implementation of citizenship education within science classes through socio-scientific issues (SSI). The first implication from this study is the potential departmental pushback intermediate/senior (I/S) science teachers may face when adapting unit and lesson plans in order to give students a socio-scientific focus to traditionally content driven lessons. A second implication that emerged revolves around notion that senior level, grades 11 and 12, science teachers of core subjects, including biology, chemistry and physics, have little time in the semester to engage their students in science through citizenship education. A final implication deals with potential challenges I/S science teachers may face when developing assessment strategies, particularly for activities and tasks relating to SSI. Following the explanation of each implication, recommendations will be made in the next section.

Incorporating SSI into science classes, especially at the I/S level requires that lessons, and maybe complete units, be restructured so that the practice of citizenship education does not appear superficial or surface level. Often, courses are planned by departments to ensure consistency is maintained between course sections; this is particularly important for most science courses at the I/S level. One of the participants mentioned that some pushback surfaces by the department when a member of the staff introduces activities that deviate from the traditional design of a said science course. Although pushback is a caveat of the emergence of new ideas in
any setting, implementation depends on teacher dedication, experience and most importantly teacher philosophy. Both teacher participants in this study were dedicated to their specific subject disciplines in science, but were also able to harness their passion for SSI, under the umbrella of citizenship education. One participant mentioned that having had experiences from professional development workshops, or just other classroom experiences, they felt far more comfortable pushing back to include citizenship education in their science classroom. However, both teachers highlighted that collegiality is necessary for citizenship education to be practiced year after year. This suggests that although teacher autonomy is valuable, the department as a whole must be willing to embrace new ideas and remove pushback. With time, new ideas will become part of traditional design, leaving room for a new cycle of pushback and acceptance. Therefore, although departmental pushback may surface in any science department, teacher autonomy and voice is needed in order to resist pushback, while also showing merit for the use of SSI in the science classroom in order to engage students with citizenship education.

In addition to departmental pushback, a second implication can be made regarding the extent to which citizenship education is implemented at the senior level in science classrooms. Science courses, specifically biology, chemistry and physics, are often painted to be content heavy, requiring students to engage in a passive banking model of education. While 21st century learning competencies in Ontario encourage a facilitated and situated learning over knowledge dumping, curriculum content at the senior level in science is heavy. A participant of this study, as mentioned in Chapter Five, spoke to the differences between implementation practices at the senior and intermediate levels in science. Although senior level science teachers are creative and passionate about how material is presented to their students, teachers may be finding that citizenship education, including SSI, does not always lend themselves well to course content.
This suggests the content heavy nature of the science classroom is not the immediate barrier, but rather that teachers may feel ill-equipped to authentically create situated learning for their students that relates course content to real world issues.

This study found that teachers experienced some difficulty in terms of developing assessment strategies that authentically represented their student’s learning from activities related to citizenship education. This is suggestive of the idea that students may feel confusion around what is expected of them when engaging in activities focused on science and citizenship education integration. Assessment planning is a difficult task in any discipline, and requires careful thought in order to provide students with a clear direction of expectations. Teacher participants mentioned that they often used the assessment as a learning technique when assessing their students in order to move away from a grades-focused learning. Doing so supposes that students would freely engage in the activity without fear of wrong answers. Although assessment as learning is useful, students may still feel a disconnect regarding what it is they are learning, seeing as science, by the I/S level, is traditionally taught to value content memorization and calculations, with some focus on application. One participant highlighted that they had to paint clear connections between the activity and content in order to contribute to a more holistic understanding of the SSI.

6.2.2 Narrow: My professional identity and practice

As a teacher-researcher, much of what has been researched and discussed through my findings and implications has impacted my own actions and beliefs related to citizenship education and science. Before conducting my research, I seldom considered the amount of resource gathering needed to engage students in activities in order to make them authentic learning experiences for students. I define resource gathering as finding materials, or the like,
such as case studies, lesson plans, or simulations developed by others, and adapting them to meet the unique needs of the classroom. Additionally, incorporating citizenship education into the science classroom, as mentioned earlier, requires a consideration of the planning of said science course. Not only should one consider how the different units within a science course relate to one another, but careful consideration of how citizenship education is used to elevate course content and situate each student’s learning is equally as important. This requires departmental collaboration, to ensure all students are exposed to the same level of rich learning. Science departments may need to reach out to non-profits or other education groups that are better able to support the incorporation of citizenship education in the science classroom.

This research has also made me question the cross-disciplinary approach to citizenship education. Science is connected to all disciplines, but is often isolated as its own subject. In fact, even within the study of science, students developed a fragmented view of how chemistry, biology and physics connect. Coming from a professional background, engaging with notions of global health, I have been trained to think about how the self and community interconnect with one another in terms of achieving equity in health for all. This requires a holistic understanding of all disciplines in science. It is my belief, that in order for science to truly benefit from the use of citizenship education, school administrators and curriculum developers need to advocate for a cross curricular design where learning science becomes part of whole rather than singular in nature. A cross-curricular design, in my opinion, elevates schooling and removes the perception that science is only for the ‘gifted’, but rather that learning science enables students to better understand their surroundings on local and global scales.

6.3 Recommendations
The following section will explore recommendations informed by the implications above, with regards to several stakeholders in the Ontario Education system. While many recommendations can likely be made, this section will highlight and discuss recommendations pertaining to administrators, teachers and teacher education programs. Each recommendation examined, will take into consideration feasibility, time, accountability and possible outcomes of such recommendations. It is the hope of this study that these recommendations may serve to remove a bias which places social science at the heart of citizenship education, while also better supporting the cross-disciplinary approach by which citizenship education should be practiced, especially within the secondary (I/S) science classroom.

6.3.1 School administrators

School administrators are essential for the successful integration of citizenship education in science. They play both the direct and indirect role of motivating their staff to explore teaching strategies that better reflect the direction education is headed, being a holistic focus of students. Participants of this study emphasized that they received ample support from their administrators, being principals, vice principals or on site teaching and learning support staff. This support came in the form of workshops, professional development seminars and conferences or community connections. Although this was specific to independent schools, I firmly believe that public schools are capable of fostering the same type of support in order to encourage a focus on citizenship within science. This type of support would need to be provided over years in order to cultivate a school environment where teacher staff are comfortable adapting their traditional lesson planning strategies. One participant mentioned that although citizenship education has been the school’s motto for over five years, staff still needed support to invest fully in the practice.
6.3.2 Teachers

The implications in the previous section, as well as the focus of this study, are indicative of the role that teachers place in shaping how students in science develop an understanding of citizenship education through SSI. Teachers must be willing to frame the focus of their science teaching through the citizenship lens in order to authentically educate for citizenship. Literature and the findings from this study show that science teachers can make citizenship education part of their lessons, but they must be willing to re-evaluate their teaching philosophy in order to make sure it aligns with the learning objectives of citizenship education. Therefore, I recommend that teachers be provided with opportunities where they are able to engage in activities that help define their teaching philosophy. This is important because many teachers engage with 21st century learning competencies for the sake of, not for an appreciation of learning. These activities may take the form of professional development, where teachers are given the choice to explore an area of education they are interested in, and present that particular area to their colleagues. Presentations could be in the form of a symposium, where discussions are encouraged, along with the exchange and sharing of ideas. These symposiums would likely need to be held at the end of the academic year so that teachers are given a year to think about their interests. This also enhances opportunities for collegiality and community building amongst staff, where similar interests and passions between teachers can better be explored, thereby increasing the likelihood of implementation in the next academic school year. Of course, administration would need to work hard to encourage their staff to engage in a philosophy of teaching.

6.3.3 Teacher education programs
Teacher education programs are the backbone of teaching, in that they either provide potential educators with an exploration of citizenship education, or gloss over the subject as one of many teaching practices. Citizenship education has the potential to develop a cross-disciplinary approach to education at the I/S level. As a current teacher candidate, I feel that the faculty could do more to engage their students in citizenship education. While courses are offered, these courses serve only as electives for those wishing to take them. In a way, teacher education programs should provide their teacher candidates with a scope of issues to be discussed, while providing students interested in citizenship education and science, the opportunity to seek out potential agencies that practice their areas of interest. Teacher candidates, rather than completing all practicum based hours within a traditional classroom setting, can be given the opportunity to opt out for a self-found internship in an area of interest. This internship makes the engagement with citizenship education and science much more authentic, and therefore may increase the likelihood of engaging with this practice after graduation. Teacher candidates can be provided this internship in their second year, to ensure they have had ample experience in the traditional classroom setting.

6.4 Areas for Further Research

The findings of this research study, while eye opening, require that future research focus on teacher practices of citizenship education within science classrooms at the public level. Both participants of this study were from the independent school system, where their experiences could be considered different from those of a public-school system. While this is an assumption, it would benefit the body of literature by seeking out school teachers from both the public and private sectors of education in order to compare experiences of citizenship education implementation, specifically within I/S science classes. Additionally, this research study, due to
scope and time constraints, was only able seek out and interview two participants that met the research criteria. While other potential participants were approached, only I/S science teachers demonstrating citizenship education practices were interviewed.

Further research in this area would also benefit from observing teacher practices in order to understand how a specific activity conveying socio-scientific issues is carried out. The process by which the activity is carried out is crucial in terms of developing further implications and recommendations that could be used to better shape curriculum documents and policy. Additionally, observing these teacher practices, like all good observations do, provide an insight as to student receptiveness and engagement with the activity. Seeing as citizenship education implementation within science classrooms deviates from a Socratic method to teaching science, exploring student receptiveness would serve the body of literature tremendously.

6.5 Concluding Comments

Overall, this research project has given me the opportunity as a teacher researcher to more deeply reflect on my passion to teach I/S science through an issues based approach, taking into consideration citizenship education. This study found that while teacher backgrounds and experiences play an important role in shaping their view of citizenship education in science, departmental implementation and administrative support on the school wide level, will increase the likelihood of incorporating SSI in the science classroom. I firmly believe that this study helps to bring a new perspective forward regarding how citizenship education is viewed, and removes a traditional bias that connects the social sciences to citizenship education. I hope that with this research, I/S teachers are more willing to view science through the lens of social justice, and give their students the opportunity to situate their learning and connect content to real world issues.
References


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Appendix A: Letter of Signed Consent

Date:

Dear _______________________________,

My Name is Leeza Shakkouri and I am a student in the Master of Teaching program at the Ontario Institute for Studies in Education at the University of Toronto (OISE/UT). A component of this degree program involves conducting a small-scale qualitative research study. My research will focus on the use of citizenship education in the science classroom. I am interested in interviewing teachers who are aware of citizenship education and the merits it holds in the science classroom. I think that your knowledge and experience will provide insights into this topic.

Your participation in this research will involve one approximately 60 minute interview, which will be transcribed and audio-recorded. I would be grateful if you would allow me to interview you at a place and time convenient for you, outside of school time. The contents of this interview will be used for my research project, which will include a final paper, as well as informal presentations to my classmates. I may also present my research findings via conference presentations and/or through publication. You will be assigned a pseudonym to maintain your anonymity and I will not use your name or any other content that might identify you in my written work, oral presentations, or publications. This information will remain confidential. Any information that identifies your school or students will also be excluded. The interview data will be stored on my password-protected computer and the only person who will have access to the research data will be my course instructor. You are free to change your mind about your participation at any time, and to withdraw even after you have consented to participate. You may also choose to decline to answer any specific question during the interview. I will destroy the audio recording after the paper has been presented and/or published, which may take up to a maximum of five years after the data has been collected. There are no known risks to participation, and I will share a copy of the transcript with you shortly after the interview to ensure accuracy.

Please sign this consent form, if you agree to be interviewed. The second copy is for your records. I am very grateful for your participation.

Sincerely,

Leeza Shakkouri, HB.Sc
Consent Form

I acknowledge that the topic of this interview has been explained to me and that any questions that I have asked have been answered to my satisfaction. I understand that I can withdraw from this research study at any time without penalty.

I have read the letter provided to me by Leeza Shakkouri and agree to participate in an interview for the purposes described. I agree to have the interview audio-recorded.

Signature: ________________________________________

Name: (printed) _______________________________________________

Date: ______________________________________
Appendix B – Interview Protocol/Questions

Thank you for agreeing to participate in this research study, and for making time to be interviewed today. This research study aims to learn how and to what extent intermediate/senior science teachers integrate citizenship education in their classrooms. This interview will last approximately 60 minutes, and I will ask you a series of questions focused on science and citizenship. I want to remind you that you may refrain from answering any question, and you have the right to withdraw your participation from the study at any time. As I explained in the consent letter, this interview will be audio-recorded.

START OF MEETING: (10 minutes)

1. Introduce self,
2. Present and discuss consent form (have 2 copies – one for our files and one for the participant to keep)
3. Answer any questions about the project
4. Test audio recorder; extra batteries
5. Begin recording
6. State date and time of interview – start interview

Interview: 60-75 minutes

Section A – Background Information

1. How long have you been working as a teacher?
   a. How long have you been working as a teacher in Ontario?
   b. Which school boards have you taught in and for how long?

2. What grades and subjects do you currently teach? Prompt…what streamed level?
   a. Which have you previously taught?

3. What motivated you to choose education as your profession?
   Possible prompts: How did your __________ contribute to your choice of teaching as a profession?
   i. Previous employment experiences
   ii. Community involvement
iii. University studies
iv. Other….

4. In addition to your role as a teacher, do you fulfill any other roles in the school (e.g. student council advisor, teacher liaison or ambassador, resource teacher etc.)?

**Section B – Citizenship Education Exposure**

5. In your school community, or through professional development workshops, conferences or the like, have you come across the phrase 21st Century Learning?
   a. If so, can you share with me how you understand this phrase?
   b. Has the term citizenship, or citizenship education, come up when discussing 21st Century Learning? (Prompt by using the word competencies)
      i. If so, in what way?

6. In your view, to what extent does citizenship education align with the current STSE (Science Technology Society Environment) educational framework in Ministry Documents? Please explain.
   Prompt… Can you elaborate on…

7. Based on your answers to the previous questions, how would you define the term citizenship education?

**Section C – Citizenship Education and Teacher Practices**

8. Please walk me through a lesson plan or activity etc. in your science classroom where you intentionally integrated citizenship education.
   a. PROMPTS: Have you highlighted citizenship education through
      i. learning goals
      ii. in resources given to students
      iii. via assessment/evaluation
      iv. in and out of class activities
      v. ICT (information, communication and technology) – highlight
      vi. etc.
   b. Were students receptive towards the lesson plan/activity you described?
      i. How did you gauge their level of receptiveness?
   c. Do you feel as though your lesson or activity met your own definition of citizenship education?

9. What would you highlight as the advantages and/or disadvantages for students when integrating citizenship education, specifically within the science intermediate/senior classroom?
10. Have you have seen your colleagues use what you understand citizenship education to be, in their science classroom?
   
   a. If yes, please elaborate.
   b. How about in the non-science classroom?

Section D - Supports and Challenges

11. To what extent is your current school/school community supportive of integrating citizenship education in the science classroom?
   
   Possible prompts: Is the concept discussed in ….

   a. Are they aware of your teaching practices?

12. What challenges do you face when teaching science that integrates citizenship?
   a. How have you worked to address these challenges?

13. Why do you believe teachers may be hesitant to educate for citizenship in science?

Section E - Next Steps

14. What advice would you give to pre-service science teachers wishing to integrate citizenship education in their classrooms?

15. Do you have any questions or thoughts to share before this interview ends?

This concludes the interview.

END OF INTERVIEW: (10 minutes)

1. Turn off recorder
2. Discuss and schedule follow up meeting – if necessary
3. Explain “member check” – will send you transcript for your review
4. Review consent
5. Thank participant

Thank you for your participation, time and responses in this research study. I appreciate your insight and have found your responses to be very helpful.