Trades Student’s Perceptions of their Experiences in the Co-Creation of OER

by

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Abstract

This research study explored the perception of trades students in the co-creation of OER. This study used a mixed-methods case study approach to examine the impact of the co-creation of OER on first-year electrical trades students. As open education continues to grow and expand, vocational education and its students could find value in adopting the tools that OER use affords, and trades could offer their distinct voice to the conversation. In this study, students participated in creating open textbooks on various topics. Data collection was based on a questionnaire with 18 participants and interviews conducted with nine participants. The qualitative analysis revealed five themes in the student’s perception in the creation of OER: accessibility, value of co-creation, digital literacy skills, value of peer and self-assessment, and student agency. Overall, participants found the process enjoyable and that it had a positive impact on their vocational education.

Keywords: co-creation, OER, open educational resources, vocational education, trades students, open pedagogy
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Chapter 1: Introduction

Vocational education is a fast-moving and quick changing discipline. It often feels challenging to keep up with the current changes in technology and safety standards (Ebel, 1981). Textbooks and materials can be obsolete before they are even in the hands of the student (O’Shea, Allen, Onderdonk, & Allen, 2014; Segarra & Tanner, 2015). This disconnect can result in students learning information that is, at best, not current and, at worst, dangerous and unreliable. The use of Open Educational Resources (OER) has potential to help programs and their instructors keep up with the changes that occur in curriculum and contexts as needed (Coleman-Prisco, 2017; Masterman & Wild, 2011; Petrides, Jimes, Middleton-Detzner, Walling, & Weiss, 2011). The widely accepted definition of OER as described by the William and Flora Hewlett Foundation (n.d.) states:

Open Educational Resources are teaching, learning and research materials in any medium – digital or otherwise – that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions. (para. 2)

OER itself is only a part of the movement for Open Education; defined by Sparc (n.d.) as, “Open Education encompasses resources, tools and practices that are free of legal, financial and technical barriers and can be fully used, shared and adapted in the digital environment” (para. 5). By being able to use and adapt OER, vocational education has the potential to be more responsive to changing technologies, building codes, and technical practices that will enable students to enter the workforce better prepared for the current trends and practices that are standard in the industry in which they find employment.
OER as a Stepping-Stone to Co-creation

The use of OER allows for adaptation and adjustments as the users see fit. As technologies in industry change, instructors can make the necessary changes to the resources to stay current and relevant. Students can also become part of adapting or creating OER (Dollinger & Coates, 2018). While many faculty and students are drawn to the cost savings of OER, it would be a mistake to see the value of OER content and creation as primarily financial (Coleman-Prisco, 2017; Hilton, 2016; Jhangiani, Pitt, Hendricks, Key, & Lalonde, 2016). It is also becoming increasingly apparent that students want to become part of the process in their learning. Dollinger, Lodge, and Coates (2018) state that students "have shown interest in playing a more active role in their higher education experience as partners" (p. 210). Bringing students into the creation process allows for a new perspective that could add immense value to both the student experience and the overall common interest of the subject matter (Bovill, Cook-Sather & Felton, 2011; Dollinger, Lodge, & Coates, 2018). Studies have shown that a stronger connection exists between a student and the subject matter when the students themselves have helped create the artifacts (Pawlowski, 2012). While OER provides the benefits of financial relief to students, it can also add value in helping students construct their knowledge.

Students as content creators. As social media becomes more prevalent in society and our students’ lives, they are developing skills that, if used correctly, could aid in their education. Students are creating content as part of their culture (Lee & McLoughlin, 2007). YouTube, Facebook, Snapchat, Instagram, and many other platforms now allow students to become content creators (Nixon, 2003). With these content creation skills that students are engaging with daily, it is now possible to bring students into the process of creating resources. No longer do students need to be mere receptacles of knowledge, but they can become part of the process by using their
skills in content creation (Bovill, Cook-Sather, & Felton, 2011). The advent of Web 2.0 tools and their participatory nature is a disruptive force in education as it is easier now than with older technologies for learners to collaborate and interact with resources (Hegarty, 2015). Whereas in previous generations, it was up to the educator to curate and create learning resources. Students now have access to many different platforms and technologies that allow them to participate in the creation and curation of content. OER is made more robust in a world where participatory technologies allow for a "change in focus, including switching from producer-led approaches to participatory ones" (Lane & McAndrew, 2010, p. 10). Students' digital content creation skills should encourage educators to consider how to bring these digital skills to the more formal arenas of higher education. Involving students with the technologies that they are becoming well versed in will be beneficial to both the students and the resource creation and curation process. This inclusion of the student's voice in the production and curation of their learning resources has the added value of engagement. When students are involved, they are more apt to engage with the content (Hodgkinson-Williams & Paskevicius, 2012).

**Benefits of student participation.** There is much to be gained by being included in the co-creation of learning resources. When students are encouraged and brought into the process of creating their education, "something 'magical' happens, and some imaginative work can be produced" (Hegarty, 2015, p. 9). Educators do not bear the sole burden of creating, curating and inspiring students. Students can share in the responsibility, and their contributions can persist and influence long beyond their specific context. The creation and use of OER make it possible for future students to add to the conversation and resources. As each class revises and improves on previous work, the resource can become all that more valuable. Co-creation can continue throughout, class after class; the resource is continually improving and iterating (Hodgkinson-
Williams & Paskevicius, 2012). Bringing students into the process of creation may benefit the resources as "consumers who experience specific problems in their daily lives are the same people who are most suitable to solve those problems" (Dollinger et al., 2018, p. 214). The student perspective is valuable, and co-creation allows for the integration of that perspective.

**Participation in communities of practice.** Participatory technologies such as blogs, wikis, video, social media, and forums as examples, allow for interactions with peers, faculty, and resources (Hegarty, 2015). The model of a single teacher delivering a series of lessons is hard to break free of, yet the technologies of the 21st century allow for collaboration and creativity in community (Cochrane, Buchem, Camacho, Cronin, Gordon, & Keegan, 2013). It is in a community that ideas can be shared, feedback given, and trust established. This learning in community is consistent with a constructivist point of view that; (a) humans learn through interaction between experiences ideas (Rob & Rob, 2018); (b) places a focus on collaborative practices (Castelo, 2016); and (c) is consistent with experiential learning theory framework, which prioritizes a learner's real experience in the role of their learning (Burch et al., 2019). Research cited has demonstrated that including learners in the production of resources can be inspiring and beneficial in their education. No longer do students have to learn in solitude, and they can create and contribute in community.

The co-production of resources can aid in student learning as they learn to work and create with their peers. The co-creation of OER could facilitate life-long learning and help create a community of practice (CoP) around the subject area (Lane, McAndrew, & Santos, 2009). A CoP is a group of learners who are in the process of learning about the same topic. This conceptual model focuses on learners becoming participants in the creation of their understanding of a topic as opposed to having a teacher being the only one involved in
dispensing knowledge (Lave & Wenger, 1991). CoP is not without its criticisms and limitations. Time constraints to form an active community, working within the confines of an existing hierarchical structure, and working within existing social structures, are common issues raised (Kerno, 2008). As students create their resources, those resources become part of the CoP and part of the conversation surrounding the subject matter. Wiley and Hilton (n.d.) state:

> When student works are openly licensed, granting 5R permissions in their use of artifacts, each work becomes the beginning of an ongoing conversation in which other learners participate as they contextualize and extend the work in support of their learning. (p.136)

In this community mindset, the resource becomes less about a finished product and more about the process. Through co-creation, not only has the student added to the commons of their particular discipline, but they have become complicit in their construction of knowledge (Dollinger et al., 2018). No longer is there a dichotomy of student and instructor, it becomes a collaboration between the student, their peers and the instructors.

**Learner and teacher roles.** This shift in roles is not without its challenges. As with any collaboration, consideration must be given to expectations of roles. With students taking a more active part, they must understand all aspects of the outcomes. How must they work with their peers and their instructor? How are they to be assessed? For the process of co-creation to be a successful venture, it demands that all the stakeholders are involved in the process at each stage, which requires transparency on all levels (Pawlowski, 2012). This type of clarity lends itself to a more open and trusting learning environment. Trust is essential in that people will not share their work openly unless they feel safe to do so (Hegarty, 2015). However, it must be cautioned that it takes time to build trust (Hegarty, 2015). One of the ways in which trust can be cultivated is through a shift in how the faculty and learners see their roles.
Power and authority structures. Both the student and the instructors come to an educational experience with certain expectations as to their roles. The process of co-creation can challenge those expectations. In a traditional setting, classes are organized in a top-down hierarchy where the faculty is at the top, as the gatekeeper of knowledge, and the student sits at the bottom, waiting to receive it (Bovill et. Al., 2011; Hodgkinson-Williams & Paskevicius, 2012). In the co-creation process, the roles between faculty and students become more equitable as they work together to create resources (Dollinger et al., 2018). Coming from a position of equity and not authority, students feel more comfortable to share ideas, reach out for help, and offer support to their peers. While the student takes a more active role in the process of their education, this in no way diminishes the instructor's role. There is still a critical element that must be implemented on the teacher's behalf; just because the students are involved in the creation does not mean they are above reproach in their methods and ideas (Bovill et al., 2011). It is also essential for the instructor to identify a student's comfort level in sharing work that they have created as not all students are comfortable sharing their work openly (Masterman & Wild, 2012). While responsibilities and roles may shift in the process of co-creation, both the instructor and the students continue to both play an essential part in the journey of education.

Potential value of co-creation for vocational education. The model of co-creation has strong implications for vocational education. As students and instructors share experiences and knowledge from industry, a co-creation model can help keep the information up to date and relevant, enable practice in collaboration and create a more engaging and enjoyable environment for all involved.
Context

I have been teaching an entry level trades training (ELTT) program for the electrical trades at the British Columbia Institute of Technology (BCIT) for the past ten years. BCIT is one of British Columbia's largest post-secondary institutions with more than 48,000 students annually enrolled (BCIT, 2019a). The ELTT program is part of the School of Construction and the Environment (SOCE), which offers over 270 part-time courses and 60 full-time programs (BCIT, 2019b). Falling under the Trades and Apprenticeship portion of the SOCE, ELTT is a foundational course for those interested in a career in the electrical trades (BCIT, 2019c).

The ELTT in the electrical trades program for this study took place at a satellite campus in Surrey, British Columbia. The class takes place in two portables on the campus of a high school: one portable is used for the theory training and classroom lectures, and the second portable is set up for hands-on and practical training.

The classroom setting is a mixture of theory-based and hands-on training, focusing on giving the students foundational skills, both in theory and in practical skills, to help them acquire an apprenticeship in the electrical trades. Before the first project, there was a class discussion on group work. It was discussed that the instructor would be observing that the groups were collaborating and that the work was not left to one or two members. A session was devoted to instructing the students on using collaboratives tools such as Google Slides and Slack. There were daily check-ins to make sure that the students were on task and on track. Each unit in the course started with the distribution of the same slide deck template (using the Google Slides platform) to each group. Each slide deck would contain headings and subheadings that covered all the learning outcomes for the unit. Before beginning the project, I gave a mini lecture on the context of all the outcomes for the unit. During the first unit, Creative Commons and OER were
explained and discussed with the students. Each unit was typically between 1-2 weeks in length. There were times due to the complexity of the subject matter that timelines were lengthened. Groups were also required to create videos explaining how they arrived at conclusions or solved a problem. Initially this was done by uploading edited videos to the learning management system (LMS), Brightspace D2L. Eventually the application Flipgrid was used, as it was more intuitive and user friendly for the students.

I would check in constantly with the groups to make sure they were on track and had nothing that would prevent them from completing the assignments on time. At the end of each unit an online survey (administered through google forms) was sent to each student. These surveys would have students assess their own learning and participation as well as assess other participants in the project. All of the co-creation activities were designed in such a way that everyone had to participate and engage. There was never an option for some students to let others do all the work. This was accomplished through my interaction with the class, the design of the activities and the self and peer assessments. The classes that participated in this study had a mixture of students who were straight out of high school and some who had post-secondary experience.

Throughout my time teaching, I have become interested in involving the students with the co-creation of learning resources as I believe that by becoming part of the process of creating learning resources students might be able to create more meaningful learning experience for themselves (Bovill et al., 2011). This research study aimed to examine the students' perspective about the co-creation of OER process.
Definition of Key Terms

Many of the following terms are likely familiar to individuals involved in open education; they are included here to clarify their use within this research. These definitions have been drawn from multiple sources and are paraphrased and cited.

**Accessibility:** The use of a resource, service or framework by people of different abilities in an effective and beneficial manner (Zhang, Tlili, Nascimbeni, Burgos, Huang, Chang, Jemni, & Khribi, 2020).

**5 R permissions:** The user may retain, reuse, revise, remix, and redistribute open educational resources based on the Creative Commons license used (Wiley, n.d.).

**Co-creation:** A collaborative experience between a teacher and a student to create resources that may be used by current and future students (Dollinger & Coates, 2018).

**Creative Commons licensing:** Creative Commons is a "some rights reserved" copyright license as opposed to an "all rights reserved" license. Creative Commons allows for a more open culture ecology which allows for a remix and reuse system (Kapitzke, Dezuanni, & Iyer, 2011).

**Open Education:** A philosophy of education that purports that everyone should have access to high-quality education and that all barriers that hinder this should be removed (Farrow, 2015).

**Open Educational Resources (OER):** Educational resources that are free with permissions that utilize Creative Commons licensing and the 5 R permissions (HARSASI, 2015).

**Open Educational Practices (OEP):** A wide range of teaching practices that incorporate the use of OER and an open educational philosophy (Hegarty, 2015).

**Community of practice (CoP):** Jean Lave and Etienne Wenger (1991) first proposed the concept of a CoP in their book *Situated learning: Legitimate peripheral participation* (Lave & Wenger, 1991). A CoP is a group of learners who are in the process of learning about the same topic. This
conceptual model focuses on learners becoming participants in the creation of their understanding of a topic instead of having a teacher being the only one involved in dispensing knowledge (Lave & Wenger, 1991).

Research Questions

The primary research question that framed the study was, "What is the experience of electrical trades students as they co-create and use OER during their own vocational education?"

Sub Questions included the following:

1. What are some barriers that students may encounter when co-creating OER?
2. What strategies might be used to assess the contribution of co-creating OER resources to the student experience?
3. What does it mean to co-create and use OER as a Trades student?

Theoretical Frameworks

This research project investigated the student experience of co-creating OER within the context of an electrical trades training course. Given that the research participants were actively constructing their knowledge, this research was guided by: (a) social learning theory; (b) constructivism; (c) constructionism; and (d) experiential learning theory, which became the theoretical frameworks for this study. The following section discusses each of these in detail and their relation to the research questions.

Social learning theory. Social learning theory (SLT) acknowledges that learning and meaning making are largely influenced by interactions with others (Dron & Anderson, 2014). Albert Bandura, the originator of social learning theory model in education, theorized that people learn from observing, imitating and modeling behaviours. Bandura (1977) states, “Most human behavior is learned observationally through modeling: from observing others, one forms an idea
of how new behaviors are performed, and on later occasions this coded information serves as a
guide for action (p.22). While not strictly a constructivist or behaviorist theory, SLT combines
behavioristic principles and cognitive psychology to describe individuals' learning processes
(Smith & Berge, 2009). SLT is based on the idea that individuals learn in a social context while
interacting with others (Nabavi, 2012).

Neal Miller and John Dollard are credited with what many consider to be the first
extensive account of SLT in their book Social Learning and Imitation (Miller & Dollard, 1941).
Their work emphasized the role of imitation in the learning process (Nangle, Erdley, Adrian, &
Fales, 2010). Albert Bandura (1977) built upon Miller and Dollard's work by investigating the
role of modeling in constructing meaning and learning. By observing a model, a student's
perception and understandings about a subject will be impacted (Hill, Song, & West, 2009).
Bandura (1977) also noted the importance of practice in social contexts as the learning and
meaning can be refined through reaction and feedback from other individuals (Dron & Anderson,
2014).

In the context of this research, the co-creation occurred in social and group settings. All
groups were given exemplars of previous work from which they could base their projects. The
co-creation process was not isolated to one project, and the student's work progressed and
improved as the course continued. It is for these reasons that this theory was chosen to inform
this research.

**Constructivism.** There is general agreement in the literature that constructivism posits
that learning occurs through the construction of meaning through experiences and not entirely
the reception of knowledge (Merriam, Caffarella, & Baumgartner, 2007; Woo & Reeves, 2007;
Ruey, 2010).
The constructivist lens focuses less on the gathering of knowledge and more on how meaning is constructed from the learner's experiences (Woo & Reeves, 2007). Jean Piaget and Lev Vygotsky have been influential in the theory of constructivism, both adding a different lens from which meaning (and learning) is constructed (Woo & Reeves, 2007). Piaget's view of constructivism focuses on how individuals create meaning from their personal experiences (Pass, 2017; Ruey, 2010). Vygotsky helped develop the foundation for the theory of social constructivism, positing that a culture's language, symbols, and social and cultural systems affect how a student learns (Merriam et al., 2007). Vygotsky diverges from Piaget with his concept of the zone of proximal development (ZPD). ZPD is the difference between what a learner can do without help and what they can do with assistance. Vygotsky defines ZPD as “the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers” (p. 86). As students interact and engage with a teacher or more knowledgeable peers, they develop the skills to independently solve problems. Social constructivists would argue that students learn through participating in collaborative processes and negotiating meaning through these interactions. Not only will a student construct meaning from their own experiences, but through conversation and collaboration in their social context, a student can build a rich learning experience (Woo & Reeves, 2007).

This theory is relevant to this research because most of the learning occurred in collaborative projects. Students had to negotiate their learning and make meaning of the topic through conversations with other students, in the context of the creation of OER.

**Constructionism.** Both Constructivism and Constructionism share the premise that knowledge is not revealed to us but is reached through the construction of meaning through
experience (Castello, 2016; Rob & Rob, 2018). While constructivism focuses on the role of the individual in the creation of meaning (Ruey, 2010), constructionism concentrates on the characteristics that learning and meaning are co-constructed with others within a community working on a real-life artifact (Rob & Rob, 2018). Seymour Papert's work on constructionism was inspired by Jean Piaget's work in constructivism (Mackerell & Pratt, 2017). Constructionism continues with the added focus of a public object, collaboration, sharing, practice, and context (Laurillard et al., 2011; Mackerall & Pratt, 2017; Rob & Rob, 2018). These added elements change the learning environment's focus from one that is teacher-initiated in constructivism to an environment that is teacher-facilitated (Rob & Rob). In a constructionist framework, students do not get the instructor's direction but effectively take ownership and agency for their ideas (Rob & Rob, 2018).

Constructionism was relevant to this research in that, similar to the constructivist learning theory; it focuses on the collaborative process of learning. While the instructor had a strong presence during all activities, the role was more of a facilitator. The students themselves navigated the creation of the OER in a collaborative process.

**Experiential learning theory.** Experiential learning theory (ELT) emphasizes the meaning and learning that is created from real-world experiences. ELT is very similar to constructivism and constructionism, in that it emphasizes the significance of a learner's prior experiences (Zhai, Gu, Liu, Liang, & Tsai, 2017). ELT places emphasis on the participant's active involvement in the learning process and the process by which they can construct meaning and learn from the experience (Burch et al., 2019). The foundations for ELT were influenced by Kurt Lewin (1948), who observed that individuals were greatly influenced in their decision making by prior group discussion. Lewin noted that experiential learning had four steps; concrete
experience, observation and reflection, the formation of abstract concepts, and finally, the testing of the new ideas (Dunn & Chaput de Saintonge, 1997). David Kolb built upon Lewin's work and developed ELT as a learning theory. Kolb (1984) asserts that the learning cycle involves four stages: concrete learning, reflective observation, abstract conceptualization and active experimentation (Kayes, Kayes, & Kolb, 2005; Zhai et al., 2017).

ELT was deemed relevant to this research as discussions guided the group projects, reflection and observation were a necessary part of the creation of the OER, and the sharing of their resources allowed them to iterate and improve the artifact.

**Theoretical Framework Relationship to Co-creation**

SLT, constructivism, constructionism, and ELT consider that in the co-creation process, students will have more of a say in how and what they are learning (Bovill, Cook-Sather, & Felton, 2011; Dollinger et al., 2018). All four theories have as a common underpinning that students need to construct their learning through experiences with the course material, instructors, and other students, as they work collaboratively to create together. As a result, the student is not a passive participant. Rather the student's role becomes much more active as they change roles from observer to one of active participation, understanding not only what they are learning but why they are learning (Bovill et al., 2011). Given that this research study focused on the co-creation of OER and the student's experience in the process, the intersection of SLT, constructivism, constructionism, and ELT form the theoretical framework that underpins this research.

**Limitations**

This research study was bounded by a series of limitations, including: (a) objectivity (b) time; (c) generalizability; (d) level of digital literacy, and (e) sample size and (f) gender
distribution. These are discussed below, and the implications of these limitations and delimitations on the study are identified.

**Objectivity.** The researcher was the instructor of the course. It is not possible to remove the subjective aspects that the researcher had with the participants. This made objectivity between the researcher, participants and materials a challenge. This limitation was mitigated through the use of a third party for data collection. The researcher had no knowledge of who the participants were and how they responded to the questionnaire and the interview questions.

**Time.** Time constraints were the most notable limitation of this research study. This study was conducted over a relatively short time frame due to the schedule of both BCIT's ELTT program (6 months) as well as the Royal Roads University masters' program (10 months). Interviews were conducted and analyzed over a period of only a few months. This short time frame resulted in an expedited interview process as well as limited time for data analysis. The research was limited to a review of the student experience. There was not enough time to gather and analyze quantitative data that may have been useful, such as the effects of co-creation on a student's grades.

**Generalization.** Due to the context (vocational education) in which the study was conducted, it may not be indicative or generalizable to other student experiences. This research study was conducted in an electrical ELTT program. All the students were assumed to have some interest in the electrical trade, and therefore this study may not be indicative of all disciplines of vocational training. While it was possible to ask general questions throughout the interviews and questionnaires, it was impossible to remove the bias of the discipline of electrical training.

**Level of digital literacy.** Because of the nature of the OER created, the students required some form of digital literacy to research, build, and curate the resources. Most of the OER that
was co-created with the students was digital (Slide decks, videos, interactive question banks).
Many educators have found that "students lack digital literacy skills, such as having difficulty
determining what information is needed, and how to locate and evaluate information" (Al-Qallaf
& Al-Mutairi, 2016, p. 537). Digital literacy is not a topic typically covered in a vocational
education program. As a result, while some time was able to be spent integrating lessons on
digital literacy, it was brief. This did not allow for any depth of discussion on the role of OER or
Creative Commons licensing. While the students were made aware of both at the beginning of
the course, there was not enough time to deconstruct the importance of OER and Creative
Commons licensing in the context of what the students were co-creating.

Sample size. The sample size was limited by the total allowable annual enrollment of the
ELTT electrical training program (16 students). As this study drew research from two different
cohorts, the number of possible participants was 31 (one student withdrew from the course early
on in the semester).

Gender distribution. The classes themselves were predominantly male and, therefore,
not representative of the actual demographics of gender in trades apprenticeships. According to
the Canadian national apprenticeship survey (2015), women comprise about 14% of apprentices.
In this research, there was one female who would account for 3.23% of the participants.

Delimitations

In the process of the study, the students were graded on the artifacts that they created.
Student grades were not addressed in this study. The study itself focused on the student
experience in co-creating OER and was qualitative. While there may be value in gathering the
quantitative data regarding student's marks, this will be left to a future study. Time limitations
and scope were the two main reasons for the exclusion of student marks.
Summary

Involving students in the construction of their knowledge and materials seemed like a natural fit for trades students learning to construct, maintain, and troubleshoot. Examining the perspectives of trades students as they are involved in OER’s creation in their Trades education is a much-needed area of research. OER is something that is relatively new in education and is a very new concept in vocational education. As we are in the early years of OER, there is much more that needs to be addressed and studied (Weller, De los Arcos, Pitt, & McAndrew, 2015). The use of OER and its pedagogical impact requires more research, and its use in Trades education could offer a valuable perspective. Wiley and Hilton (2018), make a compelling argument, "We need to spend time in these early years of researching OER-enabled pedagogy specifically investigating the value students, and faculty find in doing this work, how motivating or engaging they find it, and how it can be improved" (p.144). As open education continues to grow and expand, trades education and its students could find value in adopting the tools that OER use affords. As curriculum in vocational education struggles to keep up with the quickly changing aspects of the trades, OER can help the curriculum stay current. Collaborating with fellow students, creating resources that can contribute to the discipline, having the ability to revise documents and resources as the industry changes; these would offer much-needed help in a vocational educational context. In addition, trades could provide a distinct voice to the conversation of OER and Open educational practices.

Chapter 2: Literature review

The following chapter reviews the literature discussing, (a) the use of OER; (b) open educational practices; (c) faculty use and perceptions of OER; (d) student use and perceptions of OER; (e) challenges in the use of OER; (f) OER as an agent of change. This research project has
focused on the use and creation of OER in a co-creation model with electrical trades students. While there is an abundance of literature on the benefits and challenges of group work, collaborative learning and communities of practice, the literature reviewed focuses on both the educators and the students’ experiences through the lens of the use and co-creation of OER.

The Use of OER

Open education is a concept that can be traced back to the 1960s and 1970s. The idea of student-directed learning was discussed by Paquette in his article (1979) "Quelques fondements d'une pédagogie ouverte" translated as "Some foundations of an Open Pedagogy". In this article, Paquette discussed concepts such as teacher-student collaborations, the individuality of students learning needs, and engaging learning environments. The open education movement was seen as a response to the criticisms of the time that schools were crushing student's creativity (Morgan, 2016). While the Open Education movement has started to gather momentum since then, the use of OER is a relatively new practice in education. The term open educational resources (OER) was first adopted at a United Nations Educational, Scientific, and Cultural Organization forum in 2002 (Murphy, 2013). While there is no universally accepted definition of OER, many other definitions have emerged since 2002 (Armellini & Nie, 2013; Murphy 2013). For this study the UNESCO (2020) definition was adopted, whereby OER are defined as "teaching, learning and research materials in any medium – digital or otherwise – that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation and redistribution by others with no or limited restrictions" (para. 1).

Traditional education resources can be rigid and static, often taking years between revisions. OER use helps address these issues with an ability to change and revise not afforded to commercial textbooks. One of OER's more compelling attributes is its ability to be customized
for specific contexts (Masterman & Wild, 2011). Conventional resources, such as textbooks, are designed and released as finished products, whereas OER is designed for innovations past their release date (Lane, 2010). This agility allows for quick and agile revisions of resources for content and contextual situations. Under Creative Commons licensing, the resource may be reused, remixed, revised, and redistributed to fit the context for which the user needs (Lane, 2010; Lane & McAndrew, 2010). This permission to change the resources to fit the context and revise content gives OER an advantage over commercial textbooks. As opposed to standard teaching and learning resources, OER utilizes a mixture of content, communication technologies, digital literacy and innovations to help faculty and students in the contexts in which they find themselves (Dieman & Farrow, 2013). Whether through the replacement of textbooks with OER or moving into more of an open educational practice (OEP), OER has the potential to impact education (Masterman & Wild, 2011; Lane & McAndrew, 2010; Pitt, 2015). This impact can be both pedagogical and financial.

The two most common reasons cited for OER use are cost savings for students and access to learning resources (Karunanayaka, Naidu, Rajendra, & Ratnayake, 2015; Jhangiani et al., 2016; Petrides, Jimes, Middleton-Detzner, Walling, & Weiss, 2011). While the cost savings and access of OER attract students, faculty are more drawn to the ease of use, quality of the resources, and a number of resources available when determining adoption (Belikov & Bodily, 2016; Petrides et al., 2011). As more faculty find and use OER, it is becoming more of an option for higher education (Pitt, 2015). A study examining the adoption and use patterns of both faculty and students through a community college open textbook project found that much of OER is in the information and communication technologies (ICT) realm and requires some form of digital literacy when accessing or creating it (Petrides et al., 2011). Digital literacy is defined as
"confident and critical use of ICT for work, leisure and communication" (European Commission, quoted in Hall, Nix and Baker, 2013). It is suggested that the use of ICT and OER have the ability to shift the focus of educational institutions where "traditionally, schools are information consumers rather than producers" (Nixon, 2003, p. 269), the use of technology and OER can allow schools (and students) to become producers and consumers of content. This shift from consumption to creation has the potential to change the way educators see their practice.

**Open Educational Practices**

Educators are starting to see OER as a gateway to changing their educational practice and opening new approaches to teaching and learning (Almellini & Nie, 2013; Ehlers, 2011; Karunanayaka et al., 2015; Pawlowski, 2012). Educators are finding that OER use and reuse are opening up new approaches to teaching and learning. With open licenses that allow for adaptation and revision, educators no longer need to be the sole provider of curating and producing resources. Students themselves can become part of the production process with their peers (Masterman, 2016). OEP is emerging as the next step in the OER movement (Ehlers, 2011; Karunanayaka, Naidu, Rajendra, & Ratnayake, 2015; Murphy, 2013).

There has been a shift in focus from adopting or using OER for its cost-savings benefits to one that focused on the open educational practices that can be fostered when using OER (Ehlers, 2011). Much like OER, there is no one standard definition of OEP. Cronin (2017) defines OEP as “collaborative practices that include the creation, use, and reuse of OER, as well as pedagogical practices employing participatory technologies and social networks for interaction, peer learning, knowledge creation, and empowerment of learners” (p. 18). When investigating the connections between OER use and OEP it was found that OEP is a set of activities that center around "the creation, use and repurposing of Open Educational Resources
(OERs)” (Ehlers, 2010, p. 2). These activities and resources are not only to be created and curated by instructors, but students are also encouraged to be involved in the process and become co-creators in their learning (Hegarty, 2015; Murphy, 2013).

As students are brought into an open pedagogical model, there is a shift in the traditional roles between students and teachers. Traditionally, teachers would be seen as a source of knowledge, while the students are the receptacles (Bovill, Cook-Sather, & Felton, 2011). In an OEP model, the role of a teacher becomes one of a facilitator or mentor, guiding students in developing their meaning (Masterman, 2016). This change in relationship fits with the values of constructivism, constructionism and ELT. As knowledge is co-created through collaboration and interaction with a real-world artifact, students start to create their meaning and learning throughout the process (Ehlers, 2011; Geser, 2012; Hegarty, 2015; Masterman, 2016). This shift in paradigm is not without its detractors.

While some educators embrace an open pedagogical approach to their practice, some take issue with OEP. Arguments such as low acceptance, instructors' autonomy over the materials, and lack of trust in OER are common issues raised (Dollinger et al., 2018; Ehlers, 2011; Masterman, 2016). Students also have concerns regarding OEP. A qualitative study on the impact of OER use of lecturers and their students in the UK found that while some may find value in co-creating OER, not all feel comfortable sharing their work publicly under an open license (Masterman & Wild, 2011). Technical proficiency is also identified as a barrier for both teachers and students. Those who lack the skills in utilizing the tools available with participatory technologies are less inclined to embrace the advantages that OER and OEP have to offer (Pawlowski, 2012; Wild, 2012).
As with any new practice or movement, there will be some who fully embrace, some who are more cautious, and some who disagree entirely. OEP is starting to appear in the educational system and should not be dismissed but should continue to be investigated as the practice evolves. The ability to be able to address quick revisions for content and context and engaging students by involving them in the creation of resources has the potential to make a significant impact. For many faculty, the awareness of the existence of OER is often the first step towards a more open educational practice.

**Faculty Use and Perceptions of OER**

The range of use of OER makes it an attractive alternative for faculty. Faculty are finding that OER use saves them effort in having to find and/or create resources for their classes (Masterman & Wild, 2011). Faculty may be introduced to OER's concepts through a simple Internet search for ancillary resources (Pitt, 2015). As they become familiar with OER's capabilities, adding or removing the content as each sees fit is attractive for many (Vojtech & Grissett, 2017). Additionally, faculty may be drawn to the networking and collaborative nature of the tools and resources themselves (Masterman & Wild, 2011). Lane and McAndrew (2010), in a study investigating the networking effects of OER through the open university’s open learn initiative, state that OER allows "teachers to have the opportunity to play and experiment without needing significant support or having to seek prior permission" (p.5). Faculty's uses and impacts ranged from merely swapping out a standard textbook for an OER to a complete shift in pedagogical practice (Pitt, 2015). Faculty's comfort levels with technology often determine how they use OER. Those with a low level of comfort with technology may use the OER like a standard textbook. Those with a higher level of comfort with technology would make use of the interactive elements available with OER (Petrides et al., 2011). Whether it is using the OER as
ancillary resources or embracing a complete change in pedagogy, OER use can be used as an agent of change in a faculty's practice. Faculty are not the only stakeholders affected in the use of OER; students' experiences are also being affected by OER's use.

**Student Use and Perceptions of OER**

In a discussion of the Open University platform OpenLearn it was found that while faculty are more interested in OER's capabilities, students are more concerned with the content available and how it is presented (Lane, 2010). While cost-savings are an essential factor in determining OER's impact on a student, other attributes of note were accessibility and portability (Petrides et al., 2011).

As tuition costs and textbook prices continue to rise, the affordability of education grows as an issue for many students. OER has the advantage of providing resources that are low cost or free. The prohibitive nature of these rising costs makes OER an attractive option for many students (Weller, de los Arcos, Farrow, Pitt, & McAndrew, 2015). While cost savings may be the initial draw to the use of OER for many students, it is not the only attraction (Petrides, Jimes, Middleton-Detzner, Walling, & Weiss, 2011; Pitt, 2015; Weller, de los Arcos, Farrow, Pitt, & McAndrew, 2015).

Students appreciate the interactive elements available with the digital context of OER (Bliss, Robinson, Hilton, & Wiley, 2013). Having access at all times on their mobile devices made it easier for students to access the material as well as the format (Petrides, Jimes, Middleton-Detzner, Walling, & Weiss, 2011). Access to interactive elements such as test banks and particularly videos is appealing to students (HARSAI, 2015; Bliss et al., 2013).

At the very least, students are finding that OER use is of equal value to standard textbooks (Hilton, 2016; Jhangiani et al., 2016; Coleman-Prisco, 2017. There are very few
instances where students or faculty cited that the OER was below the quality of traditionally copyrighted material (Jung, Bauer, & Heaps, 2017). It is of interest to note that students perceive faculty that choose to use OER are more "kind, encouraging, and creative than faculty members using a traditional copyrighted textbook" (Vojtech & Grisset, 2017, p. 166). Even with the positive perceptions allocated to OER, there are other considerations that must be accounted for.

**Challenges in the Use of OER**

It must be acknowledged that the use of OER is not without its challenges. A review of the literature has revealed challenges such as: (a) finding and identifying OER; (b) motivation to use OER; and (c) digital literacy are issues facing those involved in the use of OER. As faculty look for resources for their courses, unfamiliarity with OER's characteristics presents itself as an issue.

One of the challenges facing OER adoption by faculty is how difficult it is for faculty to identify what sets it apart from other resources (Weller, De los Arcos, Farrow, Pitt, & McAndrew, 2015). One study, investigating the use of open pedagogical practices and the existing teaching and learning model at a research-intensive university, found that some faculty cannot identify what constitutes the characteristics that set OER apart from other "free" online resources (Masterman, 2016). In a study that investigated educator's perspectives on the impact of OpenStax college open textbooks, almost three-quarters of educators surveyed had not heard of OER. Those educators that had heard of OER were still unclear on how they could be used (Pitt, 2015). This unfamiliarity is not the case with all faculty as some institutes mandate the use of OER, which can bring with it additional challenges.
If OER's use is lead from a top-down initiative, where OER is mandated for use by management, the initiative often can lead to push-back, such as refusal to use OER from the faculty (Wild, 2012). This push back can be for many reasons; low acceptance, the autonomy of instructors over their materials and resources, and lack of trust in the OER (Ehlers, 2012; Pawlowski, 2012). The concern of the lack of quality in OER can also manifest in the form of the "not invented here" syndrome, where faculty do not trust anything that is not created or vetted by their institutions (Pawlowski, 2012). Even when an institute can provide support and evidence for OER's use by faculty, there are still some who take issue with OER use.

Wild (2012) and Masterman & Wild (2011) found that if faculty are not proficient in the use of technology, there is less of a chance that they will use the OER beyond a mere replacement for conventional textbooks.

More current research has shown that technical proficiency and digital literacy are being addressed. Some organizations are putting policies in place to ensure that educators have some level of digital skillsets (Borthwick & Hansen, 2017). Along with technical proficiency, an understanding of copyright and how to use Creative Commons licenses remain relatively unknown when institutions look at OER adoption (Wild, 2012; Weller et al., 2015, Masterman & Wild 2011).

Even with the challenges mentioned above, there are faculty who are embracing the use and adoption of OER. For example, BCcampus, an organization that is funded by the British Columbia Ministry of Advanced Education, Skills and Training, has a mandate to help fund the creation and use of OER in the trades across the province of British Columbia. Initiatives such as these are helping faculty embrace a shift in pedagogy. Some faculty have found that as their
understanding of OER has grown, they see it as a tool that can also benefit their teaching practices and their student's experience (Wild, 2012).

**OER as an Agent of Change**

As faculty and students start to engage with and use the available resources in open education, engagement, trust in its capabilities will grow (Pawlowski, 2012). In a discussion on the design of a course on OER utilizing Open Educational Practices, the authors found that to fully understand the features of OER often requires a mindset shift as the dynamic and customizable nature of OER is unfamiliar to many educators (Karunanayaka, Naidu, Rajendra, & Ratnayake, 2015). Once introduced to the concepts of open education, teachers collaborate and share their resources, and through the sharing of the resources, more are introduced to the tools and their benefits (Masterman & Wild, 2011).

As some faculty engage with, create, share, and reflect, they find that they are moving towards a model of open pedagogy (Wild, 2012; Hilton & Wiley, 2018). A study conducted at the University of Cape Town (Hodgkinson-Williams & Paskevicius, 2012) found that bringing students into an open pedagogical model brought a shift in power. There is minimal power-sharing between faculty and students by granting the use of material. There is maximum power-sharing in "the collaborative OER development among academics, students, and self-learners to a complete power shift in user-generated content" (p. 254). This shift in power can help facilitate a mindset of lifelong learning in students. As the students begin to create and engage with the resources, they can make a connection with the content. Weller (2013) defines open pedagogy as one that "makes use of...abundant, open content (such as open educational resources, videos, podcasts), but also emphasizes the network and the learner's connection within this" (p. 9). In a study on the interactions of postgraduate students in helping co-create OER through the lens of
activity theory the authors found that with OEP, education is no longer concerned with knowledge transmission, but the goal becomes to create life-long learners (Hodgkinson-Williams & Paskevicius, 2012). There is potential in OER and OEP to help as an agent of change in education. However, there must be other resources provided to work in concert and provide support for OER and OEP.

OER and OEP's use on their own is insufficient to provide transformation and meaning to learning in education; there must be tools, practices, and communities that surround them to help them create meaning (Lane, McAndrew, & Santos, 2009). Through collaboration with the community (both faculty and learners), these OER can grow and evolve (Bovill et al., 2011).

Wenger (2006) defines a community of practice as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly". The very nature of co-creation and co-production aims at increasing community and engagement by involving stakeholders in the creation process (Pawlowski, 2012). Collective learning takes place through the interactions between stakeholders (Cousin & Deepwell, 2005), and this makes the use of OER and OEP a good fit with a CoP (Lane, McAndrew, & Santos, 2009).

The traditional curriculum and resources design may be seen as more insular, created behind a wall by experts. OER and OEP allow for a community. Resources can be adapted, reused, and remixed, all the while being shared with the community commons (Lane & McAndrew, 2010). Through this collaboration, stakeholders are not only sharing their knowledge; they are creating something new and contributing to help reify previous knowledge (Tasato and Bodi, n.d.).
Literature Review Summary

Upon review of the literature, this research sought to add the context of vocational education to the growing library of literature on the impact of OER through the lens of the student experience. Through a review of the literature available, there is evidence of a gap in the use of OER, OEP, and co-creation of OER in the area of vocational education. In the papers cited in this literature review, only one made any mention of vocational education (Murphy, 2013). This research focuses beyond the impact measures that include cost savings benefits, access, and portability of OER and investigated the student experience in the co-creation of OER.

Chapter 3: Methodology

The use of open educational resources is a relatively new innovation in education, and therefore OER requires some additional study on its impact on students (Weller et al., 2015). This study attempts to add the perspective of trades education to the discussion of the impact of OER on students. The study used a mixed methods approach to the research. Mixed methods research is used when there is a combination of numerical and narrative data to analyze and the researcher aims to "provide improved depth and strength to a study" (Aaron, 2011, p. 274) and is the approach taken for this exploratory case study research.

Kin (2013) describes a case study as "an in-depth inquiry into a specific and complex phenomenon (the 'case'), set within its real-world context" (p. 321). The main research question investigated the experience of electrical trades students as they co-created OER during their own vocational education. This research meets the parameters of an exploratory case study, as defined above. As this research took place while the students were taking their training, it was impossible to separate the experiences of creating OER (the phenomenon) from the classroom context and all that entails. Utilizing the case study approach allowed the investigation "to gain a richness of
detail, to focus on concrete events, and to cover such events as they occur in the field" (Yin, 1992, p. 353). To fully appreciate the student experience, the context is as important as the phenomenon.

The methodology of the case study was appropriate, given the theoretical frameworks of social learning theory, constructivism, constructionism, and ELT, as these recognize that the students' experiences are subjective. The students created artifacts as they worked on the OER, along with creating meaning in their learning. This interplay of both subject and object was examined through the lens of constructivism and the methodology of a case study.

**Methods**

This research study involved two separate cohorts. The first cohort ran in 2018/2019 with 16 students and the second cohort ran in 2019/2020 with 15 students. Throughout the study, attention was given to barriers students encountered while co-creating OER, how self and peer assessment contributed to the experience and strategies that were used to assess the contribution of co-creation.

The artifacts created during the course were online textbooks created by the students using the google slides platform. For a detailed description of the course, refer to the context section of this study. Students were educated on Creative Commons licenses at the beginning of the course and shown where to find OER for their research. When the projects were complete, students were asked if they were comfortable sharing their resources under a Creative Commons CC-BY license. The students also created explainer videos using the Flipgrid platform. These videos contained student explanations of topics and provided detailed walkthroughs on how they would solve the problems. The videos were shared openly with the class through the Flipgrid
platform. Students were made aware that it was possible to upload these videos to YouTube and share them with a Creative Commons license instead of the standard YouTube license.

Multiple data collection methods were required in this research to ensure its validity. As Hartley (1994) notes:

Many case study researchers, in their pursuit of the delicate and intricate interactions and processes occurring within organizations, will use a combination of methods, partly because complex phenomena may be best approached through several methods, deliberately to triangulate and, thereby, improve validity. (p. 324)

The most commonly used data sources in case study research are personal observation, documentation, and interviews (Yin, 2003; Merriam, 2009). The data collection instruments used in this study included: (a) questionnaires; (b) focus interviews; (c) note taking and observations; and (d) artifacts. Each will be discussed in detail below.

**Questionnaires.** Questionnaires are an important tool that allows educators to listen to and engage in dialogue with students to help understand and influence their motivation for learning (Rowely, 2003). Given that this research focused on the experience of electrical trades students in the co-creation of OER, it was beneficial to gather some quantitative data regarding that experience. For this study's purpose, a third party provided the cohorts with access to a nineteen-question questionnaire (Appendix D). The use of a third party was necessary as the researcher was also the instructor and held a perceived position of power over the participants. All questionnaires were administered online through a secure connection with an assurance of confidentiality and anonymity. Each questionnaire contained a consent form. All participants had an electronic code number assigned to them to disconnect their identity from their data. Data collection was held online until the analysis is complete. The questionnaires were administered
with a 5-point Likert scale with the five points being: (1) Strongly agree; (2) Agree; (3) Neutral; (4) Disagree; (5) Strongly disagree. Upon completion of the study, data will be stored for five years and then will be destroyed. As per research ethics granted by RRU and BCIT, all participants in the study were made aware that they were able to withdraw at any time, and their data will be destroyed.

Using Chenail's (2011) "Interview the investigator" method, a colleague took on the researcher's role while the researcher assumed the role of the student. This process helped review the questions for the questionnaires and interviews. Throughout the process, changes were suggested, and the original list of questions was modified, "as modifications are suggested, or existing questions are confirmed, the original list of questions should be edited and annotated" (Chenail, 2011, p. 259). An invitation to participate in the research was sent to 31 potential participants. 19 consented to participate and with that 18 completed the full questionnaire.

**Focus interviews.** The key to this study was to obtain the student's perceptions of the co-creation of OER. Therefore, it was essential to interview individual students. Nine participants consented to be interviewed as part of this research. A third party conducted one interview (Appendix D) with each research participant during the course over the Zoom platform. The interviews allowed the students to give a voice to their journey in this learning process and give legitimacy to their experience (Stringer, 1999). The interviews were designed using open-ended questions and digitally recorded for transcription purposes.

**Note-taking and observations.** Note-taking and observations are a common method of conducting qualitative research. Yin (2009) states, "making direct observations in the field, if nothing else, the opportunity to make such observations is one of the most distinctive features in doing case studies" (p. 9). Qualitative research allows for a reflexive process whereby the
researcher becomes aware of our contributions to the creation of meaning and experiences (Palaganas, Sanchez, Molintas, & Caricativo, 2017). As the instructor of the course, as well as a researcher for the study, I was aware that there were subjective aspects of my relationship with the students and the materials that made objectivity a challenge. However, good qualitative research embraces the subjective relationship and understands that it is an integral part of the research process (Meyers, 2001). A journal was kept by the researcher throughout the course with daily notes and observations to track thoughts and observations of the process. However, due to the time available for this research study, the data collected was considered out of the scope of this study and may be used for future research.

**Artifacts.** Throughout the class, the students participated in activities such as; building slide decks, recording videos, and creating assessments. The objects created in these activities were by no means passive, they were as much a part of the learning process as any lecture they may receive from instructors (Marz, Kelchermans, Vermeir, 2017). Throughout the creation process, there was an interaction that occurs between the students and the resources they are creating. In the creation of the artifact, the meaning was created for the student, which adds value to the object itself (Ogawa, Crain, Loomis, & Ball, 2008). However, due to the time available for this research study, the data collected was considered out of the scope of this study and may be used for future research.

**Data Analysis**

31 participants representing two different cohorts were invited to participate in this research study. Quantitative data were collected using a questionnaire (n=18) and qualitative data was collected using an interview (n=9) by a third party. Thematic analysis (TA) was used to analyze the data collected. The data was collected using Google Sheets. TA is the process of
identifying themes from the qualitative data collected (Alhojailan, 2012; Braun & Clark, 2006; Maquire & Delahunt, 2017). TA does not merely supply a summary of the data content but identifies and interprets it through a "rigorous and high-quality analysis" (Clarke, & Braun, 2017, p. 297). There are some noted benefits to using TA. For those who are still early in their research career, as the researcher, TA offers a more user-friendly form of analysis (Braun, 2006; Nowell, Norris, White, & Moules, 2017). TA is noted for its flexibility in that it can be used across various methodologies to analyze small or large samples (Clark & Braun, 2017; Maguire & Delahunt, 2017; Nowell et al., 2017). This flexibility can also be a disadvantage as it could lead to inconsistency when developing themes taken from the data (Holloway & Todres, 2003). The mitigation of inconsistency was achieved through the study's scope that addressed the experience of the participants in co-creation. As the research question was broad and was investigating all good and bad experiences, inconsistency would not be an issue.

The data collected from the questionnaires, note-taking, interview transcriptions and artifacts was archived as, "archiving all records of the raw data provides an audit trail and a benchmark against which later data analysis and interpretations can be tested for accuracy" (Nowell et al., 2017, p. 5). Following this, a six-step process provided by Braun and Clarke (2006) was utilized as a framework for the analysis. These steps included:

1. Become familiar with the data. The researcher must become familiar with the entire body of data before continuing the next steps in the process (Maguire & Delahunt, 2017). It is here that an initial list of ideas about what is in the data and what is of interest was generated (Braun & Clarke, 2006).

2. Generate initial codes. This phase involved the initial coding of specific data characteristics that the researcher finds interesting (Nowell et al., 2017).
3. Data began to be organized into meaningful groups (Braun & Clarke, 2006).

4. Search for themes. Through the generation of codes, patterns of interest or significance (themes) were identified (Maguire & Delahunt, 2017).

5. Themes were sorted, grouped and collated (Braun & Clarke, 2006).

6. Review themes. Once the initial set of themes had been identified, it was then necessary to refine them (Braun & Clarke, 2006). At the end of this phase, the researcher should understand the structure, arc, and story that the data is telling (Nowell et al., 2017).

7. Define themes. Each theme was then be identified and explained in detail (Nowell et al., 2017). This phase aims to explain what each theme is saying (Maguire & Delahunt, 2017).

8. Write-up. After themes have been identified and analyzed, a written report of the findings explains the findings (Braun & Clarke, 2006). The final write-up should tell the "overall story about what the different themes reveal about the topic" (Braun & Clarke, 2017, p. 11).

TA is not without its disadvantages, though most of them have more to do with poorly conducted research questions and poorly conducted analyses (Braun & Clark, 2006). Qualitative research is a growing field, and with it, analytical frameworks such as TA will continue to grow and be refined (Braun & Clarke, 2006; Newell et al., 2017).

TA was used for both the questionnaire and the interview data using the six-step process outlined above. Both the questionnaire and the interview data provided different themes which will be discussed in greater detail in the findings chapter.
Bias

As an instructor of the ELTT program in which the study was conducted, I acknowledge that I bring biases to the study. This section will discuss those biases and how they were addressed. As an advocate of OER, I carry the perception that students will benefit from its use. With a keen interest in open education and co-creation, one of my goals in this study was to determine if my perceptions of OER's use and co-creation are accurate. This was done by examining the experiences and perceptions of the students in the process of the co-creation of OER.

Intentional reflection played a role in acknowledging and addressing biases. Understanding that I will have biases in my practice and studies will help me to challenge and accept the differences that may arise during the process. Marcos, Sanchez, & Tillema (2011) state, "Reflection is rooted in the understanding that teachers recognize teaching as a process that lies open to scrutiny and deliberation, which permits a change in existing practices" (p. 21). Reflection is not a single exercise; it must occur before the study, during the study, and after the study to keep the process dynamic and help keep issues top of mind and biases recognized (Reagan, Case, Case, & Freiberg, 1993). Throughout the projects, I kept a journal where I recorded observations and reflections on the students and my experiences in the process. This journal was vital during data analysis to understand the thoughts and reflections that occurred during the process.

Variables such as how I communicated, teaching style, and perceived position of power also had an impact on the students' perception of the learning environment (Chory & McCroskey, 1999). As there were a rapport and affinity with students, there was a concern that as the researcher, the students may have felt influenced by my position as their instructor.
Care was given to the sample selection as there ran the danger of severe and systematic errors in the study (Collier & Mahoney, 1996). The population size of the class was relatively small (31 students), so all students were invited to participate in the research study to avoid bias. Additionally, all students received an invitation to participate through a third party who coded each student with a number to allow for anonymity in the questionnaires.

This research study adhered to the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS, 2014) three core principles: Respect for Persons, Concern for Welfare and Justice (p. 6). These core principles were addressed as follows:

*Respect for persons:* All willing participants were asked to sign a consent form that they were willing to participate in the research study. Throughout the study, participants were reminded that they could withdraw at any point without penalty.

*Concern for Welfare:* Participants were made aware that privacy and confidentiality are of utmost importance. Participants were made aware of the coding process, so they were aware of how their privacy is being respected.

*Justice:* The TCPS (2014) defines justice as "the obligation to treat people fairly and equitably. Fairness entails treating all people with equal respect and concern" (p.8). It was made clear to all the students in the course that participation in the study did not affect their final grades. Throughout the study, all students were reminded that no preference was shown to study participants in the course.

This study was reviewed and approved by both BCIT and Royal Roads University ethical review boards. The Associate Dean of the SOCE and the chief instructor of the electrical training center were made aware of the study as any concerns that students may have with my instruction
or influence in the study will be directed towards them. It was made clear to the participants that participation was voluntary and that they could withdraw at any time.

**Chapter Four: Research Findings**

Invitations were sent to 31 students to participate in this study investigating the experience of electrical trades students in the co-creation of OER. Mixed methods research was used to collect the data. The data was analyzed using thematic analysis. The research findings are presented below, starting with quantitative results and followed by qualitative results.

**Questionnaire**

The following results from the survey have been grouped into themes and may not follow the numerical order in which they appeared in the questionnaire. For a graphical and detailed representation of the questionnaire, see appendix G. The themes identified in the quantitative data include: (a) learning outcomes; (b) student experience; (c) self and peer assessment; (d) textbook context; (e) technology; (f) future skills; and (g) overall experience. Descriptions of the findings of these themes follow.

**Learning outcomes.** Of the 18 questions asked in the questionnaire, three of them linked to learning outcomes. When asked if the learning outcomes were clearly laid out for them, all of them responded positively. Once learning outcomes had been established and understood, it was then necessary that the projects provided a pathway to achieving those outcomes. Sixteen of the participants either strongly agreed or agreed that the experience of co-creation enabled them to achieve the course's learning outcomes. One student responded with a neutral response.

All projects were bound by timelines and had to be completed by specific dates. These timelines were dependent on the content of the course and would vary from unit to unit. Fifteen
of the participants strongly agreed or agreed that the schedules were sufficient to complete all the learning activities in the class. Three students gave a neutral response.

These results support that students feel that OER's co-creation helped them succeed in working towards the courses' learning outcomes. As the students worked towards accomplishing the learning outcomes, the student experience was integral to the process.

**Student experience.** The student experience with the co-creation of OER was addressed with three questions from the questionnaire. All of the projects in the electrical vocational education course involved some sort of collaboration with peers. The instructor played the role of a facilitator and encouraged them to work with each other to learn the subject matter. Fifteen students strongly agreed or agreed that co-creation created opportunities to learn from their peers. Three students gave a neutral response.

Co-creation was a new model of education for many of the students, and seventeen of the participants strongly agreed or agreed that the co-creation activities helped them learn effectively while one student gave a neutral response. Once the projects were complete and the learning outcomes met, all of the participants strongly agreed or agreed that the learning activities that involved co-creation extended their knowledge of the topics they were tasked to learn. Once the projects were complete, they were assessed by themselves and their peers.

**Self and peer assessment.** Self and peer assessment were used to gauge the students' level of understanding of a topic and to teach students the value of constructive criticism among their peers. Two questions from the questionnaire were aimed to gather data regarding their perception of peer assessment activities.

At the end of each unit, each student was required to complete an online survey. These surveys would have students assess their learning and participation as well as the other
participants in the project. Seventeen of the participants strongly agreed or agreed that the peer assessment activities surrounding the co-creation of resources helped them learn effectively.

All students were made aware that the unit would include a self and peer assessment. There were many discussions about the value of assessment in learning and the role of constructive criticism with peers. Seventeen participants strongly agreed or agreed that the learning activities that involved co-creation prepared them for the peer assessment activities. One participant gave a neutral response. Based on the data it would appear that students do find value in being involved in the process of assessment and evaluation.

**Textbook context.** As shown previously, most of the participant's responses were positive concerning the activity of co-creation. As will be shown below, regarding the context of commercial textbooks, the experiences of the participants diverge, and the responses vary.

The participant's experience with commercial textbooks was varied. Some students had come straight from high school, and others had post-secondary experiences from university. These experiences possibly account for the mixed responses to the statement of preferring the use of standard textbooks over creating their resources shown in figure 4.1.
As stated above, the experience of the students with traditional textbooks was varied. As will be discussed in the qualitative results, those who had experience from post-secondary had strong feelings concerning the mandated use of commercial textbooks and their costs. A trades student will pay up to $2000 for their textbooks over the course of their training. Those who decide to pursue a career in the trades may see the cost of textbooks as a requirement and would not see that as a detractor from pursuing a trades education. While most of the participants felt that textbook costs were important to them when considering future studies, as shown in Figure 4.2, two participants disagreed or strongly disagreed that textbook costs were important to them.
The resources and exercises required more engagement with the material than merely just reading out of a textbook and answering questions at the end of a chapter. Students were required to complete a slide deck, build assessments, create videos, and present findings. All these activities were performed in the context of co-creation. While most of the participants embraced the interactive nature of these resources and exercises, Figure 4.3 shows one participant did not agree that the activities that involved co-creation were more beneficial than the use of standard textbooks.
Figure 4.3

Questionnaire question #12

The learning activities that involved co-creation were more beneficial than using a standard textbook.

Technology. Three questions from the questionnaire addressed the student’s comfort with technology in the co-creation of learning resources. As outlined in Figure 4.4, not all students were comfortable using technology in the co-creation of OER. While many of the students were comfortable with their device of choice (i.e. smartphones, laptops, tablets), some had issues with how to research information online. As will be discussed in the interview section, some students may have strong skills with social media, but some struggle with digital literacy, and not all the students were comfortable in finding information for the projects.
Some projects required students to create explainer videos as part of the co-created resource. Most of the students agreed that creating the videos helped them better understand the concepts they were learning. However, six students gave a neutral response, as shown in Figure 4.5. Future studies may wish to investigate further student's experience with video creation in education.
Most of the students involved in the projects had a strong familiarity with the digital tools (PowerPoints, video creation, google) necessary to complete the assignments. Those who did not then received extra guidance from their peers and the instructor. 16 of the participants strongly agreed or agreed that they were comfortable using technology and two gave neutral responses.
Future skills. Two questions from the questionnaire focussed on the student's perception of how useful the skills they acquired in OER's co-creation may be in the future. Many skills acquired in the classroom can translate to the industry and trade in which many will find employment. Having access to these tools and skills after completion of the course was an outcome communicated to the students from the beginning of the course. 16 participants strongly agreed or agreed that they would be able to use these future skills in their future employment, while two participants gave a neutral response.

Some of the students had already completed their foundation level electrical training and had recently completed their second level apprenticeship training. As will be discussed in the qualitative section, some found the resources they created in foundation useful for the next level. Sixteen participants strongly agreed or agreed that they would be able to use these skills in their future studies, while two participants gave a neutral response.
Overall experience. The final two questions from the questionnaire address the student's total satisfaction in the experience of co-creating resources. Students' engagement was a critical factor in the design of the learning activities surrounding OER's co-creation in the electrical trade classroom. 16 of the participants strongly agreed or agreed that the co-creation activities increased their overall engagement with the learning experience, and two participants gave a neutral response. As will be discussed in the interview section in detail, many students found the experience enjoyable and satisfying. 16 students strongly agreed or agreed that the activity of co-creating resources increased their overall satisfaction with their learning experience. One participant gave a neutral response, and one other participant disagreed that the activity increased their overall satisfaction.

Interviews

In this section, a thematic analysis of qualitative interview data is included. A third party sent out 31 invitations and received nine responses. Responses from the nine interviewees to the ten question semi-structured interview prompts (Appendix D) were analyzed to identify emergent themes related to the research question: What is the experience of electrical trades students as they co-create and use OER during their own vocational education? Three sub-questions were also considered when identifying emergent themes: (1) What are some barriers that students may encounter when co-creating OER; (2) What strategies might be used to assess the contribution of co-creating OER resources to the student experience; and (3) What does it mean to co-create and use OER as an electrical trades student? Five themes emerged from the thematic analysis process: (a) Accessibility; (b) Retention of information; (c) Collaboration in the learning process, and (d) Use of technology. These are discussed below.
Accessibility. Understanding of open resources refers to the student's perception of the term open educational resources and how their knowledge about open was closely associated with accessibility. The benefits of open access to resources refer to the participants' experiences in accessing the resources in different contexts. Accessibility was viewed as the ability of the students to obtain or use information from specific resources based on Petrides et al.'s. (2011) discussion on student's perceptions of OER. Three sub-themes emerged from the data related to the accessibility of resources in the co-creation of OER: (a) accessibility of commercial textbooks; (b) understanding of open resources; and (c) the benefits of open access to resources. These are discussed below and examples from the data are provided for the sub-themes

Accessibility of commercial textbooks. Accessibility of commercial textbooks referred to the student's previous experience with the interaction and usefulness of the resource. While not all participants had experience in post-secondary education, the majority of those who participated alluded to some form of experience within a higher educational context. When asked what their experience of purchasing commercially produced textbooks as part of their post-secondary experience, participants frequently mentioned that while they were required to purchase them, they would not always be used. On the issue of cost and use, a participant stated, "It's too expensive, man. Yeah, I feel like most of the textbooks you purchase you hardly use" (Interview participant, 2020). Another participant stated that "Sometimes you buy them, but you don't really need them"(Interview participant, 2020). With the addition of digital ancillary resources that many commercial textbooks offer, a participant noted that it limited their ability to purchase used textbooks, "Especially with the books, sometimes they come with codes. You can't buy a used textbook; you have to buy the code for some reason, which is 75 bucks in itself" (Interview participant, 2020). A majority of participants (67%), noted that context sometimes can
be an issue. Many of the textbooks they buy have information that can be inaccessible for them to understand as the information goes too in depth for their level of knowledge. For example, a participant, who had experience with post-secondary education, noted:

I'm really against, because I believe you don't gain as much knowledge as you would want from those textbooks, I believe there's information in there that, kind of, goes in too deep. It puts more pressure on the student. (Interview participant, 2020)

As the program also has many first-generation Canadians, some struggle with understanding the context of the information due to constraints of English being their second language, can create. One participant noted regarding understanding the textbook, "Yeah, because English is my second language, so for me it would be a little difficult" (Interview participant, 2020). While not all of the participants stated they were implicitly against buying textbooks, they did wish there were other options available. This participant noted, "I'm not against purchasing textbooks, but there should be another option for us" (Interview participant, 2020). While seen as necessary for their education, the participants struggled with how accessible the commercial textbooks were from a financial, contextual, and usability standpoint.

**Understanding of Open Resources.** The first co-creation project began with a description of Creative Commons licensing and open educational resources. As the course progressed, the terms were brought up sporadically but not in the detail it was on the first project. While the participants embraced the concepts at the beginning of the course, their understanding diminished as the course progressed. When asked to describe open licensing or OER, one participant responded, "I think my understanding of it is that a lot of it is online?" (Interview participant, 2020). Participants did not always have a definitive answer when asked to describe Creative Commons licensing or open educational resources.
All nine of the participants, however, did acknowledge that both offered increased access to resources. As one participant stated when asked to describe what Creative Commons meant to them, "I think it means like that things are open and available anytime. You don't necessarily have to pay for them" (Interview participant, 2020). Another participant noted, "So it's like Wikipedia, it will be available like Wikipedia, but if you use that information, you have to put your references and everything" (Interview participant, 2020). When asked to describe what open educational resources were, many participants were quick to mention the availability of information at any time, as noted by this participant's response, "Basically it is a resource where you can access it anytime" (Interview participant, 2020). It was also noted that not only could the resources be accessed anytime, but anyone could also find them. One participant stated, "Anyone can use it, anyone can make it broader" (Interview participant, 2020). Participants may not have had a concrete definition of open resources, but all of them acknowledged that accessibility was an important feature of their understanding of open resources.

**Benefits of open access.** Open access refers to acquiring free educational resources, most often in a digital format. Several participants discussed the benefits of being able to obtain the resources whenever they wanted or needed them. The fact that they were not constrained to having a standard textbook that they were beholden to was seen as a benefit. This participant noted, "I can be sitting in my bed, how I am right now, looking through the slides, rather than going over to my desk, going on there, flipping through the pages, and then obviously not in the right order like the slides were" (Interview participant, 2020). For some of the participants, they needed to be able to examine the resources at later dates. One participant stated, "It's very good because we can also have it; we can access it anytime we want" (Interview participant, 2020). Some participants created their resources in an entry-level course and continued to second-year
apprenticeship training. The benefits of having access to those resources beyond the context of the entry-level course were significant to them, "We opened this one in level one, but you can always go back to it, which is good" (Interview participant, 2020). One participant appreciated that their work was available to them whenever they needed it, "I think that's huge, to where you know that the information, it's still going to be there" (Interview participant, 2020). In creating these authentic assignments, some participants found comfort in knowing that a resource they had created and put in their own words was going to be available whenever needed. Some participants stated, "The data is permanent, we can access it any time in the future when we need it" (Interview participant, 2020), and "I could always come back to it" (Interview participant, 2020). Overall, it would appear that students appreciated the access they had to resources during and after the course was completed.

**Retention of information.** In this section, retention of information is interpreted as the ability to keep something in one's memory. All nine participants in the interviews mentioned that co-creating open educational resources helped them retain the information they needed for the course. As one participant stated, "It helped us learn better…We didn't just remember the information; we understood it" (Interview participant, 2020). One of the most frequently mentioned attributes that the participants found in OER's co-creation are the benefits of being able to put information into their own words. In this context the resource being referred to is the google slide deck that was created as an open resource. Examples, where participants referred to the benefit of having resources in their own words, include the following. "Once you gained the knowledge, you change it into your own words, which makes it simpler for us to understand" (Interview participant, 2020). Another explained, "So I just go back to the slides and then it just explains it, because I put it in my own words" (Interview participant, 2020). A third stated,
"Since I put it in my own words and the group put it in the words that everyone can understand, it helps me reach back to the textbook that we created, and it was easier to understand" (Interview participant, 2020). In these examples, participants believed that being able to put the information into their own words helped them understand and retain the information they needed for the course.

Many participants mentioned how difficult it was to read through textbooks and having a resource that they had created themselves was beneficial. One respondent stated, "It would be just straight to the point, instead of zigzagging around and not really getting clear" (Interview participant, 2020). Another stated when describing the benefit of the co-created OER as opposed to a commercial textbook, "You'll actually understand it because it is not in the fancy lingo that they use, it's in your own words" (Interview participant, 2020). A third respondent noted how much more engaging the content they created than a textbook, "I like how easy it was to remember the information afterward. I felt like it made things really make sense after, whereas just reading through your textbook, sometimes you're just like, 'oh, what did I just read?' and you have to go back and do it again" (Interview participant, 2020).

Creating the information and not just having to consume the resources was frequently mentioned as a benefit. Respondents mentioned that creating a resource helped them retain more information than they would have had they just read through a resource provided to them. One participant stated:

I guess it's not all about the tests, but just for me I really remember that, when it asked a question about something I put in my textbook and that I knew, and it was like, 'oh this is the answer' because I put that in the textbook. (Interview participant, 2020)

Another participant mentioned:
I think it actually made me learn more because the building your own textbooks and stuff like that, you have to take the time to actually learn it rather than copy and pasting it, which I guess you could do, but since we're getting graded on it, you actually take the time to learn the material itself. (Interview participant, 2020)

A third participant noted, "When I put it in my own words, I could always come back to it" (Interview participant, 2020). The process of researching and putting the information into a vernacular that they could understand helped the participants retain and access the information for the unit's subject matter.

Several participants spoke to how the process was engaging and enjoyable, which in turn helped them retain the information. As one participant noted, "It was different, but it was also, I guess, more engaging because instead of just reading something and then trying to retain it, you're figuring it out yourself; as you figure it out you retain more" (Interview participant, 2020). When discussing how co-creating resources for their first-year electrical trade program differed from previous post-secondary experiences, participants stated, "It was a little more fun making the textbook. And then it would just be like the information stuck in my head more. I wasn't having to go over and memorize it as much" (Interview participant, 2020), and:

I find it kind of fun building your own textbook because you like, start out with nothing and it's kind of you're overwhelmed. But then once you got the ball rolling, then you just got more in depth in it and you be just kind of going through it. (Interview participant, 2020)

All nine participants found that in the process of co-creating OER they were better able to retain the information they were learning.
Collaboration in the learning process. Collaboration was a theme that was strongly prominent across the interviews. This section will define collaboration as the process of working within a group to produce an artifact. In this case, the artifact is the slide deck that the group created together.

As mentioned in the previous section, the respondents stated that they primarily used the Internet as a resource for their projects. Some respondents found great value in gathering information within their groups and coming to an agreement whether the information was valid. One respondent stated, "We would go online and look at different resources and try to see how clear cut it was. And we would look it over together as a group and we would put that into the PowerPoint" (Interview participant, 2020). It was also encouraged that the groups check in with other groups and share information. The whole point of the project was to share as much information as possible. While some felt uncomfortable at first talking and sharing with other groups, the class eventually embraced the value this collaboration could bring. This respondent stated, "We would talk to other groups that were around us that were working. We would see what they also said. And we would try comparing or contrasting like how our views were the same or different from theirs" (Interview participant, 2020).

Some of the respondents struggled at the beginning with the collaborative nature of the projects. Determining who was responsible for what tasks, timelines, and what content was deemed necessary were issues that many groups struggled with communicating. As the course progressed, communication got better as they continued to work toward the common project. One participant states; "the communication wasn't good at first, but later on it picked up" (Interview participant, 2020). After some time, however, many of the respondents felt that it was easier to talk to each other than it might be to talk to the teacher. They felt safer with their peers.
This respondent noted, "I think it was better getting knowledge from your own classmates and talking to just them, because it feels more comfortable" (Interview participant, 2020).

As the projects progressed, the students shared information with each other, whether in their group or with other groups. The groups contained a mixture of ages and experiences. Many of the interviews noted that this was beneficial to the learning process of all involved. As the students became more comfortable with co-creation, the groups started seeing the value in sharing information within their groups and with others. This respondent stated, "for example, there's four of us in a group, so each person has a couple subtopics, they do the research on that; they get the information, and then relay it back to everyone in the group" (Interview participant, 2020). Some of the participants started to discover that sharing and teaching others helped them to retain and learn better as this respondent noted, "Because once you teach it to someone you know it, basically right?" (Interview participant, 2020). Some respondents appreciated that not only were they gathering knowledge but also sharing it with others as this respondent stated, "Not only do you gain knowledge from your peers, but you could also give back. You could share your knowledge that you have with that subject with them, that may help in a certain area that they were struggling" (Interview participant, 2020).

Finally, a few of the respondents mentioned that the process was enjoyable and helped with learning the information. One respondent noted regarding the creation of the google slide decks that "That fact, that we were all doing the same thing, but we couldn't write the same things. It helped us think about it in different ways, which helped us learn better. The best part of it was that it was actually fun to do" (Interview participant, 2020). Some of the students started making the connection that they were learning the subject matter and that the project was
teaching them about collaboration. In industry, these tradespeople will be expected to work in
teams and collaborate. This participant mentioned:

> It's better for us, especially in that class, to learn that way, because in the field, that's what
we'd actually be doing, right? We'd actually be on our phones sometimes, we'll be talking
to the guy next to us, asking him questions, it's like what we do and you'd share ideas
right? So it help with the real life version of it. (Interview participant, 2020)

Based on the data collected it would appear that participants found value in collaboration
and learned the value of fostering these types of collaborative relationships in experiences
outside of the classroom.

**The use of technology.** The use of technology in this section will focus on the online
resource available for the students to use for their research and the accessibility of their
resources. This research was done primarily through the Internet.

When asked to define the term open educational resources meant to them, some
participants pointed towards online resources. As one participant stated, "I think my
understanding of that is that a lot of it is online" (Interview participant, 2020), and another noted,
"That's like the Internet. Yeah. And so nowadays, the Internet is basically open" (Interview
participant, 2020). When asked how they researched and found resources for their project's,
participants stated, "Different websites, and then there's a lot from YouTube videos" (Interview
participant, 2020); another noted "We would go online and look at different resources and try to
see how clear cut it was" (Interview participant, 2020). The criteria for the reliability of a
resource varied among the participants. When asked how they determined the quality of the
resources they used, one participant stated, "Just by seeing if it's from a university website that I
knew, that is was truly worthy" (Interview participant, 2020). Another participant noted, "I'd look
at the information from one site and look from another site. Then obviously, they have similarities. Then I would put it in my own words; then I'd also skim the textbook, as well to make sure" (Interview participant, 2020). A third one mentions the URL as a telling sign as to the reliability of the site, "Well, you use your discretion, like dot org, or dot gov, on certain websites" (Interview participant, 2020). Video-based information sites were mentioned by a few participants as being reliable, as this participant notes, "Maybe YouTube video as well as Khan academy. I would watch a lot of their videos. And they were good at making sense" (Interview participant, 2020). One site that was mentioned many times as being unreliable was Wikipedia. Without any prompts from the interviewer, many participants stated you could not trust Wikipedia. This participant said "If it was Wikipedia, then I wouldn't trust it" (Interview participant, 2020); another "I wasn't using Wikipedia because you can't really trust where those sources are coming from" (Interview participant, 2020); and a third, "On Wikipedia, you never know if it's definitely correct" (Interview participant, 2020).

While the majority of the groups used the Internet as the primary source of information, it was also noted as a barrier. Some felt overwhelmed by the amount of information. This participant stated when asked about the barriers they encountered when building their own resources, "I would say that the most challenging part, was again, I would say the Internet, honestly, because there are just so many resources on the Internet" (Interview participant, 2020). Others found that they could not find the information they needed as stated by this participant, "So just went on Google. Sometimes it was just like a dead-end" (Interview participant, 2020). There is a general lack of understanding as to what OER is, although it appears that technology is acknowledged as a vital part of OER and co-creation but not without its issues.
Chapter Five: Discussion and Summary

This chapter includes discussion and analysis of the experience of electrical trades students as they co-created and used OER during their vocational education. Connections are made between the emergent themes and the relevant literature. This research focused on the experiences of a very specific group of people, first-year electrical trade students. While the context is specific, and care must be taken when interpreting the data, this research offers insight into the value of OER's co-creation within the broader context of a classroom.

Discussion

Interestingly, in defining Creative Commons licensing and OER, participants in the study indicated very minimal working knowledge. Most claimed no knowledge of either and those that attempted a definition that linked Creative Commons and OER to the Internet, open-source, or both. This lack of knowledge could very well be attributed to the relatively new practice of open education and the relatively new impact it has on technology (Weller et al., 2015). This would be especially true in vocational education as there is not much provided in the way of OER, and the available resources are challenging to find or acquire. The students that did have a rudimentary understanding of Creative Commons and OER were positive in their responses to the philosophy and practices that are included with co-creation, OER, and OEP. It was mentioned many times in the interviews that the participants benefited from working in a collaborative space while interacting with a real-world artifact. This one participant points out,

It opened my eyes for me, seeing that working with other people, around your age, and just feeling comfortable with them, instead of just going to the teacher all the time. You have students around you that will help you, they understand what you're trying to find
out. It kind of made... It made learning way better than it was before (Interview participant, 2020)

This is supported by constructionism, which focuses on the attributes that learning and meaning are co-constructed in community while working on a real-life artifact (Rob & Rob, 2018).

In answering the primary research question examining the experience of electrical trades students as they co-create and use OER during their own vocational education, four findings came from this research; (a) accessibility; (b) value of co-creation; and (c) engagement.

**Accessibility.** Textbook cost continues to be an issue for post-secondary students (Jhangiani, Pitt, Hendricks, Key, & Lalonde, 2016); however, many of the participants took issue with accessibility of textbooks used in electrical vocational education. Many of the commercial textbooks required in the trades program are not written in a manner that is easy to understand for typical trades students. The language is more skewed towards engineering students and would frustrate many of the participants. This disconnect in language was also a strong barrier for those who are first-generation Canadians enrolling in the program. Trying to understand a new language written in technical jargon makes it prohibitive for these students to understand. These issues with the context and language would cause many of the students to buy the textbooks but then not use them. Having access at any time to the co-created resource is a benefit that many participants mentioned. Having resources that were written in a language and style that they could understand was largely beneficial to many of the students. It was easier for the participants to find and understand the information. This was found not only in using the resources that they created but also in the sharing of resources with the other students. One participant noted, "I think it was better getting knowledge from your own classmates and talking to them, because it feels more comfortable" (Interview participant, 2020). The participants stated
that it was easier to use the other students co-created resources to check against their work and as study aids.

Textbooks can be cumbersome to transport back and forth from class. Many would choose to leave their textbooks either in class or at home as they used public transport or walked to school. This inconvenience was a burden that many would sacrifice study time. Having access to the resource on a mobile device meant that they could obtain the learning resources at all times. This mobility also made it easier for the participants to keep track of their learning resources. After a course is complete, the students would often sell, or misplace their textbooks.

When it came time for the participants to use the textbooks (for continued schooling or industry), they would be challenging to find. One participant stated, "Honestly, the biggest thing is just that you could access it at any time" (Interview participant, 2020). Being able to acquire digital copies of the resource made it easier for the participants to call up the information that they needed when they needed it. This research supports previous literature, which cited that students appreciate OER's interactive and portable nature (Bliss, Robinson, Hilton, & Wiley, 2013; Petrides, James, Middleton-Detzner, Walling, & Weiss, 2011).

**Value of Co-creation.** Students stated in interviews that they had an easier time retaining the course's information when they co-created resources with their peers. This finding aligns with Hegarty (2015), who states, "learning is facilitated not only by teachers but more often than not by peers" (p. 3). The majority of the participants responded that being able to put information into their own words was extremely beneficial in retaining the information they needed.

Having to research, investigate, collaborate and write the information in their own words caused them to engage with the course material at a deep level. Participants noted that these self-
directed and collaborative tasks helped them understand the information rather than just reading a textbook or memorizing certain facts for a test. One of the participants stated, "we didn't just remember the information, we understood it" (Interview participant, 2020). As mentioned previously, participants often had issues with the language and complexity of the text, having to write the resources in their own words helped remove this barrier. It was evident throughout the responses that the collaborative process had a positive impact on the experience of co-creating OER in trades. Participants would engage with the course content more genuinely when creating resources themselves. This engagement would help them retain and understand the information; it proved to be an enjoyable experience for many.

**Engagement.** Students appeared to engage with the content and enjoy the process of co-creating OER with their peers. This enjoyment was not something that many of the participants expected. One of the participants noted, "I find it kind of fun building your own textbook" (Interview participant, 2020), and another "It made class more enjoyable every day, other than just being depressed and working by yourself. But just working with other people, having a good time, just talking, just doing the work at the same time was pretty fun" (Interview participant, 2020). The projects were designed in such a way that the students were strongly encouraged to interact with those in their groups as well as the other groups. These activities and projects were designed in such a way as to encourage the creation of a CoP. The findings support the literature that having learners become participants in the creation of resources within a community of practice is beneficial in the formation of an understanding of the topic (Lane, McAndrew, & Santos, 2009; Lave & Wenger, 1991). This type of engagement would lead to all of them, discussing, debating, and designing their resources. This supports Elsharnouby (2015) who stated that, “Students favor classrooms with a high level of student-student social interaction” (p.244).
A few participants noted that it was difficult at the beginning of the course because they were shy and did not know anyone. However, as the students started to get more comfortable, it was noted that the school days became more enjoyable. They found that they would converse and work on the projects outside of the classroom with little resistance. This research would appear to indicate that having a pleasant classroom environment in trades education is beneficial to students' learning. This finding aligns with Pawlowski's (2012) findings that there is more engagement when there is an emotional connection.

This research also includes several secondary questions which examine the experience of electrical trade student's experience in the use and co-creation of OER. These were; 1) what are some barriers that students may encounter when co-creating OER; 2) what strategies might be used to assess the contribution of co-creating OER resources to the student experience; and 3) what does it mean to co-create and use OER as a trades student? From these secondary research questions, three themes emerged; 1) lack of digital literacy skills; 2) value of peer and self-assessment, and 3) Student agency. Below is a summary of these findings.

**Lack of digital literacy skills.** The data collected from the participants to answer this question focused almost exclusively on using the Internet as a resource for research. While preparing the students for the project, I made some commercially available textbooks available to them for reference. Many participants opted not to use the textbooks and used the Internet for most of their research. The research found that participants were proficient at using social media. Setting up WhatsApp or Snapchat groups for discussion came easy to many of the participants. This use of chat software is a common practice in their experience of education. Many classes will have backchannel group chats set up to discuss class issues. While proficient with social media, many participants struggled with where to begin in their research. Many of the students
did not know where to begin or how to even use basic searching skills on the Internet. Those that
did have an understanding of the necessary skills for search still cited overwhelm in the amount
of information that was available on specific topics. Many of the participants struggled with
sorting through the available information. It is of interest to note that many of the participants
stated a distrust in Wikipedia as a source. These responses were unprompted as Wikipedia was
never mentioned in the survey or the interview questions. Some of the participants raised
questions as to the validity of information and how to identify a credible source. As the
participants progressed throughout the course, their skills at searching and sorting through the
information available became more honed, and they were able to gather the information they
needed in a timely and useful manner. It is a common misunderstanding that students who have
been raised in the age of the Internet have strong technical skills and an intuitive digital literacy.
Students are more and more becoming content creators rather than consumers and education has
a responsibility to embrace that reality in their curriculums (Nixon, 2003). This idea of digital
natives and digital immigrants has been challenged. The findings emerging from this research are
consistent with research that shows that students' use and knowledge of technology are much
more complicated than the idea of Prensky's (2001) 'digital native' would suggest (Lea & Jones,
2011).

Value of peer and self-assessment. From the interview data, it would appear that the
peer and self-assessment used in the course was a positive experience for the students. After the
completion of each unit the students would assess themselves and their peers on their
participation in the projects. These assessments provided a resource for in-depth discussion
around the purpose of assessment and constructive criticism in vocational education.
Student agency. Based on the data collected in this research study, it would appear that there was a change in how the participants had previously experienced education. Most of the participants had experienced the typical classroom setting where the instructor shared their information from the front of the classroom to the students. This "banking model," where an instructor has the information and knowledge and then deposits that knowledge into the students. (Freire, 2007) is something that many participants had felt comfortable with. As the class shifted towards more of an open pedagogical model of co-creation, some participants noted that it was uncomfortable at first. This one participant noted, "I was scared at first because I thought they probably know much more than me, so when I'm doing my work, I want it to be perfect" (Interview participant, 2020). As the course progressed, many found the experience was enjoyable and changed how they viewed education as a practice. This supported the literature that found that OEP requires a shift in the traditional roles of both students and instructors (Bovil, Cook-Sather, & Felton, 2011; Masterman, 2016) As one of the participants noted, "It, honestly, kind of, changed everything, like the way I learn now" (Interview participant, 2020). The participants were becoming lifelong learners and participants in the creation of their knowledge. It would appear that participants found that co-creation not only helped them learn and retain information better but that it was giving them skills that they would need and use as they worked in the industry. This research supports the literature discussing how co-creation helps create community and more active engagement among those involved (Pawlowski, 2012; Cousin & Deepwell, 2005; Lane, McAndrew, & Santos, 2009). Co-creation of OER not only helps students retain the subject matter, but it can also help in the facilitation of skills that will be useful in their future careers.
Further Research

While this research does provide perspectives about the experience of electrical trade students as they co-create and use OER during their own vocational education, it raises additional questions which researchers may wish to explore in future studies. These include: (a) digital fluency; (b) peer assessment; and (c) student grades.

Digital literacy and fluency. As the Internet becomes more prevalent in education, it stands to reason that more students are using it as a resource for information. With the ubiquitous use of ICT, it is becoming more important that schools help promote "responsible uses of the Internet and raising awareness on new threats, as reminded in OECD council recommendations" (Avvisati, 2014, p.17). This can be accomplished through integrating digital literacy and digital fluency into the curriculum. In differentiating digital literacy from digital fluency Sparrow (2018) states, “digital literacy is an understanding of how to use the tools; digital fluency is the ability to create something new with those tools” (para.3). Digital literacy and digital fluency both play an important role in a student’s educational experience. Trades education would benefit from the integration of a digital literacy and digital fluency component into the program. These skills would also prove invaluable as students enter the workforce as trades are expected to install, construct and troubleshoot in their daily work. A lot of this is done with resources found on the Internet. Knowing how to disseminate and use the information they have available would prove to be an invaluable skill. As the paradigm of education shifts from students being information consumers to information producers, more research is needed on the importance of having skills in the area of digital literacy and fluency.

Peer assessment. As mentioned in the discussion, this research shows that students found the role of peer assessment useful. Peer and self-assessment are essential skills in the trade as
apprentices are often faced with receiving feedback from their fellow co-workers. As they progress throughout their training it will also be necessary for them to provide feedback to their peers. This study did not investigate this in greater detail. More research could be centered around the question of; what is the impact of self and peer assessment in trades education? Peer and self-assessment are important skills in the trade as apprentices are often faced with receiving and giving feedback from and to their fellow co-workers.

**Student grades.** While this research investigated the qualitative experience of an electrical trades student in the co-creation and use of OER, it did not investigate the quantitative effects on the student's grades. While the data collected supports this, more data could have been collected in the interviews to get a broader understanding of the student experience with peer assessment activities. What effect do the co-creation and use of OER have on trades students’ grades?

**Scalability.** This research investigated the impact of co-creation in a setting of an electrical trades classroom. The findings appear to demonstrate that co-creation has a positive impact on the student’s educational experience. More research focused on the scalability of the methods and tools used by the instructor, and the students’, is required to account for issues of personality, disposition and context. A framework outlining digital literacy and digital fluency skills is needed, and the support systems and tools that would need to be developed for larger scale projects to ensure quality and rigour could benefit from additional investigation. This would allow other disciplines, outside of vocational education, to use the methods and benefit from the findings of this research.

**Underpresented groups.** As mentioned in the limitations section of this thesis, only 1 female participated in the study. Females and other underrepresented groups, such as LGBTQIA
and minorities have traditionally not had a strong voice in the trades and subsequently vocational education. Vocational education and the trades would benefit greatly from research that focuses on the experiences of underrepresented groups in the trades, specifically with respect to the potential of co-creation to create spaces for these underrepresented groups.

**Conclusion**

This study examined the experience of electrical trades students in the co-creation and use of OER. Information was collected using an online questionnaire (n=31) and interviews (n=9) conducted by a third party over Zoom. The interview and questionnaire data collected were analyzed using a thematic analysis framework to help identify themes from the student's experience in this study.

Group projects have been a common practice in trades classrooms for quite some time to mixed results and experiences. This research would indicate that with careful design, the artifact created in group projects has use beyond just the one assignment. The data showed that students engaged actively and had a great interest in the project. Unlike group projects where one or two students may carry the rest of the group, the usefulness of the information allowed others to share their opinions and research more openly. The useful nature of the project also can be attributed to the continuing nature of the projects. The process of co-creation continued throughout the length of the course and became an expectation and culture among the students.

This research would also appear to indicate that students understand that not only are they gaining the knowledge that they need for the subject matter; they are learning how to interact with their peers in a way that will benefit them outside of the context of a classroom. The trades industry is complex and often requires skills in research and collaboration. Co-creation helps the students acquire skills that will benefit them in industry, no matter what trade they are pursuing.
In this model, students learn how to research, critique, collaborate, compromise, and troubleshoot. These are valuable skills in an industry that focus on construction, maintenance, problem solving, teamwork, and time and resources management.

While this research examined the experience of trades students in the co-creation and use of OER, it also served as an examination of a much different type of model in trades education. This research would indicate that students who participate in the construction of their education discover a love of learning that had been missing from their previous experiences in education. Students, trades or otherwise, do not have to be just passive receivers of information. On the contrary, when given the tools and the opportunity to create something that has use beyond the immediate context of the assignment, students become active, engaged and enthusiastic participants. When given the opportunity and support, students can achieve a level of engagement that brings value to them personally. As the research has shown, participants reported higher satisfaction with their understanding of the concepts and skills through the process of co-creation. This satisfaction could lead to habits and practices that would help further the student’s own lifelong learning, as well as the commons of the trades in which they are training.

The integration of co-creation exercises in trades education has the potential to add some much-needed changes to the current model. The current system trains students to perform well on rote learning exams. Assessments in the theoretical training of trades instruction often come in the form of a multiple-choice exam. It could be argued that trades education is training students to pass multiple choice exams. It should be noted that this may not necessarily be a bad thing. Most trades licensing exams are multiple-choice exams. However, there is much more to experience in the trades classroom. Collaboration, problem-solving, troubleshooting, and
communication skills are all valuable skills in industry and co-creation exercises can help teach and practice those skills. While our trades students must learn the foundations of their trades, we also have an opportunity to provide a richer and deeper understanding of how the industry works. Co-creation can help vocational students become better in their trades and help them work towards making the trades better. While this research was performed in the context of an electrical trade’s classroom, it would be a mistake to see this study as only benefitting vocational education. The methods and lessons learned from this study have implications for all disciplines of education. Bringing students into the process of co-creating their own educational resources can be beneficial for the students, the institute in which they attend, and the discipline in which they study.
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Appendix A: Initial Contact Email

Invitation to Participate in a Research Study

Trades Students Perception of the Co-creation of OER

A study being conducted by Chad Flinn
British Columbia Institute of Technology

This research project explores the perception of first-year electrical trades students as they participate in the co-creation of OER. It will use a qualitative case study approach to examine the impact that the co-creation of OER had on first-year electrical trades students.

As a participant you will be asked to do the following:

- Participate in a 15-20 minute questionnaire; and
- Complete 45-minute interview.

All feedback will be confidential. Please note the following important points:

- Participation is voluntary and you are free to decline participation without explanation or consequence. Even though the research is being conducted by your instructor, you are under no obligation to participate in this research project. You may terminate your participation during the interview at any time by verbally informing the third party conducting the interview. Any data you have provided up to that point will be deleted.
- By consenting to participate in this research, participants do not waive any legal rights.
- There are no potential risks to you in participating in this study.
- You have the option to withdraw without penalty or prejudice.
- All raw data collected is completely confidential and will be available only to the researcher of this project, Chad Flinn. The study is designed in such a way that the researcher (Chad Flinn) will have no knowledge of which students participated in the study and which did not until after graduation.
- A third party will be conducting the interviews and sending out the invitations to participate in the questionnaire. This third party will have signed a confidentiality agreement stating that they will not reveal ANY information about what is contained in the interviews. If you would like a copy of the signed agreement, one may be provided.
- Survey monkey uses US-based servers, NO personal or identifiable information is collected in this survey, and as a normal procedure, all data will be deleted from Survey Monkey immediately after the data collection period. The data will then be stored in digital form and secured by password-protected encryption on computer hard drives at the British Columbia Institute of Technology. Complete anonymity of your responses is
assured. The interview data will be transcribed by a third party, so that the participants cannot be identified by voice and stored on servers at BCIT. The raw data will be accessed by the third party and the PI. The PI will have no access to any information that may identify the participants, and who did or did not participate in the study, until after graduation.

- Raw data will be kept for 5 years for possible future studies. After 5 years all data will be destroyed. If you choose to withdraw prior to the completion of the survey, your data will not be included in the study.

Participants may request to view or discuss their own specific data directly from the third party at any time. As the third party will be using a Gmail account, your personal information will be stored in the US and available to US authorities. By agreeing to participate, you consent to storing your personal data outside of Canada. Participants will be informed when the analysis and findings of the study will be made public by email.

There are no affiliations with any employers or unions. There are no profits being made from this research.

As open education continues to grow and expand, trades education and its students may find value in adopting the tools that OER use affords and trades could offer their distinct voice to the conversation. The benefits of participating in this research include being able to share participant’s perceptions in the co-creation of OER, barriers that may be encountered as they participate in the co-creation of OER and improve the experience of first-year electrical trades education for future cohorts.

If you are interested in participating in this research study, please respond by email to [redacted]. In your response please state if you would be interested in participating in the interview, questionnaire, or both. If you agree to participate the third party will email you consent forms for both the questionnaire and the interview.

Thank you for considering participating in this research.

Chad Flinn
Appendix B: Request for informed consent form

Trades Students Perception of the Co-Creation of OER

This consent form describes the research study to help you decide if you want to participate.

Project Title

Trades student’s perception of the Co-Creation of OER

Project Investigators
Chad Flinn, Faculty of the School of Construction and the Environment, British Columbia Institute of Technology.

Who is invited to participate in this study?
Current and former students who have participated in the Co-Creation of open educational resources in first-year electrical training.

What is the purpose of this research?
This research explores the perception of first-year electrical trades students as they participate in the co-creation of OER. This research will identify the student’s perceptions in the co-creation of OER, barriers that may be encountered as they participate in the co-creation of OER and will make recommendations that could be implemented for future vocational classes similar to this one. This project is part of a Master of Arts in Learning and Technology thesis through Royal Roads University. For verification, you may contact the academic advisor; Dr. Elizabeth Childs:
Email Address: Elizabeth.Childs@RoyalRoads.ca
Telephone: 250-391-2600
Extension: 4843

What does my participation involve?
If you agree to participate in this study, we will ask you to participate in a semi-structured interview during we will ask you to reflect on your perception of, and participation in the Co-Creation of OER.

Your interview will take place either in-person, via telephone, or on Skype at a time that is convenient to you and agreed upon with the research team.

How long will I be in this study?
The interview is expected to take approximately 45 minutes to 1 hour to complete.

What are the risks of this study?
We do not anticipate any risks of being in this study.
What if I wish to withdraw?
If you wish to withdraw at any point, you may do so by informing the third party conducting the interview in writing (email) or verbally at any point during the course of the interview.

What are the benefits of this study?
As open education continues to grow and expand, trades education and its students may find value in adopting the tools that OER use affords and trades could offer their distinct voice to the conversation. The benefits of participating in this research include being able to share participant’s perceptions in the co-creation of OER, barriers that may be encountered as they participate in the co-creation of OER and improve the experience of first-year electrical trades education for future cohorts.

Will I be paid for participating?
You will not be paid for being in this research study.

How will the results of the study be communicated?
The results of the study will be communicated via academic journals, conference presentations, online media, and news articles. Should you choose, you may request a summary of the study, or receive a notice of any free publications in which this study may appear.

What about confidentiality and privacy?
We will keep your participation in this research study confidential to the extent permitted by law. Data will be stored in a locked cabinet and/or on password-protected servers/computers in Canada. Your interview or focus group may be recorded to aid transcription. The audio recording will be permanently deleted once we transcribe the interview.

Audio recordings will not be made available to the primary investigator until after the graduation of the research participation from the primary investigators class. Until that time the primary investigator will be provided with anonymized transcripts

Raw data will be kept for 5 years for possible future studies. After 5 years all data will be destroyed. If you choose to withdraw prior to the completion of the interview or focus group, it is accepted that any data collected from you can be used in the final paper/presentation, unless expressly prohibited. While it is understood that every attempt will be made to retain anonymity, it is also understood that, by nature, it is not possible to guarantee anonymity in an interview setting.

Recorded skype interviews will be anonymous but there is a remote possibility that the primary investigator will be able to identify you from the audio.
Is being in this study voluntary?
Taking part in this research study is completely voluntary. You may choose not to take part at all. If you decide to be in this study, you may stop participating at any time.

What if I have questions?
This research has been approved the Research Ethics Board of Royal Roads University.

Should you have any questions regarding the interview, please contact Nathan Torhjelm

If you have any questions about the research study itself, please contact the primary investigator:

Chad Flinn (chad_flinn@bcit.ca)

If you have questions, concerns, or complaints about your rights as a research subject or about research related injury, please contact the Royal Roads Research Ethics Office at (250) 391-2600, ext. 4425, or ethicalreview@royalroads.ca.

[  ] I consent to participate in this research
[  ] I consent to have this interview recorded
[  ] I do not consent to participate

By signing this letter, you give free and informed consent to participate in this project. Please return this signed copy via email to

Name: (Please Print): ______________________________________________

Signed: _________________________________________________________

Date: ___________________________________________________________
Appendix C: Questionnaire Template

Trade student’s perceptions of co-creating OER.
A study being conducted by Chad Flinn
British Columbia Institute of Technology

Each question will be based on a 5-point Likert scale, with the following descriptions.

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

Questions

1. Learning outcomes were clearly laid out for me
2. The learning activities that involved co-creation extended my knowledge of the topic.
3. The activities that involved co-creation helped me to learn effectively.
4. The learning activities that involved co-creation created opportunities for me to learn from my peers.
5. The learning activities that involved co-creation prepared me for the peer assessment activities.
6. The peer assessment activities surrounding the co-creation of resources in the course helped me to learn effectively.
7. The timeframe was sufficient to complete all the learning activities that involved co-creation.
8. The experience of co-creation of learning activities enabled me to achieve the learning outcomes of the course.
9. The learning activities that involved co-creation were more beneficial than using a standard textbook.
10. Textbook cost is important to me when considering my future studies
11. I would prefer the use of standard textbooks over creating my own resources.
12. I felt comfortable using technology for co-creating learning activities for this course.
13. Creating videos helped me better understand the concepts we were learning about.
14. I was comfortable finding information for the creation of my resource.
15. I will be able to use the co-created resources and associated skills built in this course in my future studies.
16. I will be able to use the co-created resources and associated skills built in this course in my future employment.
17. The activity of co-creating resources increased my overall satisfaction with my learning experience.
18. The activity of co-creating resources increased my overall engagement with my learning experience.
Appendix D: Interview Template

Trade student’s perceptions of co-creating OER.

A study being conducted by Chad Flinn
British Columbia Institute of Technology

Participant identification number:

Date & Time:

1. What is your experience of purchasing commercially produced textbooks as part of your post-secondary experience?
2. Please describe what open licensing (Creative Commons) means to you?
3. What does the term open educational resources (OER) mean to you?
4. How did you research and find resources for your first-year electrical trades course?
5. Please describe the experience of co-creating your own learning resources for your first-year electrical trades course?
6. Please describe how you determined the quality of the resources you used in building your own resources?
7. What are some of the challenges you encountered when building your own resources?
8. What were some of the things you liked about building your own resources?
9. Describe how the experience of co-creating impacted your learning in your first-year electrical trades course?
10. How did the process of co-creating your resources for your first-year electrical trades course differ from previous post-secondary experiences?
Appendix E: Interviewer confidentiality agreement

Trades Students Perception of the co-creation of OER

You have been hired to conduct interviews for Chad Flinn, on the research project *Trades Students perception of the co-creation of OER*. The ethical guidelines of this study require that you read and sign this form, signifying that you are willing to enter into a confidentiality agreement with respect to the data collected in this study.

The audio recordings you will receive will likely contain identifying markers of the participants as well as names of third parties (for instance colleagues, family members and/or acquaintances of participants). In order to protect confidentiality, you are to remove all identifiers of third parties and of participants. If transcription occurs outside the institute, you will ensure that all records, transcripts and recordings are kept confidential (i.e., materials are never left unattended and are secured when not being used). As a third party hired to collect data, you will have a key that contains the identities of all research participants. You are to maintain a copy of the key until it has been confirmed that all research participants have graduated from the primary investigators course. At this time, you will release the key to the primary investigator who will store the key on BCIT servers until such a time that the data collected will be destroyed.

By signing below, you agree not to reveal any information about what is contained on the audio recordings or in the written transcripts. Furthermore, you agree not to discuss anything regarding the participants, or the data collected in this study with anyone other than the principal investigators.

By signing below, you are indicating that you have read and understand the above agreement and that you will follow all of the specified conditions.

Name: (Please Print): ______________________________________________

Signed: _________________________________________________________

Date: ___________________________________________________________
Appendix F: Third party email script

Hi,

My name is Nate Torhjelm and I have been hired by Chad Flinn to help conduct research for his thesis. Chad has been using open educational resources and open educational practices in the course you are currently enrolled in. His study is aimed at finding out your perception of the experience. I am reaching out to see if you would be interested in helping Chad by participating in a short interview via Skype and an online survey through Survey monkey.

If you are interested, please respond to this email and I will send you more information and schedule a time for the interview. Thank you for considering taking part in this important study. For more information regarding the project please read Chad’s description below.

Nate

Invitation to Participate in a Research Study

Trades Students Perception of the Co-creation of OER

A study being conducted by Chad Flinn
British Columbia Institute of Technology

This research project explores the perception of first-year electrical trades students as they participate in the co-creation of OER. It will use a qualitative case study approach to examine the impact that the co-creation of OER had on first-year electrical trades students.

As a participant you will be asked to do the following:

- Participate in a 15-20 minute questionnaire; and
- Complete a 30-minute interview.

All feedback will be confidential. Please note the following important points:

- Participation is voluntary and you are free to decline participation without explanation or consequence. Even though the research is being conducted by your instructor, you are under no obligation to participate in this research project. You may terminate your participation during the interview at any time by verbally informing
the third party conducting the interview. Any data you have provided up to that point will be deleted.

- By consenting to participate in this research, participants do not waive any legal rights.
- There are no potential risks to you in participating in this study.
- You have the option to withdraw without penalty or prejudice.
- All raw data collected is completely confidential and will be available only to the researcher of this project, Chad Flinn. The study is designed in such a way that the researcher (Chad Flinn) will have no knowledge of which students participated in the study and which did not until after graduation.
- A third party will be conducting the interviews and sending out the invitations to participate in the questionnaire. This third party will have signed a confidentiality agreement stating that they will not reveal ANY information about what is contained in the interviews. If you would like a copy of the signed agreement, one may be provided.
- Survey monkey uses US-based servers, NO personal or identifiable information is collected in this survey, and as a normal procedure, all data will be deleted from Survey Monkey immediately after the data collection period. The data will then be stored in digital form and secured by password-protected encryption on computer hard drives at the British Columbia Institute of Technology. Complete anonymity of your responses is assured. The interview data will be transcribed by a third party, so that the participants cannot be identified by voice and stored on servers at BCIT. The raw data will be accessed by the third party and the PI. The PI will have no access to any information that may identify the participants, and who did or did not participate in the study, until after graduation.
- Raw data will be kept for 5 years for possible future studies. After 5 years all data will be destroyed. If you choose to withdraw prior to the completion of the survey, your data will not be included in the study.

Participants may request to view or discuss their own specific data directly from the third party at any time. As the third party will be using a Gmail account, your personal information will be stored in the US and available to US authorities. By agreeing to participate, you consent to storing your personal data outside of Canada. Participants will be informed when the analysis and findings of the study will be made public by email.

There are no affiliations with any employers or unions. There are no profits being made from this research.

As open education continues to grow and expand, trades education and its students may find value in adopting the tools that OER use affords and trades could offer their distinct voice to the conversation. The benefits of participating in this research include being able to share
participant’s perceptions in the co-creation of OER, barriers that may be encountered as they participate in the co-creation of OER and improve the experience of first-year electrical trades education for future cohorts.

If you are interested in participating in this research study, please respond by email to [REDACTED] In your response please state if you would be interested in participating in the interview, questionnaire, or both. If you agree to participate the third party will email you consent forms for both the questionnaire and the interview.

Thank you for considering participating in this research.

Chad Flinn
Appendix G: Questionnaire results

Question #1.

I have read the description of this study and understand that by selecting "I consent to participate in this research", I have agreed to participate.

Answered: 18    Skipped: 0

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<thead>
<tr>
<th>ANSWER CHOICES</th>
<th>RESPONSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>I consent to participate in this research</td>
<td>100.00%</td>
</tr>
<tr>
<td>I do not consent to participate in this research</td>
<td>5.56%</td>
</tr>
</tbody>
</table>

Total Respondents: 18
Question #2

Learning outcomes were clearly laid out for me

Answered: 18   Skipped: 0

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>TOTAL</th>
<th>WEIGHTED AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no label)</td>
<td>72.22%</td>
<td>27.78%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>18</td>
</tr>
</tbody>
</table>
Question #3

The experience of co-creation of learning activities enabled me to achieve the learning outcomes of the course.

Answered: 17    Skipped: 1

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>Total</th>
<th>Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no label)</td>
<td>47.06%</td>
<td>47.06%</td>
<td>5.88%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>17</td>
<td>1.59</td>
</tr>
</tbody>
</table>
Question #4

The timeframe was sufficient to complete all the learning activities that involved co-creation.

Answered: 18  Skipped: 0

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Total</th>
<th>Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no label)</td>
<td>77.78%</td>
<td>5.56%</td>
<td>16.67%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>18</td>
<td>1.39</td>
</tr>
</tbody>
</table>
Question #5

The learning activities that involved co-creation created opportunities for me to learn from my peers.

Answered: 18  Skipped: 0

<table>
<thead>
<tr>
<th></th>
<th>STRONGLY AGREE</th>
<th>AGREE</th>
<th>NEUTRAL</th>
<th>DISAGREE</th>
<th>STRONGLY DISAGREE</th>
<th>TOTAL</th>
<th>WEIGHTED AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no label)</td>
<td>66.67%</td>
<td>16.67%</td>
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<td>0.00%</td>
<td>0.00%</td>
<td>18</td>
<td>1.50</td>
</tr>
</tbody>
</table>
**Question #6**

The activities that involved co-creation helped me to learn effectively.

Answered: 18  Skipped: 0

![Bar chart showing responses to the question](chart)

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Total</th>
<th>Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no label)</td>
<td>61.11%</td>
<td>33.33%</td>
<td>5.56%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>18</td>
<td>1.44</td>
</tr>
</tbody>
</table>
Question #7

The learning activities that involved co-creation extended my knowledge of the topic.

Answered: 18   Skipped: 0

![Bar chart showing responses to the question]

<table>
<thead>
<tr>
<th>(no label)</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>TOTAL</th>
<th>WEIGHTED AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>72.22%</td>
<td>27.78%</td>
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<td>0.00%</td>
<td>0.00%</td>
<td>13</td>
<td>18</td>
<td>128</td>
</tr>
</tbody>
</table>
Question #8

The peer assessment activities surrounding the co-creation of resources in the course helped me to learn effectively.

Answered: 18    Skipped: 0

<table>
<thead>
<tr>
<th></th>
<th>STRONGLY AGREE</th>
<th>AGREE</th>
<th>NEUTRAL</th>
<th>DISAGREE</th>
<th>STRONGLY DISAGREE</th>
<th>TOTAL</th>
<th>WEIGHTED AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no label)</td>
<td>61.11%</td>
<td>33.33%</td>
<td>5.56%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>18</td>
<td>1.44</td>
</tr>
</tbody>
</table>
Question #9

The learning activities that involved co-creation prepared me for the peer assessment activities.

Answered: 18   Skipped: 0

![Bar chart showing responses]

<table>
<thead>
<tr>
<th>Label</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>Total</th>
<th>Weighted Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no label)</td>
<td>50.00%</td>
<td>38.89%</td>
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<td>0.00%</td>
<td>0.00%</td>
<td>18</td>
<td>1.61</td>
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</tbody>
</table>
Question #10

I would prefer the use of standard textbooks over creating my own resources.

Answered: 18  Skipped: 0

![Bar chart showing responses to the question]

<table>
<thead>
<tr>
<th>STRONGLY AGREE</th>
<th>AGREE</th>
<th>NEUTRAL</th>
<th>DISAGREE</th>
<th>STRONGLY DISAGREE</th>
<th>TOTAL</th>
<th>WEIGHTED AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no label)</td>
<td>16.67%</td>
<td>0.00%</td>
<td>33.33%</td>
<td>33.33%</td>
<td>16.67%</td>
<td>18</td>
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</table>
Question #11

Textbook cost is important to me when considering my future studies

Answered: 18    Skipped: 0

![Bar chart showing responses to the question]

<table>
<thead>
<tr>
<th>Response Level</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Strongly agree</td>
<td>50.00%</td>
<td>9</td>
</tr>
<tr>
<td>Agree</td>
<td>22.22%</td>
<td>4</td>
</tr>
<tr>
<td>Neutral</td>
<td>16.67%</td>
<td>3</td>
</tr>
<tr>
<td>Disagree</td>
<td>5.56%</td>
<td>1</td>
</tr>
<tr>
<td>Strongly disagree</td>
<td>5.56%</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total**: 18

**Weighted Average**: 1.94
Question #12

The learning activities that involved co-creation were more beneficial than using a standard textbook.

Answered: 18  Skipped: 0

<table>
<thead>
<tr>
<th>STRONGLY AGREE</th>
<th>AGREE</th>
<th>NEUTRAL</th>
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</tr>
</thead>
<tbody>
<tr>
<td>(no label)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>77.78%</td>
<td>11.11%</td>
<td>5.56%</td>
<td>5.56%</td>
<td>0.00%</td>
</tr>
<tr>
<td>14</td>
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<td>18</td>
<td>139</td>
<td></td>
<td></td>
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</table>

WEIGHTED AVERAGE: 1.39
Question #13

I was comfortable finding information for the creation of my resource.

Answered: 18  Skipped: 0

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>Total</th>
<th>Weighted Average</th>
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<tbody>
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<td>0.00%</td>
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<td>1.83</td>
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</tbody>
</table>
Question #14

Creating videos helped me better understand the concepts we were learning about.

Answered: 18  Skipped: 0

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>TOTAL</th>
<th>WEIGHTED AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no label)</td>
<td>33.33%</td>
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<td>0.00%</td>
<td>0.00%</td>
<td>18</td>
<td>2.00</td>
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</tbody>
</table>
Question #15

I felt comfortable using technology for co-creating learning activities for this course.

Answered: 18   Skipped: 0

<table>
<thead>
<tr>
<th></th>
<th>STRONGLY AGREE</th>
<th>AGREE</th>
<th>NEUTRAL</th>
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<th>TOTAL</th>
<th>WEIGHTED AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no label)</td>
<td>77.78%</td>
<td>11.11%</td>
<td>11.11%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>18</td>
<td>1.33</td>
</tr>
</tbody>
</table>
Question #16

I will be able to use the co-created resources and associated skills built in this course in my future employment.

Answered: 18   Skipped: 0
Question #17

I will be able to use the co-created resources and associated skills built in this course in my future studies.

Answered: 18   Skipped: 0

<table>
<thead>
<tr>
<th>(no label)</th>
<th>STRONGLY AGREE</th>
<th>AGREE</th>
<th>NEUTRAL</th>
<th>DISAGREE</th>
<th>STRONGLY DISAGREE</th>
<th>TOTAL</th>
<th>WEIGHTED AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>66.67%</td>
<td>22.22%</td>
<td>11.11%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>18</td>
<td>1.44</td>
</tr>
</tbody>
</table>
Question #18

The activity of co-creating resources increased my overall engagement with my learning experience.

Answered: 18  Skipped: 0

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>Total</th>
<th>Weighted average</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no label)</td>
<td>55.56%</td>
<td>33.33%</td>
<td>11.11%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>18</td>
<td>1.56</td>
</tr>
</tbody>
</table>
Question #19

The activity of co-creating resources increased my overall satisfaction with my learning experience.

Answered: 18   Skipped: 0

<table>
<thead>
<tr>
<th></th>
<th>STRONGLY AGREE</th>
<th>AGREE</th>
<th>NEUTRAL</th>
<th>DISAGREE</th>
<th>STRONGLY DISAGREE</th>
<th>TOTAL</th>
<th>WEIGHTED AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no label)</td>
<td>50.00%</td>
<td>28.89%</td>
<td>5.56%</td>
<td>5.56%</td>
<td>0.00%</td>
<td>18</td>
<td>1.87</td>
</tr>
</tbody>
</table>
Appendix H: Co-creation project template example

Magnetism Project

It is up to your group how you would like to present the information. Some ideas:
- Google Slides
- Video
- Prezi
- Google Doc
- Flipgrid Video
- Podcast

Think of this as a resource that others may use in the future (including yourself). Use the information available in the learning hub but also find outside resources as well. All resources will be cited in a reference slide. Use this article (https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_formatting_and_style_guide/reference_list_basic_rules.html) as a guide on references (We will be using APA format, 7th edition)

Each phase should include a 5-10 question bank using the H5P.org question set tool. Click here (https://www.youtube.com/watch?v=-t8vC25bGI4&feature=youtu.be&ab_channel=Educraft) for a tutorial on how to use H5P. Each person in the group is to create at least ONE quiz set. All members of the group should attempt each question set.

You will be graded according to the attached rubric.

Phase 1

- Kickoff meeting
  - Develop Group Charter
  - Develop group Role Checklist
  - Decide on format
- Permanent magnet properties
- Electromagnetic properties
- Magnetic Domains
- Flipgrid/Discussion post reflection due

Phase 2

- Magnetic lines of flux
  - Characteristics of Magnetic lines of force
• Magnetic Materials
  o Paramagnetic
  o Diamagnetic
  o Ferromagnetic
• How to Demagnetize a magnet
• Quiz #1 due
• Flipgrid/Discussion post reflection due

Phase 3
• Oersteds’s experiment
• Left hand rule for magnetic fields
• Left hand rule for coils
• Magnetisms similarity to electricity
• Flipgrid/Discussion post reflection due

Phase 4
• Check in
• Magnetomotive force
• Magnetic flux
• Reluctance
• Flipgrid/Discussion post reflection due

Phase 5
• Magnetic properties/Math
  o Flux Density
  o Magnetizing force/intensity
  o Permeability
  o BH curve
  o Hysteresis loop
• Quiz #2

Phase 6
• Project due
• Magnetism final
• Self/Peer assessment due
**Rubric.**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>4- Excellent</th>
<th>3- Proficient</th>
<th>2- Progressing</th>
<th>1- Non-Proficient</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Content</strong></td>
<td>Information is organized in a clear, logical way. It is easy to anticipate the type of material that might be on the next slide. 10 question quiz included.</td>
<td>Most information is organized in a clear, logical way. One slide or item of information seems out of place. 10 question quiz included.</td>
<td>Some information is logically sequenced. An occasional slide or item of information seems out of place. Some sort of quiz is included.</td>
<td>There is no clear plan for the organization of information. No quiz is included.</td>
</tr>
<tr>
<td><strong>Graphics</strong></td>
<td>All graphics are attractive and support the theme of the presentation</td>
<td>A few graphics are not attractive but all support the theme of the presentation</td>
<td>All graphics are attractive but a few do not seem to support the theme of the presentation</td>
<td>Several graphics are unattractive AND detract from the content of the presentation.</td>
</tr>
<tr>
<td><strong>Background</strong></td>
<td>The choice of background is consistent from slide to slide and is appropriate to the topic. And is appropriate to the topic</td>
<td>The background does not distract from the text or other graphics and is consistent from slide to slide</td>
<td>The background does not distract from the text or other graphics.</td>
<td>The background makes it difficult to see text or competes with graphics on slides</td>
</tr>
<tr>
<td><strong>Spelling and Grammar</strong></td>
<td>No misspellings or grammatical errors.</td>
<td>Few minor errors but does not distract from the deck.</td>
<td>Frequent grammatical errors.</td>
<td>Constant errors and are distracting from the presentation.</td>
</tr>
<tr>
<td><strong>Use of class time</strong></td>
<td>Used time well during the class period. Never distracted others.</td>
<td>Used time well and usually focused on getting the project done.</td>
<td>Used some of the class time well. Occasionally distracted others.</td>
<td>Did not use class time well and distracted others.</td>
</tr>
</tbody>
</table>