ATHABASCA UNIVERSITY

PROFESSIONAL DEVELOPMENT GUIDELINES FOR OER: A CASE STUDY OF BRAZILIAN FUNDAMENTAL EDUCATION PUBLIC SCHOOL TEACHERS

BY

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A DISSERTATION

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE

DEGREE OF DOCTOR OF EDUCATION

THE CENTRE FOR DISTANCE EDUCATION

ATHABASCA UNIVERISTY

MAY, 2018

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Dedication

This dissertation is first and foremost dedicated to my parents, Sergio Vladimirschi and Liliane Vladimirschi, who gave me the best educational conditions possible so that I could pursue my love for learning and achieve my professional objectives. Their unconditional love and moral, emotional and financial support throughout this journey helped me overcome numerous barriers and challenges. Their support was decisive for my achieving a doctoral degree.

This dissertation is also dedicated to all Brazilian public school educators. To be successful in their endeavors, they have to face daily hardships and challenges. They are heroes, given the lack of all kinds of resources in the Brazilian K-12 public school system, and it is absolutely necessary for them to feel professionally valued. I hope this work not only conveys my profound respect and admiration for all of them but also provides them with the necessary support, motivation and inspiration to begin implementing innovative instructional practices.

Acknowledgments

My sincere thanks are extended to the members of my dissertation committee; I am deeply indebted to all of you for your guidance and support throughout this journey. Thank you for your precious time and your willingness to review so many drafts, your timely and constructive criticism, your insistence on a high research standard and your continuous encouragement and intellectual support. Dr. Rory McGreal, as my supervisor, your mentoring, knowledge, invaluable insights, encouragement, patience and trust in my abilities as a researcher provided me with the inspiration, motivation and self-confidence to study this topic. Your faith in my abilities as a researcher has helped me and guided me through the challenges and trials more than words can express. Thank you for believing that I was capable and competent enough to undertake this study. Dr. Connie Blomgren, thank you for sharing your expertise on K-12 teachers and for providing me with thorough written feedback and comments on each draft, which greatly helped me focus my thinking, refine my theory and hone my English writing skills. Dr. Jon Dron, thank you for your detailed, constructive criticism and valuable comments on my work; your knowledge and experience have undoubtedly helped me become a better critical thinker and researcher.

My gratitude goes out to Dr. Bea de los Arcos, Dr. Javiera Atenas, Dr. Carina Bossu and Dr. Chrissi Nerantzi for reviewing the draft guidelines and providing constructive feedback on my work. I would also thank my cohort and the staff of Athabasca University, who were always extremely supportive and helpful. I would also like to acknowledge the leaders and colleagues of the Global OER Graduate Network for

providing me with the funding to attend two GO-GN seminars and two Global Open Education Conferences and for the networking opportunities they provided. All of my colleagues of the Global OER Graduate Network have been instrumental in my development as an open researcher.

A big thank you goes to all the participants of this study for their time and effort.

Finally, thank you also to Sabrina Lautenschleguer, my friends near and far and my loved ones for their moral and emotional support during both the difficult and joyful times of this journey.

Abstract

K-12 public education in Brazil suffers from low investment in teacher training, which results in a lack of support for fostering pedagogical change through the use of digital technology resources for pedagogical use. The use of Open Educational Resources (OER) in the K-12 public education sector enables teachers to access to a wide variety of free sources and new ideas for planning and enhancing their lessons, and it affords them the possibility to improve their own knowledge and skills in information and communication technologies (ICTs). There has been little empirical research on teachers' use of OER in K-12 public education in Brazil. This case study addresses that gap, exploring a set of evidence-based OER guidelines in the context of teacher professional development (TPD) for Brazilian *fundamental education* public school teachers through the development and delivery of a face-to-face OER professional development program (ODP). The study was conducted at one Brazilian *fundamental education* public school; quantitative data assessed the intentions of the participants of the study to adopt and use OER; qualitative data identified barriers and learning needs and assessed learning outcomes upon completion of the ODP. The findings of this study suggest that ongoing facilitator support and practical, step-by-step, hands-on TPD in OER can enhance teachers' engagement and confidence with OER and that school administrations' awareness and engagement is imperative to ensure their success. The study proposes a set of evidence-based OER guidelines for stakeholders who wish to promote the adoption and use of OER in the Brazilian public *fundamental education* system.

Keywords: OER, ICTs, digital resources, K-12, *fundamental education*, public schools, Brazil, TPD, case study, mixed methods, guidelines, design thinking

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Glossary of Terms

To provide the reader with a better understanding of how some terms have been applied and construed in the context of OER implementation and adoption, some definitions are in order.

Active learning is defined as a process "that essentially occurs when an instructor stops lecturing and students work on a question or task designed to help them understand a concept" (Andrews, Leonard, Colgrove & Kalinowski, 2011, p. 394). Active learning is fostered when the instructor uses pedagogies of construction that provide greater learner control, autonomy, and hands-on learning rather than pedagogies of transmission that are more likely to promote passive reception.

Andragogy is the science of adult learning that emphasizes the role of the learner as being self-directed in his or her studies, problem-driven and motivated to learn by internal factors (Merriam, 2001).

Collaborative learning "is personal philosophy, not just a classroom technique. The underlying premise of collaborative learning is based upon consensus building through cooperation by group members" (Panitz, 1999, p. 4). Collaborative learning refers to an instruction method in which teachers or students work together in small groups toward a common goal.

Computer proficiency is defined as the knowledge and ability to use computer applications (spreadsheet, word processors, etc.) (Grant, Malloy & Murphy, 2009).

Computer literacy is defined as "that compendium of knowledge and skills which ordinary educated people need to have about computers in order to function effectively at work and in their private lives" (Haigh, 1985, p. 161).

Constructivism. A philosophy of teaching and learning based on the principle that individuals construct meaning and understanding as they experience and engage with the world. In it, "learning is viewed as a process of creating and adjusting mental models to accommodate new experiences" (Swan, 2010, p. 127).

Cooperative learning consists of "a set of processes which help people interact together in order to accomplish a specific goal or develop an end product, which is usually content specific" (Panitz, 1999, p. 5).

Creative Commons. Organization dedicated to promoting open content and open licenses such as the Creative Commons (CC) licenses for content creators to license their work. "Every license helps creators retain copyright while allowing others to copy, distribute, and make some uses of their work–at least non-commercially" (Creative Commons, 2015, para. 1).

Design thinking is defined as "an analytic process and creative process that engages a person in opportunities to experiment, create and prototype models, gather feedback, and redesign" (Razzouk & Shute, 2012, Abstract). Design thinking is an approach focused on creating solutions to difficult problems in education by addressing the needs of the teachers who will consume a product or implement

innovation and the infrastructure that enables it (Brown & Wyatt, 2010).

Digital literacy "is a contested term, there are multiple definitions and it is conceptually very fuzzy" (J. Dron, personal communication, February 18, 2016). Martin (2005) provides a comprehensive definition of digital literacy, which for the purpose of this study is: "the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others" (Martin, 2005, p. 135).

Digital resources. In the context of this study, digital resources refer specifically to OER use. However, they can also refer to ICT use, which is in this context considered an important avenue to OER use.

Digital skills. For the purpose of this study, digital skills encapsulate four skill clusters and corresponding definitions: "set of basic skills in using Internet technology (operational skills); skills to handle the structures of digital media and skills of navigation and orientation (formal skills); skills to locate information in digital media (informational skills); and skills to employ the information contained in digital media towards personal and professional development (strategic skills)" (van Deursen & van Dijk, 2011, p. 895). While "digital literacy focuses on why, when, who, and for whom (Bali, 2016, para. 1), digital skills focus on what tools to use and how to use them" (Bali, 2016, para. 3).

Horário de Trabalho Pedagógico (HTP). The objective of this initiative in

Brazilian K-12 public schools is to provide ongoing teacher education based on reflection and group work. HTP meetings are held weekly by the pedagogical coordinator of the institution, and during this time teachers also get together to plan, discuss and establish goals for improving the delivery of instruction at the school.

Information and Communication Technology (ICT) or Information and Communication Technologies (ICTs). For the purpose of this study, "the term ICT is defined as ways of working with computers, Internet or software that can be applied to teaching and learning" (Jakobsdóttir, McKeown & Hoven, 2010, p. 105).

Multilevel Evaluation Framework is a framework consisting of five levels aimed at evaluating teacher professional development (TPD) (Guskey, 2002). Level one focuses on assessing participation's reactions; level two focuses on assessing participants' learning; level three focuses on assessing organizational support and change; level four focuses on assessing participants' use of new knowledge and skills; and level five focuses on assessing students' learning outcomes (Guskey, 2002).

Open educational practices (OEPs). Hegarty (2015) suggests that OEPs comprise specific attributes such as openness, connectedness, trust and innovation, which when in place can lead to innovative learning processes through use of OER

Open educational resources (OER). For the purpose of this study, OER are broadly defined as "teaching, learning or research materials that are in the public domain or that can be used under an intellectual property license that allows re-use or adaptation (i.e., Creative Commons)" (UNESCO, 2017a, para. 1). However, it is

not implicitly clear in the UNESCO definition that there is a need for OER to comply with Wiley's (2010a; 2013) 5Rs (the right to retain, reuse, revise, remix and redistribute) to be considered authentic open instructional resources. It is the researcher's understanding that for OER to be considered truly "open" they must comply with Wiley's 5Rs through use of open licenses that are within the boundaries of copyright law, such as those afforded by Creative Commons.

Open access. Journals, scholarly articles or e-print (i.e., preprints or postprints) repositories that are freely available to everyone on the Internet (Antelman, 2004).

OER Development Program (ODP). The OER development program that was developed and delivered in a face-to-face format to the participants of the study. The ODP was designed and developed using the design thinking approach and was delivered during teachers' *HTP* activity time.

Open education "encompasses resources, tools and practices that employ a framework of open sharing to improve educational access and effectiveness worldwide" (Open Education Consortium, 2015 para. 2).

Open source software (OSS). Computer software that is freely available, including its source code (Wiley & Gurrell, 2009).

Plano Nacional de Educação (PNE). Brazilian National Education Plan. The plan consists of 10 guidelines and 20 goals that include all levels of education, supporting and emphasizing several of the rights already guaranteed by the Federal Constitution (Brasil, 2014). The PNE sets targets for a decade, and then is renewed

(T. Amiel, personal communication, April 7, 2018).

Teacher professional development (TPD). A long-term process that includes regular formal and informal learning opportunities and experiences planned systematically to promote growth and development in the profession (Villegas-Reimers, 2003).

Twenty-first century teaching and learning. 21 st century education is characterized by: *kindling the fire*; helping students learn to learn; providing learning that is outcome-based; providing instruction that is media driven; fostering active learning; incentivizing collaborative and cooperative learning; having the teacher's role as more of a "guide on the side"; and having schools offer an integrated curriculum (Twenty-First Educator, 2009).

Unified Theory of Acceptance and Use of Technology (UTAUT) framework. A framework developed to assess the likelihood of success of new technology introductions and for promoting understanding of the drivers of acceptance so as to enable researchers and stakeholders to proactively design interventions (Venkatesh, Morris, Davis & Davis, 2003). It is worth noting that "the UTAUT framework applies to adult education. In K-12 there are other technology implementation frameworks that are used such as the Technological Pedagogical and Content Knowledge (TPACK) framework" (C. Blomgren, personal communication, June 20, 2017).

We all live under the same sky but we don't all have the same horizon.

- Konrad Adenauer, *Goodreads.com, 1876-1967*

Chapter 1: Introduction

Introduction and Overview

In German, a person's "horizon" relates to his or her ability to see the whole (Støcker, 2014). If a person's horizon is limited, he or she will see only those things that directly belong to him or her and will not be interested in seeing others' problems, even if those problems affect him or her (Støcker, 2014). The epigraph above encapsulates the notion that despite the fact that many of us live under similar conditions and realities, we tend to think that our problems are the only problems that exist and that other problems are unimportant. A population's collective horizon may be so limited that it may negate access to fundamental rights such as basic education and health services, thereby thwarting the growth and development of a nation.

It can be said that the Brazilian Federal Government's present views on matters of education have a quite narrow horizon. The adverse effects of Brazil's national *realpolitik* characterized by government complacency, systemic corruption, lack of adequate funding and systematic budget cuts have negatively affected the development and growth of public education. Facts and figures corroborate this assertion. For example, the 2015 OECD (Organization for Economic Co-operation and Development) report ranked Brazil 60th out of 75 in Math and Science achievement test scores among 15-year-old students (Faulkner, 2015). "Brazil is in the lowest category of countries for its education, alongside

countries like Peru, Botswana, Saudi Arabia and South Africa" (Faulkner, 2015, para. 2). Additionally, in 2015, due to a severe economic crisis, there was a large budget cut to public education in the actual amount of R$ 10.5 billion (roughly US $ 3.11 million) (UOL Notícias, 2016). In 2016, facing one of the largest recessions in recent times, the Federal government again reduced its Education budget by R$ 1.3 billion (approximately US $ 2.9 million) (Alves, 2016). Although "the quality of schools' educational resources has greatly improved since 2003, a shortage of computers in schools may hinder the development of information and communication technology (ICT) skills among the population" (OECD, 2015, p. 2). The latter not only directly impacts the 45 million students enrolled in Brazil's K-12 public schools but also the teachers who work in these schools (Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira, 2011). There are currently over 150 thousand public basic education institutions in Brazil (Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira, 2016). Moreover, there are earning disparities between workers with different levels of educational attainment, which means that there are large income gaps for people whose highest level of educational attainment is basic education (OECD, 2015). Brazil needs to improve its public education system to meet the skill, knowledge and innovation requirements of a country striving to improve the quality of life for all its citizens and to climb higher on the world stage (Barrionuevo, 2010; Geromel, 2013). Wide dissemination of K-12 education is imperative to promote "innovation in line with the priorities of a renewed social agenda, focused on the knowledge era" (Rossini, 2010, p. 6) and on establishing Brazil as a developed nation.

To fill the gaps of a deficient public school system and democratize access to knowledge by promoting inclusive and equitable education to more citizens, Brazilian educators have recommended increasing the use of open education (dos Santos, 2009; Haddad, 2009; Litto, 2009; Litto, 2014). "The development of Brazil will be quicker, more democratic and safer once its citizens are able to make use of information and knowledge as the main raw material for decision-making, enriching the lives of all citizens" (Litto, 2009, p. 308). Open education is characterized by the sharing of knowledge and resources (de Hart, Chetty & Archer, 2015). It is a mode of realizing education enabled by digital technologies and offers multiple ways of teaching and learning, building and sharing knowledge, as well as a variety of routes of access to formal and informal educational (dos Santos, Punie & Muñoz, 2015). Open educational resources (OER) emerged within the context of open education and hold the potential to lead us toward a new world in education (Olcott, 2013), where all digital learning materials are available free of charge to anyone with access to the Internet (Bates, 2008). This worldview is congruent with the 2012 Paris OER Declaration (UNESCO, 2012), which argues that OER can offer a new dynamic of sharing that will provide potential learning benefits for users, particularly in economically developing regions of the world. The chief objective of the OER movement, therefore, is to "increase access to knowledge and educational opportunities worldwide through sharing educational content" (D'Antoni, 2008, p. 8). The UNESCO OER definition aligns well with the purpose of this study, in which OER are

> teaching, learning or research materials that are in the public domain or that can be used under an intellectual property license that allows re-use or adaptation (i.e.,

> Creative Commons). The potential of opening up educational resources for use and adaptation by everyone, especially those in resource-poor environments, is a great opportunity to achieve quality education for all. (UNESCO, 2017a, para. 1)

This definition for OER is also in harmony with the United Nations' (UN) new resolution, termed the 2030 Agenda for Sustainable Development, which was adopted and signed in September 2015 (United Nations General Assembly, 2015). The new resolution was built on the success of the Millennium Development Goals, which expired in 2015. The UNs' new commitment maintains inclusive, equitable and quality education as a key element of ensuring the sustainability of the planet. It also foregrounds the role of digital technologies as a means to advance human progress, decrease the digital divide, and promote the development of knowledge societies. Nonetheless, UNESCO (2017a) offers us a rather broad definition of OER that may fail to capture the real essence of OER use. Wiley (2010a; 2013) offers a more narrow and comprehensive definition, defining "open" in terms of *5Rs*: ability to *retain* (the right to make, own, and control copies of the content: download, duplicate, store, and manage), *reuse* (unaltered, as is), *revise* (adapt and modify the content, such as a translation), *remix* (combine the original content or revisions, creating something novel), and *redistribute* (share copies of the original, revised or remixed content). For OER to be considered truly open, they must comply with Wiley's 5Rs.

We are living in an era of rapid and profound change, during which needs and opportunities for professional development keep growing as K-12 teachers strive to cope effectively with 21st century teaching practices (Jakobsdóttir, McKeown & Hoven,

2010). Twenty-first century teaching practices encompass technology literacy, inventive thinking, learning to learn, collaborative and cooperative learning, active learning and networked and community learning (Twenty-First Educator, 2009). Twenty-first century teaching practices also include driving educational technology adoption and the use of OER in schools (Johnson, Adams Becker, Estrada & Freeman, 2014). Teachers are increasingly expected to routinely use technology-based and other approaches for content delivery, learner support and assessment (Johnson et al., 2014). Consequently, "modes of teacher education and training created to meet 20th century needs and contexts are wholly inadequate for the 21st" (Moon, 2010, p. 122). In order to keep in pace with 21st century demands, it is important for Brazilian K-12 teacher trainers and educators to consider offering professional development programs that are more aligned with the scenario described above.

Since the 1990s, ICTs have been viewed as crucial levers of innovation in pedagogy (Blanchard, Ryad & Frasson, 2005; Castells, 2010; Jessop, 2000). ICTs are defined as ways of working with computers, the Internet or software, which can be used for teaching and learning purposes (Jakobsdóttir et al., 2010). The K-12 educational system appears unable to keep pace with the increasingly large roles that the Internet and ICTs are playing in our lives. (Johnson, Smith, Levine & Haywood, 2010). Brown (1992) calls attention to the fact that even when educational innovations do reach the classroom, they are often met with significant challenges. Teachers' frustrated attempts "to adopt new practices in the absence of ongoing support, followed by the inevitable decline in use, and the eventual abandonment of the program (Brown, 1992, p. 172) appear to be a common problem for educational innovations. The challenges outlined above strengthen

the mandate to employ OER, as they hold the potential to improve teachers' knowledge and skills with ICTs.

Teacher professional development (TPD) is important in supporting educational innovation that creates lasting improvements in student learning (Borko, 2004; Grubb & Tredway, 2010; Ingvarson, Meiers & Beavis, 2005). Professional development of teachers is considered to be a process that includes regular formal and informal learning opportunities and experiences planned systematically to promote growth and development in the profession (Villegas-Reimers, 2003). Yet, "there seem to be significant issues in education with identifying and providing high quality TPD that will support teachers in meeting the needs of educational reforms" (Ostashewski, 2013, p. 2). Issues in identifying and providing high-quality TPD or proper pedagogical support are particularly likely to surface when new instructional innovations, such as OER use, are introduced (Sáenz, Hernandez & Hernández, 2017). Findings of several studies conducted in the field of TPD have revealed that learning by means of a collaborative, interactive, participatory, and hands-on process enables teachers to not only expand and build on their existing practices but also to correct built-in distortions, misconceptions and beliefs by means of ongoing critical reflection, problem-solving, and meaning-making (Garet, Porter, Desimone, Birman & Yoon, 2001; Grubb & Tredway, 2010; Ingvarson et al., 2005; Villegas-Reimers, 2003).

The digital and dynamic nature of OER hold the potential to enhance both teaching and learning practices by promoting the development of knowledge-creating communities where teachers are afforded opportunities to collaborate, share, discuss, critique, use, reuse, and continuously improve educational content and practice (Casserly

& Smith, 2008; Frydenberg & Matkin, 2007; Geser, 2007; Petrides & Jimes, 2006; Petrides, Nguyen, Jimes & Karaglani, 2008). Despite the widespread diffusion of the Brazilian OER movement, as attested to by a growing number of Brazilian K-12 OER initiatives, the level of adoption of OER into common teaching practices of Brazilian K-12 public school teachers remains quite low (de Liddo, 2010). This is predominantly due to the fact that Brazilian K-12 public school teachers know very little about OER and their potential uses in education (Meier & da Silva, 2015). Teachers have mashed up textbooks, photocopies, pictures, web sites and graphics for many years, despite the fact that most have little, if any, understanding of copyright laws. There is, therefore, need for a legal and pedagogical framework to provide support for actual OER practices. What distinguishes mashing up practices from OER use is that the latter is intended to be be "free to access, free to reuse, free to revise, free to remix, and free to redistribute" (Wiley, 2013, para. 2) through use of open licenses that are within the boundaries of copyright law, such as those afforded by Creative Commons. There are important differences between these and the materials that are proprietary and not created to be freely accessed, reused, revised, remixed and redistributed.

Additionally, OER are primarily delivered through ICTs, which are relatively lacking in developing countries such as Brazil (Nti, 2015). Common barriers to ICT use in K-12 public schools in Brazil center around a lack of adequate technology and infrastructure, such as a reliable electricity supply, physical access to computers, access to the Internet and adequate Internet bandwidth (OECD, 2007). However, ICT implementation and use for educational purposes in Brazil has a long-standing history

that dates back to 1984, when the Ministry of Education (MEC[1]) launched a project entitled EDUCOM[2] (Education with Computer) that was geared towards promoting the creation of pilot-centers in five Brazilian public universities (de Almeida, 2008). "The main goals of these pilot-centers were to conduct multidisciplinary research and build human resource capacity aimed at informing the decision-making process of the use of technology in education" (de Almeida, 2008, p. 26). To enable these pilot-centers to operate, in 1987, the MEC created the FORMAR project that consisted of postgraduate specialization courses aimed at preparing teachers to disseminate and multiply TPD practices focused on using technology in education (de Almeida, 2008). In 1989, the MEC implemented the first national program of educational technology Proinfe[3] (National Programa of Educational Technology). This program's objectives included providing TPD to teachers and technical staff; implementing technology centers for education; providing financial aid for the purchasing of computer hardware; and producing, purchasing, adapting and evaluating educational software (de Almeida, 2008). In 1996, the Brazilian government created the SEED[4] (Secretary of Distance Education) that was geared towards fostering ICT implementation in education. The SEED promoted the creation of programs focused on introducing technologies in schools and in TPD programs. These programs were developed in cooperation with the education departments responsible for articulating state and municipal policies with regards to curriculum guidelines and in undertaking ICT use in Educational Technology Centers

[1] MEC – Ministério da Educação
[2] EDUCOM – Educação com Computador
[3] Proinfe – Programa Nacional de Informática Educativa
[4] SEED - Secretaria de Educação a Distância

and in public schools. Since 2002, there are two specific projects aimed at training school administration for ICT use (de Almeida, 2008). de Almeida (2008) posits that

> The underlying assumption of these projects is that the incorporation of ICTs leads to profound changes in school culture and impacts educators' conceptions, which imply a change of attitude in relation to the pedagogical use of technology and, above all, the integration of ICT-related activities in the school environment. (p. 30)

Since 2010, the Brazilian Internet Steering Committee (GGI.br) has conducted annual studies that evaluate the infrastructure of ICTs available in schools and how these are used by teachers and students. According to a study conducted in 2015 by TIC Educação (ICT Education), data revealed that 93% of the public schools in urban areas possessed some kind of access to the Internet, in contrast to private schools, which all have access to the Internet (TIC Educação, 2015). In the classroom, access to the Internet is available to only 43% of the schools in the public school system, compared to 73% of private schools (TIC Educação, 2015). Limited access to the Internet in public schools has driven many teachers in schools with limited access to use their mobile devices and the schools' computer labs to create educational activities (TIC Educação, 2015). A further complicating vector is that students are not allowed to use their mobile phones or devices in public schools, and 62% of schools with Internet prohibit students from using their Wi-Fi Networks (TIC Educação, 2015). For the Internet to reach its full potential to democratize access to information and facilitate the production, use, distribution and publication of content and digital resources, more investments need to be made in the infrastructure of ICTs in the public school sector.

New policies are also needed to foster innovative education scenarios that enable students to engage in learning experiences outside of the computer lab. Findings of a recent study conducted by Sáenz et al. (2017), which explored how teachers and teacher educators in Colombian schools use and create OER more effectively, also reveal the need for ongoing training and pedagogical support "that facilitates the use of ICTs available in schools and at home, to access, create and share OER (digital resources)" (p. 2). For those Brazilian K-12 public schools that do possess some kind of access to the Internet, continuing education through the use of ICTs can be seen as crucial to improving the professional practice of teachers in light of the demands of 21st century teaching practices.

The 21st century, also known as the knowledge era, comes with the imperative not only to demonstrate that TPD programs can make a real difference for educators but also to equip teachers to effectively deal with innovations in their pedagogical practices. "Real proof of value consists of significant improvements in skills, knowledge, and attitudes for educators and for their students, the ultimate value proposition" (Shaha, Lewis, O'Donnell & Brown, 2004, Abstract). Effective TPD in OER requires a deeper understanding of the relationships between technology tools, rules and policies of school directors, instructional development functions and the communities and networks of practice that underpin course development and course delivery (Porter, 2013).

To conclude, it is important to provide TPD to support the development of OER and research and development initiatives and ensure effective practices (McGreal, Anderson & Conrad, 2015). However, there are currently no ready-made TPD programs for OER uptake in the Brazilian K-12 public school sector. This study fills this TPD gap

by undertaking an intervention in a Brazilian K-12 public school so as to develop and deliver a TPD program for OER uptake. The intervention came in the form of face-to-face design thinking workshops focused on encouraging teachers to rethink their current pedagogical practices and identify challenges to and opportunities for incorporating digital resources. It was aimed at teachers and only indirectly at their students. In the context of this study, digital resources refer to specifically to OER use. However, in general they can also refer to ICT use, which in this context is considered an important avenue to OER use. The following section states the problem addressed in this study.

Statement of the Problem

Major problems facing the Brazilian K-12 public education sector include a lack of adequate funding, low investment in teacher training and a paucity of support for promoting pedagogical change through technology (Comunidade REA-Brasil, 2015; Curso REA, 2013; Rossini, 2010). One of the goals of the Brazilian *National Education Plan* (PNE) 2011– 2020 is to increase the nation's scores in the IDEB[5] (Index of Basic Education Development) for "*fundamental education* (a 9-year cycle divided into two stages: Grades 1–5 (6- to 10-year-olds) and Grades 6–9 (11- to 14-year-olds)" (dos Santos, 2011, p. 19). Strategies to achieve this goal include improving teacher training and developing pedagogical resources, disseminating educational technologies and providing digital technological resources for pedagogical use. As Comunidade REA-Brasil (2015), Rossini (2010) and dos Santos (2011) have argued, OER can be used in all of these strategies.

[5] IDEB – Índice de Desenvolvimento da Educação Básica.

OER are currently present in two goals of the PNE, which was sanctioned in 2014. Furthermore, the Municipal Education Office of the city of São Paulo in Brazil (Population: 11.8 million) has decreed that all educational resources paid for by the city must be OER licensed using a Creative Commons license (Sao Paulo, 2011). Yet, the literature "shows a conspicuous lack of analysis regarding experience with open digital content and OER" (Mota, 2011, p. 6). In the context of OER within the basic education system, statistics show that OER have been used by teachers in different subjects; however, very little research has given guidance as to how or how successfully have they been used (dos Santos, 2011). The continued deployment of OER in Brazil, therefore, demands greater dissemination and practical implementation actions "in order to harness the potential of OER to support the achievement of the national education goals" (dos Santos, 2011, p. 63).

The average K-12 public school teacher faces various barriers and challenges that impact OER uptake. These include readiness for change and innovation (Torres, 2013); possessing technology literacy (Amiel, 2006; Amiel & Reeves, 2008; Amiel, 2013); the way teachers use resources and their power to choose resources (T. Anderson, personal communication, June 20, 2014); and institutional support for innovation (Ferreira, 2014). Because of these various challenges there is a great need for TPD in OER. To overcome these barriers, the literature review underscores *the importance of awareness-raising strategies* (Aguilar, Montoya & de Monterrey, 2013; dos Santos, 2011; Torres, 2013), *capacity-building* (Commonwealth of Learning, 2015; Kanwar, Uvalić-Trumbić & Butcher, 2011; McGreal et al., 2015) and *the need for a paradigm shift in the pedagogical practices of teachers for OER uptake* (Davidson & Goldberg, 2009; Torres,

2013; Umar, Kodhandaraman & Kanwar, 2013; Vaughn, Cleveland-Innes & Garrison, 2013).

Purpose of the Study

To address the problem outlined above, a case study methodology was used to explore a set of evidence-based OER guidelines in the context of TPD for Brazilian *fundamental education* public school teachers, by undertaking an intervention in one school. This intervention was aimed at developing a face-to-face OER Development Program (ODP) for the teachers who participated in this study; a secondary task was measuring the intervention's effectiveness in terms of awareness-raising strategies, content taught and instructional approaches utilized, so as to extract a set of evidence-based guidelines for a TPD program that may more effectively foster the use of OER in this unique, complex environment. Following Stake's (1995) statement, "people and programs are clearly prospective cases" (p. 2), the case study methodology held the potential to probe deeply and investigate the phenomena in its real, specific context. The research focused on the challenges and issues identified by and within the context of one Brazilian *fundamental education* public school in light of the ODP that was offered to its members. The findings of this case study focused on "providing a unique example of real people in real situations and on enabling readers to understand ideas more clearly by presenting them with abstract theories and principles" (Cohen, Manion & Morrison, 2011, p. 289). As the purpose of this study was to work with teachers who teach children from Grades 1 to Grades 9, from here on the term "*fundamental education*" will be used instead of "K-12" in the context of the participants, because it more accurately describes

the setting under examination. Although there is a limited ability to produce general findings from such a small, bounded sample (Cohen et al., 2011), the findings from this case study could prove useful not only for researchers and practitioners working in the Brazilian *fundamental education* public school system, but also for the broader field of those working in K-12 curriculum and pedagogy. The next section introduces the research setting, briefly describes the participants in the study and provides a rationale for selecting this particular group.

Research Setting and Participants

This study took place at a *Fundamental Education* Municipal School located in Osasco, a municipality of the Greater São Paulo area in Brazil, and all academic staff were invited to participate. The school was inaugurated on December 15, 2001 and its academic staff consists of a school director, a vice-director, a pedagogical coordinator and 43 teachers. Even though only one teacher possesses a Master's degree, all other teachers have earned an undergraduate degree in some field of study, possess a São Paulo state teaching license, and are civil servants. Currently, there are 1100 students enrolled in the school. Teachers have a workload of twenty-seven hours per week. Of these twenty-seven hours, eighteen hours per week are devoted to teaching and seven hours per week are allotted for activities such as studying, researching, developing activities or lesson plans, and correcting assignments or tests. In addition to these extra seven hours, all teachers are paid for one-hour biweekly of TPD activity time (*HTP–Horário Trabalho Pedagógico*), which is when the ODP and the focus group interviews were conducted. Before commencing the study, the researcher was informed by the school director that

the school possessed 35 computers in the computer lab and reliable access to Wi-Fi broadband Internet, provided by the city hall of the municipality of Osasco. However, this is not what the researcher witnessed during the TPD program, and in fact there was never any Wi-Fi connectivity when the researcher was on school premises. Teachers did have computers in the teachers' office, but many of these computers were broken or non-operational. The findings of this study corroborated these important infrastructural deficiencies.

There were three main criteria upon which this school was selected. First, the school administration was initially supportive of implementing novel educational practices, as they wanted to be perceived as a model for other *fundamental education* schools in the state of São Paulo. Second, the intervention and the focus groups could be conducted during teachers' one-hour biweekly TPD activity time (*HTP*) on school premises, which meant there were less disruptions to the teachers' daily activities. Third, and most importantly, the school was not currently using OER, and they had not received any formal or informal training in it prior to the intervention.

The next section presents this study's guiding research questions, in order to clarify the purpose of the study.

Guiding Research Questions

The research study questions that drive this study are derived from inquiry into the research problem, review of the related literature, observational field data and collection and analysis of quantitative and qualitative data. The study sought to answer the research questions by measuring the overall effectiveness of the ODP. In a case study, the use of

"how", "what" or "why" questions are ideal to be asked about a contemporary set of events that the researcher has minimal or no control over (Yin, 2009). . The three questions underpinning this research are:

1. What factors influence Brazilian *fundamental education* public school teachers' adoption and use of OER in their professional practices?
2. What role, if any, can TPD play in teachers' OER adoption decisions?
3. Based on research findings from RQ1 and RQ2, what is a set of evidence-based OER guidelines in the context of TPD for public school teachers in Brazilian *fundamental education*?

Having presented these three guiding research questions, the next section addresses the two conceptual frameworks used in this study.

Conceptual Frameworks Used in the Study

Two conceptual frameworks guided this study: the Unified Theory of Acceptance and Use of Technology (UTAUT) framework and the Design Thinking for Educators framework. These two frameworks were geared towards providing the researcher with data that addresses and explores RQ1. This section presents an overview of the two frameworks and provides a rationale for why each was utilized.

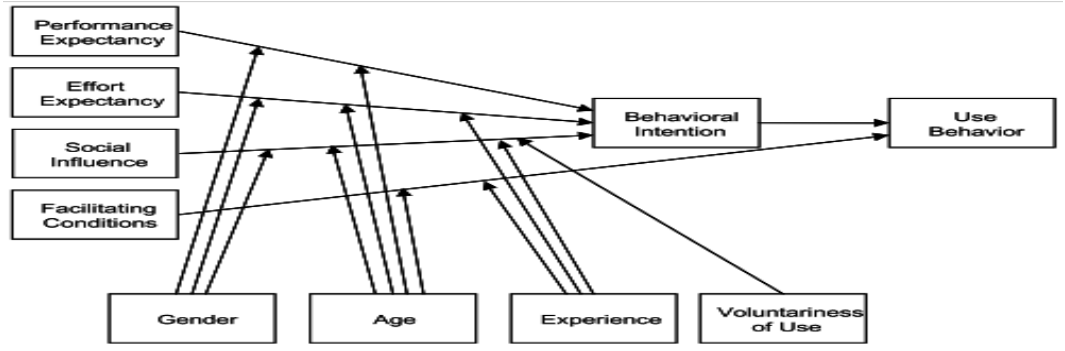
The UTAUT Framework

This case study commenced with an in-depth exploration of the intentions of the stakeholders: the school director, vice-director, pedagogical coordinator, and 46 teachers to adopt and use OER. The UTAUT framework, developed by Venkatesh, Morris, Davis and Davis (2003), was used to inform the development of a quantitative, 5-point Likert-

like scale questionnaire that measured stakeholders' intentions to adopt and use OER, and to gain an initial understanding of what factors facilitate or hinder the use of OER in this particular setting. The UTAUT survey questionnaire is addressed in more detail in *Chapter 3: Methodology*.

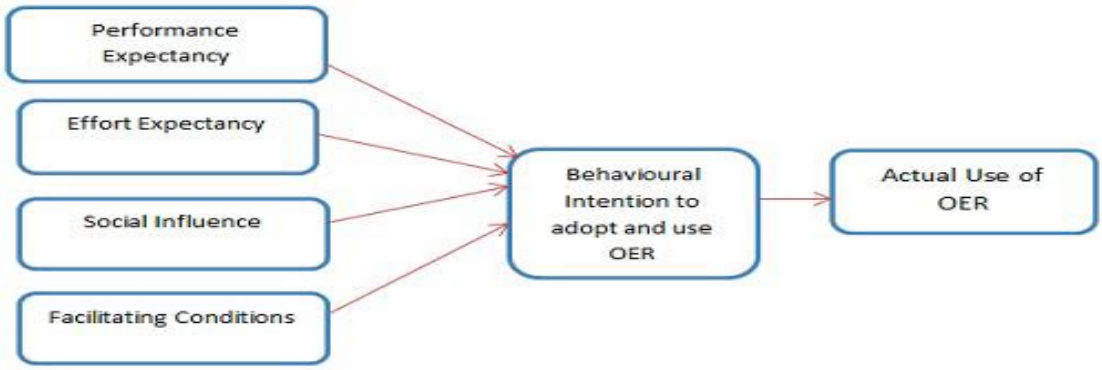
The UTAUT has proven to be a useful tool for assessing the likelihood of success of introducing new technology, and for promoting the understanding of drivers of acceptance, enabling researchers to proactively design interventions (Dulle & Minishi-Majanja, 2011; Im, Hong & Kang, 2011; Oshlyansky, Cairns & Thimbleby, 2007; Percy & Van Belle, 2012; Venkatesh et al., 2003). The framework consists of four key constructs: performance expectancy, effort expectancy, social influence and facilitating conditions. shows the original UTAUT model and its four key constructs. Based on an adapted version of the original UTAUT model, Mtebe and Raisamo (2014) developed a research model focused on assessing how the four key constructs of the UTAUT model impacted behavioral intention to adopt and use OER, leading to actual use of OER. Figure 2 shows Mtebe and Raisamos's (2014) research model, which helped guide this study.

Figure 1. The UTAUT Model



Note. From *User acceptance of information technology: Toward a unified view (p. 447)* by V. Venkatesh, M.G. Morris, G.B. Davis & F.D. Davis, 2003. Copyright V. Venkatesh, M.G. Morris, G.B. Davis & F.D. Davis. Adapted with permission.

Figure 2. Mtebe and Raisamos's (2014) Research Model



Note. From *Challenges and instructor's intention to adopt and use open educational resources in higher education in Tanzania (p.255)* by J.S. Mtebe and R. Raisamo, 2014. Copyright J.S. Mtebe and R. Raisamo. Adapted with permission.

Performance expectancy is "the degree to which instructors believe that using OER will help them enhance their teaching performance" (Mtebe & Raisamo, 2014, p. 254) and is linked with teachers' perceptions of whether OER will increase their teaching effectiveness (Mtebe & Raisamo, 2014). Effort expectancy represents "the degree of effort associated with locating, adapting, and using OER" (Mtebe & Raisamo, 2014, p. 254) and is closely related to instructors' abilities to incorporate 21st century teaching and learning skills (Ochsner, 2010). In stark contrast to 20th century education, 21st century education is characterized by: *kindling the fire* as opposed to *filling the vessel*; helping students learn to learn rather than merely transferring information; providing learning that is outcome-based as opposed to time-based; providing instruction that is media driven as opposed to textbook driven; fostering active learning rather than passive learning; incentivizing collaborative and cooperative learning instead of students working in isolation; teachers' playing more the role of a "guide on the side" than that of a "sage of the stage"; and having schools offer an integrated curriculum, not a fragmented one (Twenty-First Educator, 2009). Social influence represents "the degree to

which instructors perceive how important it is for others to believe they should adopt and use OER" (Mtebe and Raisamo, 2014, p. 254) and is related to readiness for change and innovation. Mtebe and Raisamo (2014) write, "…it is expected that the OER adoption rate will increase if instructors perceive their colleagues in the department or institution management believe they should use it" (p. 255). Facilitating conditions are defined as "the degree to which an individual believes that organizational and technical infrastructure exists to support the use of the system" (Venkatesh et al., 2003, p. 453), such as the availability of computers and reliable Internet, and having the digital literacy and digital skills in order to use OER (Mtebe & Raisamo, 2014). The next section provides a rationale for using the UTAUT framework in this study.

Rationale for Utilizing the UTAUT Framework

There are three primary justifications for using the UTAUT framework to investigate the intention of stakeholders to adopt and use OER. First, in similar studies, both Percy and Van Belle (2012) and Dulle and Minishi-Majanja (2011) reported that the UTAUT model proved suitable in guiding an understanding of the factors that contribute to the acceptance and usage of open access and OER in a research environment. Second, Oshlyansky, Cairns & Thimbleby (2007) validated the UTAUT model over nine culturally diverse countries. Findings of Oshlyansky et al.'s (2007) study revealed that the UTAUT tool is robust enough to withstand translation and to be used in differing contexts without concern for its cross-cultural validity. This result is particularly useful as the current means of explaining cross-cultural differences regarding technology use, interaction and adoption have relied heavily on the use of cultural models that have not been validated in this field of study (Oshlyansky et al., 2007). Third, at the time this

study was conducted, a scale developed by Mishra and Sharma (2015)–the Attitude Towards OER (ATOER) scale - that measures teachers' attitudes, motivations and conceptions of quality and barriers to OER in India (Research on Open Educational Resources for Development, 2015) was still under development. Due to the fact that the scale is still a work in progress and that "the scale validation and reliability work is currently under review" (S. Mishra, personal communication, September 1, 2015), its use was not viable at the time of this research. Finally, the technology acceptance model (TAM), which is a validated and mature model focused on examining technology adoption and influencing variables, "has a narrower scope than the UTAUT" (Im et al., 2011, p. 6). This is because "the UTAUT model has two additional constructs compared to the traditional TAM model: facilitating conditions and social influence" (Im et al., 2011, p. 8), which are useful for assessing the organizational and technical support in place for use of a particular technology and the peer pressure to use this technology (Im et al., 2011). It should be emphasized that the researcher does not view OER as a technology but rather as a set of resources that can be adapted and reused through use of ICTs. As illustrated by Figure 1, the UTAUT framework was chosen to exclusively assess the intention of participants to adopt and use OER, and not to measure user acceptance of technology. The UTAUT framework also suits this study more effectively than the TPACK framework, which is more focused on identifying the nature of knowledge that teachers require to integrate technology into their teaching, a matter outside the scope of this study. This study therefore used the research model illustrated in Figure 2.

The following section describes the Design Thinking Framework that was used for delivering three workshops during teachers' *HTP* activity time during the ODP. Although Design Thinking is not a framework *per se*, the Design Thinking for Educators toolbox contains a structured approach geared towards enabling collaborative activities in the classroom by fostering higher-order thinking and creative skills (Razzouk & Shute, 2012) to solve a specific problem. This approach is particularly useful for enabling "high-impact solutions to bubble up from below rather than being imposed from the top" (Brown & Wyatt, 2010, p. 32).

The Design Thinking Approach

Design thinking is defined as the way designers think: "the mental processes they use to design objects, services or systems, as distinct from the end result of elegant and useful products" (Dunne & Martin, 2006, p. 517). It is also defined as "an analytic and creative process that engages people in opportunities to experiment, create and prototype models, gather feedback and redesign" (Razzouk & Shute, 2012, Abstract). The design thinking approach and process is usually very effective for solving *wicked* problems, a term coined by Horst Rittel in the 1960s (Buchanan, 1992). Wicked problems are a "class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing" (Churchman, 1967, p. 141). An analogy can be drawn between the Brazilian K-12 public school system and its wicked problems. In this social system, which is profoundly marked by conflicting worldviews, values and cultures, teachers are often faced with the need to teach content more effectively, so as to improve students' performances in state and national exams.

The strategies needed for this may be aligned with the values of educational authorities, from the Ministry of Education of Brazil all the way down to the principal/head master, but not with the teacher's values (and vice versa). Particularly when faced with the need for technological change, how this change must be implemented is usually a major cause for disruption. If all stakeholders are not on board and if there is miscommunication and confusion between parties involved, any innovation is likely to falter and fail. Indeed, time and time again, innovations or interventions fail because they are based on neither the needs of the teachers nor of the schools, and "have never been prototyped to solicit feedback" (Brown & Wyatt, 2010, p. 32). Too often, authorities dictate educational policies, changes and innovations without consulting stakeholders in the schooling system (Fullan, 2002). As a result of this top-down approach to innovation, which quite often fails to recognize the importance of teachers' roles in the decision-making process, teachers remain tied to their traditional form of instruction, even when they engage in training and other government-led professional development programs (Benavides, 2015). It is also quite often the case that when researchers go into the field, "they may enter with preconceived notions of what the needs and solutions are" (Brown & Wyatt, 2010, p. 32) particularly regarding solving some of the wicked problems of education. Thus, the design thinking approach not only enables researchers to gain more insight into potential solutions for introducing new professional practices, but also affords teachers multiple opportunities to participate in the process of determining how innovation may be best implemented.

The origins of design thinking date back to 1991, to the founding of IDEO, an international design and consulting company that today has locations in major cities

throughout the world. IDEO was formed as merger between "David Kelley Design, which created Apple Computer's first mouse in 1982, and ID Two, which designed the first laptop computer, also in 1982" (Brown & Wyatt, 2010, p. 33). The company initially focused on undertaking traditional design work, such as designing famous brands of toothbrushes and chairs. However, in 2001, IDEO was requested by a health care organization to help it restructure its organization (Brown & Wyatt, 2010). "This century-old manufacturing company wanted to better understand its clients, and a university hoped to create alternative learning environments to traditional classrooms. This type of work took IDEO from designing consumer products to designing consumer experiences" (Brown & Wyatt, 2010, p. 33).

Since then, design thinking has been used and applied in several fields, including design, business, engineering and industry. Recently, the concept has started to receive increased attention among those interested in "21st century education across disciplines because it involves creative thinking in generating solutions for problems" (Razzouk & Shute, 2012, p. 331). The design thinking approach holds the potential to support students in honing skills such as systems thinking and teamwork, enhancing their overall problem-solving abilities and better preparing them for their college studies and future careers (Razzouk & Shute, 2012). "These [design thinking] skills are consistent with the theoretical traditions of situated cognition (Lave & Wenger, 1991), developmental theories (Piaget, 1969), and constructivism (Bruner, 1990)" (Razzouk & Shute, 2012, p. 331).

Because the design thinking approach is human-centered, collaborative, experimental and inherently optimistic, several K-12 schools have been using it to tackle

challenges related to the design and development of the curriculum, and to effect changes in the spaces of learning environments, in processes and tools and in schools' goals and policies (Design Thinking for Educators, 2013). The distinguishing feature of design thinking as an approach for transforming difficult challenges into opportunities in a K-12 educational system is how it affords educators the ability to experiment with new ways of doing things and to learn by doing in the process (Design Thinking for Educators, 2013). Although there are no fixed or sequential steps in the design thinking approach, since projects may loop back through the refinement of new ideas and directions, Brown and Wyatt (2010) provide a summary of the spaces involved in the design thinking process:

> The design thinking process is best thought of as a system of overlapping spaces rather than a sequence of orderly steps. There are three spaces to keep in mind: inspiration, ideation, and implementation. Think of inspiration as the problem or opportunity that motivates the search for solutions; ideation as the process of generating, developing, and testing ideas; and implementation as the path that leads from the project stage into people's lives. (p. 33)

According to the *Design Thinking for Educators Toolkit* (2013), the design process is characterized by five phases. The first phase comprises the discovery of a challenge and how to best approach it. The second phase comprises how to interpret something that is learned from the discovery phase. The third phase consists of ideation, in which ideas are generated and refined. The fourth phase focuses on experimentation by making prototypes and getting feedback on the ideas that were created in the third phase. Finally, during the fifth phase, stakeholders focus on tracking what was learned during the previous phases and on evolving their prototypes (Design Thinking for Educators, 2013).

As the design thinking process is not linear, it is quite common for unexpected discoveries to arise from these different phases or spaces. "Not only do unexpected discoveries become the driving force for the invention of issues or requirements, but also the occurrence of invention tends to cause new unexpected discoveries" (Razzouk & Shute, 2012, p. 335). It is important for those who are carrying out the design thinking process to alternate between different modes of activity, such as "drawing sketches and conceiving of design issues or requirements that are dynamically related to one another" (Razzouk & Shute, 2012, p. 335). Ultimately, the design activity is characterized as opportunistic in nature, "as the designer pursues issues and requirements in an evolving solution concept" (Razzouk & Shute, 2012, p. 335). How the three design thinking workshops were conducted is addressed in *Chapter 3: Methodology*. The next section provides a justification for using the design thinking approach in this study.

Rationale for Utilizing the Design Thinking Approach

Justifications for using the design thinking approach are as follows. First and foremost, as an outsider to this specific setting, the researcher sought to establish empathy, curiosity, constructiveness and an overall good rapport with the study participants. The design thinking approach enabled the researcher to see problems and challenges through the eyes of participants, which is in line with the interpretive tradition of case study research (Cohen et al., 2011). Moreover, "it was also designed for K-12 schools–not an approach from business or health care that is "adapted for K-12" and hence the framework is likely well suited to be used in another K-12 school" (C. Blomgren, personal communication, June 20, 2017). However, there are no data or figures on how many K-12 schools in Brazil have benefited from the use of this

framework. Second, its structured approach and process through use of spaces and phases enabled the researcher to raise awareness on the use of OER in a more active and collaborative fashion. Rather than delivering direct instruction or lectures on OER use, the design thinking workshops enabled the teachers to identify their own assumptions and challenges regarding OER use in their professional practices, generate potential solutions, reflect on what was learned and refine their ideas in light of the challenges that were brought up. Finally, the design thinking approach held the potential to tap into the capacity of individual teachers, allowing them to solve other school-related issues beyond the scope of our specific study, and promoting divergent thinking, which "is the route, not the obstacle, to innovation" (Brown & Wyatt, 2010, p. 34). Naturally, for it to produce the best results, the approach needs to be embraced by the entire organization, which was not the case in this study, as the school administrators did not participate in the workshops. Nevertheless, the design thinking approach may be viewed an initial step towards action that involves adopting innovation in this particular setting, enabling the researcher to gain a deeper insight into this complex system while at the same time providing teachers with an opportunity to improve and hone their creative, team work and system thinking skills. The use of this learner-centered and district-centered approach also provided the researcher with data that helped inform RQ1. Such insights and skills would not have been attainable if the researcher had opted to deliver lecture-based OER awareness-raising and capacity-building workshops. Moreover, "the design thinking approach models through experiential learning a process that is akin to OER creation and sharing" (C. Blomgren, personal communication, June 20, 2017). It is also worth stressing that the researcher used design thinking as an approach to assess

teachers' volition and responsiveness to changing their pedagogical practices by means of OER uptake. It was not the researcher's intention to impose OER adoption, but rather to provide participants with an opportunity to learn something new, taking into consideration their needs, knowledge and local realities, thereby enabling them to identify the existing challenges and how these could be overcome if they decided to adopt OER. This is in line with Sáenz et al. (2017), who argue that "it is important to promote bottom-up approaches for the adoption of OER in schools through projects that take into account local realities as well as teachers' expectations and local needs" (p. 5). The design-based thinking approach should not be confused with Design-Based Research (DBR).

Having addressed the two conceptual frameworks that guided this study and the rationale for using them, the following section describes the expected outcomes of this study.

Outcomes of the Study

There were two primary outcomes that this study aimed to achieve. First was the development and delivery of an ODP for the teachers who participated in the study. The main goal of the ODP was to raise awareness and build teachers' knowledge regarding OER adoption and use. The ODP, which was comprised of design thinking workshops, is discussed in *Chapter 3: Methodology*.

The second and most important outcome of this study was the development of a set of evidence-based OER guidelines for Brazilian *fundamental education* public school teachers. Qualitative data collection and analysis during the study assisted in informing

how and in which ways this TPD program was or was not effective in helping to extract a set of evidence-based OER guidelines.

This study capitalizes on the potential value of 21st century teaching and learning trends for the development and delivery of the ODP. According to a 2014 school census on K-12 public education undertaken by the Department of Education of the State of São Paulo, there are roughly 5, 000 basic education schools in the state of São Paulo, with over 4 million students enrolled; this accounts for 20.6 percent of all students enrolled in basic education in Brazil (Secretaria da Educação do Estado de São Paulo, 2014). The greater São Paulo area, legally termed Região Metropolitana de São Paulo (RMSP), consists of 39 municipalities, including the state capital, São Paulo. The RMSP, known as a financial and economic center of Brazil, has an estimated population of 22 million inhabitants and is considered one of the ten most populated regional municipalities in the world.

There are a number of advantages to using a case study methodology, and the knowledge and insights gained throughout this study can be of particular interest to policymakers, teacher educators, educators and other researchers. According to Adelman, Kemmis and Jenkins (1980) as cited by Cohen et al. (2011), the case study "begins in a world of action and contributes to it. The insights gleaned from it may be directly interpreted and put to use; for staff or individual self-development, for within-institutional feedback; for formative evaluation; and in education policy making" (p. 292). The findings therefore have potential application beyond the São Paulo municipality, and could be applied in other Brazilian K-12 public school settings, as well as in other developing countries, which face similar challenges (see also Abeywardena,

Chan & Tham, 2013; Amiel, 2013; Amiel & Amaral, 2013; Cobo, 2013; Nie, 2012; Nti, 2015). The following section addresses the scope and delimitations of the study.

Scope and Delimitations of the Study

This study was geared towards providing TPD in OER for teachers from one Brazilian *fundamental education* public school and was therefore learning-centered. The decision to source participants from only one Brazilian *fundamental education* public school may yield interesting data in this particular environment, but also means that the study findings have a limited applicability to other environments, such as those experienced by Brazilian *fundamental education* private school teachers. Accordingly, criteria for excluding certain issues have been determined by whether an issue is sufficiently relevant and important, and/or how feasible it is to investigate a certain topic at the present time. This last point applies especially to items (a) and (e) addressed below.

This study was not intended to address or analyze the following issues: (a) school administrators' policies with regards to OER uptake; (b) student experience and/or engagement with OER; (c) student experience and/or knowledge of ICTs with *per se*; (d) the direct effect of the use of OER on *fundamental education* public school students' learning outcomes; and (e) school administrators' motivation to adopt and use OER. The next section outlines the significance of the study.

Significance of the Study

To quote Parente (2015), "as educators we can choose to continue evolving slowly or we can choose to embrace innovation in order to give new meaning to routines and procedures aimed at enabling our students to understand the social importance of school" (para. 4). This study raises questions about the complex relationship of innovation, the use of ICTs, assembling and repurposing of OER and their instructional implications in the K-12 public education sector, and calls attention to an opportunity for educators to embrace innovation and incorporate new pedagogical practices in their development of instructional material.

OER provide a strategic opportunity to improve the quality of education of K-12 public schools as well as to facilitate knowledge sharing and capacity-building (UNESCO, 2015a). Yet, "research on the impact of OER is generally limited, in the context of K-12 only a handful of peer-reviewed papers and commissioned reports exist" (de los Arcos, Farrow, Pitt, Weller & McAndrew, 2016, p. 24). The potential role of OER in TPD has been highlighted in a study conducted by the Institute for the Study of Knowledge Management in Education on the state of K-12 music OER (ISKME, 2013). Findings from this research indicate that an open approach to teaching music to musicians who have not had any formal training may have positive effects in addressing the demands of 21st century teaching and learning practices, and also foster collaboration and cooperation among peers.

This study contributes to the fields of curriculum and pedagogy by: (a) elucidating new insights on TPD for OER implementation and uptake within K-12 education; (b) raising awareness and building knowledge on OER use in this group; and (c) providing a

set of evidence-based OER guidelines in the context of TPD for Brazilian *fundamental education* public school teachers.

Conclusion

This chapter set the stage for the case study research by depicting the context of the study and discussing the main problems expected therein. Issues and other gaps in the extant literature on TPD for OER adoption and use were also addressed. A mixed-method case study was used, through which an ODP was developed and delivered by the researcher to the participants; upon completion of the intervention, the ODP was assessed to measure its effectiveness.

This chapter also presented the two conceptual frameworks that were used in this study: the UTAUT Framework and The Design Thinking Approach. Justifications for their use were provided, and this chapter briefly discussed how data collected from these frameworks helped inform RQ1, which explored what factors influence Brazilian *fundamental education* public school teachers' adoption and use of OER in their professional practice.

Criteria for ensuring that the ODP was designed to address participants' learning needs and gaps included: raising awareness on OER so as to address participants' misconceptions (Andrews, Leonard, Colgrove & Kalinowski, 2011); using TPD practices that cater to the socio-economic and cultural context of the participants; ensuring that participants understand why and how the use of OER can benefit their instructional

material development practices; and, most importantly, using data gathered from all sources of the study to inform how effective, or not, the intervention was.

The questions that guided this study integrated an investigation into the series of actions related to intervention development and delivery, the many variables and constraints involved and the matter of to what extent they impacted teachers' practices. Ultimately, the goal of the ODP was to provide participants with knowledge on OER so that they would be able to "make informed decisions about making use of OER" (J. Dron, personal communication, February 18, 2016). Changes in attitudes or misconceptions regarding the use of OER were also used to indicate how effective, or not, the ODP was for the participants of the study. By understanding the multiple factors involved in adopting and using OER and their corresponding relationships, this study was able to attain its two primary outcomes: building knowledge on OER and generating a set of evidence-based OER guidelines for teachers. The insights and theories developed herein may be of value to other Brazilian *fundamental education* public schools, Brazilian school administrators and Brazilian policy makers (Stake, 1995).

The remainder of this dissertation is organized as follows. *Chapter 2: Review of Related Literature* provides an in-depth description of the Brazilian K-12 educational landscape, the current status of TPD in the Brazilian *fundamental education* public school system and the theoretical foundations that ground this research. *Chapter 3: Methodology* discusses the research methodology, the research design and quantitative and qualitative data collection and analysis procedures. *Chapter 4: The Design Thinking Workshops: Findings and Discussion* addresses the qualitative findings from the design thinking workshops. *Chapter 5: Focus Groups: Findings and Discussion* presents the main

findings of the focus groups and provides an in-depth discussion of the results. *Chapter 6: The UTAUT Survey Questionnaire: Findings and Discussion* presents a thorough description of the quantitative findings and a discussion of these data. *Chapter 7: Guidelines for TPD on OER* presents information that can provide stakeholders and educators some guidance on actions and procedures that could be used to improve the TPD process and/or mitigate potential problems. These guidelines derive from the analysis and triangulation of quantitative and qualitative data collected during the study. This dissertation concludes with *Chapter 8: Conclusion, Limitations, and Recommendations for Future Research*.

Chapter 2: Review of Related Literature

Introduction

The literature review briefly explores OER and provides a succinct description of interrelated concepts such as open source software (OSS) and open educational practices (OEPs). It also contains an overview of the Brazilian K-12 educational landscape, national education policy and the use of ICTs in education. The review focuses on issues and open questions about OER's potential to fill the educational gaps of K-12 public education in Brazil. It looks at TPD in the Brazilian *fundamental education* public school system in order to outline current policies, practices and challenges, which serve as the backdrop for an analysis of practices in TPD and teacher professional evaluation, with particular emphasis on change, innovation and OER uptake. Next, the review briefly addresses a TPD evaluation framework and an ICT framework, and explains why these frameworks were used to assist the coding of qualitative data collected from the ODP. This is followed by a description of two theories of learning that are consistent with characteristics of certain *effective* professional development programs, both of which underpinned the design of the ODP. In summary, this chapter focuses on research that assisted in the development of the ODP and in the analysis of findings.

The Right to Education and its Relation to Open Education

Education has the potential "to bring about fundamental, social, cultural, political, and economic changes in society" (Spurgeon & Moore, 1997, p. 13), and it is fundamentally characterized by a quest to improve the human condition (Cleveland-

Innes, 2012). The Universal Declaration of Human Rights, Article XXVI, the Brazilian Constitution, and several other frameworks that address Education and Human Rights state that affordable and accessible education to all is a human right. The right to education grants all humans the opportunity to share and learn new information and knowledge; moreover it promotes individual freedom, empowerment and intellectual and professional growth (UNESCO, 2015b). Nevertheless, millions of children and adults in the modern era are deprived of educational opportunities, many as a result of poverty and lack of access to schools (UNESCO, 2015b).

Limited or lack of access to school is undoubtedly the most visible barrier to education. However, there are other barriers to education that are less visible, such as some groups or cultures not perceiving any value in formal schooling, and the fact that formal schooling may inculcate the dominant power structure's political ideology (Amiel, 2012). Freire's (1970) work on *Pedagogy of the Oppressed* and his work with illiterate people lend substance to the notion that a formally educated population becomes more fully aware of their actual circumstances, and will question the status quo, which can be seen as less-than-ideal by those holding power. While education can indeed serve as one of the antidotes to social problems, many public schools in this day and age promote ideologies and methodologies that are often in conflict with the democratic principles implicit in the concept of education (Saviani, 2008). This is largely due to the fact that public schools are legally bound to the dominant power's political ideology. This is the case in Brazil and is true in many other public education systems around the world. For example, although it may be a prerequisite of a curriculum to teach critical thinking skills to students, the ruling authorities are still often the ones who decide which

things are acceptable to be critical about. Therefore, "the power dynamic of the choice of the curriculum and how it is taught is often embedded into the conservative nature of public education" (C. Blomgren, personal communication, June 20, 2017).

There are also structural problems with the current model of basic education, and these affect the quality of education offered (Amiel, 2012). Brazil has faced long-lasting issues related to teacher shortage and insufficient teacher development programs for basic education, which has forced many teachers to conduct activities for which they do not feel prepared (Gatti & de Sá Barretto, 2011). Gatti and de Sá Barretto (2011), for instance, call attention to the crystallization of curricula in teacher preparation courses and to a lack of reliable information on how teacher education is undertaken, supervised and monitored. Against the backdrop of these complications, demand for teachers, especially in basic education, continues to grow in Brazil.

"Open education encompasses resources, tools and practices that employ a framework of open sharing to improve educational access and effectiveness worldwide" (Open Education Consortium, 2015 para. 2) and have the potential to promote continuous formal and informal *lifelong* and *lifewide* learning opportunities to a diverse growing population. That is, OER constitute formal and informal learning opportunities that can occur in multiple contexts, such as work, at home and in our social lives. While the idea of free and open sharing in education is not new, "open education seeks to scale educational opportunities by taking advantage of the power of ICTs, allowing rapid and essentially free dissemination, and enabling people around the world to access knowledge, connect and collaborate" (Open Education Consortium, 2015, para. 4). The use of ICTs enhances collaborative practices and interaction between people in differing

educational settings; these practices may be more comprehensive if they are strengthened by the use of OER (Amiel, 2012; Pereira & Alves, 2015). In line with this, the Cape Town Open Education Declaration (2007) stresses the importance for both educators and learners to actively participate in the open education movement. "Participating includes: creating, using, adapting and improving OER; embracing educational practices built around collaboration, discovery and the creation of knowledge; and inviting peers and colleagues to get involved" (Cape Town Open Education Declaration, 2007, para.7). Lastly, open education embraces the following concepts that are essential for accessing information in the knowledge era: new formats and spaces for teaching/learning purposes that go beyond the traditional classroom format with rows of desks; accessibility for people with special needs; appreciation of different ways of learning (including use of digital devices); the provision of varied and autonomous learning pathways for learners; and the use of OER and free software that allow changes and adaptations for both teachers and students (Comunidade REA-Brasil, 2015).

It is important to stress that the concepts of OER, OSS, and open access are intertwined, as the OER movement does not exist in isolation. As Rossini (2010) states, "free software and free culture are in many ways siblings" (p. 23). She continues, "open access is a knowledge distribution model through which scholarly, peer-reviewed journal articles are made freely and openly over the Internet" (Rossini, 2010, p. 24). Open access publishing of journal articles and research enables teachers and students to have access to the latest research findings throughout the world and build on the findings of others free of cost and other restrictions. Open access publishing therefore is an ideal model for disseminating research publications (Weller, 2013). For software to be open source, it

must be freely distributed, distribution of source code must be permitted, the creation of derivative works must be allowed, and the license must not discriminate against any person, group, or field of endeavor (Wiley & Gurrell, 2009). Accordingly, at the minimum, the triad that supports OER comprises: open access (licenses), open education (learning content), and open source software (technical tools).

In today's society, knowledge has enormous value to individuals and societies; those who possess it are more competitive (dos Santos, 2010) and have broader career options. OER afford multiple ways of obtaining knowledge and information, yet there are many competing definitions for the term "open" in OER, not all of which are commensurate with the underlying principles of OER. The meaning of "open" can carry a number of different connotations, each of which substantially impacts its practice.

For Wiley (2010a), for a resource to be "open" it must be free of cost and there must be permissions such as the right to retain, the right to reuse, the right to revise, the right to revise, and the right to redistribute that resource. These permissions are called the *5Rs*, which have been addressed in *Chapter 1*. According to Wenk (2010), "open" means having:

- the freedom to use the work and enjoy the benefits of using it;
- the freedom to study the work and to apply knowledge acquired from it;
- the freedom to make and redistribute copies, in whole or in part, of the information or expression; and
- the freedom to make changes and improvements, and to distribute derivative works. (p. 435)

Tuomi (2006) has defined openness, particularly in the context of OER, as sources of service that:

> (a) provide nondiscriminatory access to information and knowledge about the resource (level I openness);
>
> (b) can be enjoyed by anyone with sufficient nondiscriminatory capabilities (level II openness);
>
> (c) can be contributed to (level III openness). (p. 34)

Implicit in both Wiley's (2010a) and Wenk's (2010) definitions of "open" OER is the focus on granting permissions regulated by copyright, specifically the use of open licenses. Tuomi's (2006) definition of openness places great emphasis on "sources of services" that provide nondiscriminatory access to knowledge and information to all, thus empowering people while at the same time making them more competitive by virtue of the knowledge they have acquired. However, degrees that are offered by "open" universities that incur costs cannot by definition be categorized as being truly "open." For a service or a resource to be considered truly open it must be available to the public at little or no cost and be licensed under open licenses.

The OER movement sees open education as a human right. In this context, it is expected that access to information includes the possibility of each citizen to interfere, share, recreate, revise, update and finally interact with this information, generating new knowledge and social practices (Curso REA, 2013). "Knowledge and education should be considered common and public goods. This implies that the creation of knowledge, as

well as its acquisition, validation and use, are common to all people as part of a collective societal endeavor" (UNESCO, 2015b, p. 11). Allen (2015) has argued "if the public paid for it, the public should have access to it–and the ability to add value to it" (August, 19, n.p.). One could infer from Allen's argument that the "public" refers to the taxpayers of a particular nation. While (almost) all knowledge, particularly knowledge related to education and research, should be freely available to a country's taxpayers, it would be unreasonable to expect that knowledge generated by other nations would be equally and openly provided to citizens of other nations. This argument can therefore become a tricky one to uphold. However, there is empirical evidence that the use of OER in K-12 education can significantly reduce education costs, and so that it is a wise way of spending taxpayers' money. For example, Hilton, Gaudet, Clark, Robinson & Wiley (2013) "worked with 20 middle and high school sciences who adopted open textbooks to understand the process and determine the overall cost of such an adoption" (Abstract). Findings from their study reveal that if there is an implementation strategy in place for the adoption of open textbooks, then costs can be reduced by over 50% when compared to the costs of using traditional textbooks (Hilton et al., 2013). A research project by de Los Arcos, Farrow, Perryman, Pitt & Weller (2014) across four different education sectors—K-12, college, higher education, and informal education—is one significant example of a study that has found a financial incentive to adopt and implement OER in schools. A key finding of their study is that "88.4% of the learners stated that the opportunity to study at no cost influenced their decision to adopt OER" (de Los Arcos et al., 2014, p. 5). Particularly in developing countries where there is a dearth of quality educational materials, the use and creation of OER holds the potential to expand access,

decrease costs and improve the overall quality of public education (Kanwar, Kodhandaraman & Umar, 2010).

The UNESCO (2017a) argument for knowledge and education being considered a common and public good is in line with the OER movement, which emphasizes the need for each citizen to be able to access high-quality teaching, learning and research resources and to freely use and repurpose these resources. The concept of the Creative Commons comes into play in the above UNESCO argument and ties back nicely to Freire's (1970) work and UNESCO's sustainable development goal number four, which aims "to ensure inclusive and quality education and promote lifelong learning opportunities for all" (UNESCO, 2017b, para. 1). However, there are distinct differences between the concepts of the Commons and of public goods (Bollier, 2011). Bollier (2011) maintains that the term "Commons" is "a set of ongoing practices, not an inert physical resource" (para. 1), which suggests that "the commons is really more of a verb" (para. 1) as opposed to public goods, which can be characterized as a noun that describes "inert physical resources" (para.1). Bollier (2011) summarizes the Commons as "as a general concept describing durable, dynamic sets of social relationships for managing resources -- all sorts of resources: digital, urban, natural, indigenous, rural, cultural, scientific, to use some crude categories" (para. 1). In essence, each Commons has its own unique character that is "shaped by its particular location, history, culture and social practices" (Bollier, 2011, para. 2). This helps explain why *commoners* (actual people) in Brazil have a different view or perspective of the Commons than North Americans or Europeans do (Bollier, 2011). Within this framework, it is up to the *commoners* of a particular country to determine what practices should be implemented, managed and

shared according to their particular geographical, historical, cultural and social norms. The use of OER enables teachers to build upon existing knowledge, generating new knowledge and social practices. The following section addresses some of the advantages of OER use in education and the importance of OER being easily discoverable and accessible.

The Use of Open Educational Resources in Education

The OER movement gained considerable traction after being legitimized by UNESCO's 2012 Paris OER Declaration. The declaration marked a historic moment in the OER movement by advancing 10 recommendations that speak to many aspects of open education, open access and open resources, including the fostering of awareness, facilitation of technological capability, strategy and policy development, encouragement of cultural inclusion, cooperative research and the sharing of resources (UNESCO, 2012). OER increases access to education, converts lurkers into students, accelerates learning and reduces faculty instructional material preparation time (McGreal, 2015). It can also reduce instructional material costs for the K-12 public education sector (de Los Arcos et al., 2014; Hilton et al., 2013; McGreal, 2015). Other tangible benefits of OER use include: increasing teachers' knowledge and skills with ICTs; increasing and promoting the sharing of ideas and collaboration between teachers and students within the school; providing teachers and students with a sense of authorship; obtaining open peer review and timely student feedback, enabling the institution to improve and enhance its curriculum; reaching a wider range of learners through the development of OER that

cater to different learning needs; and enabling institutions to enhance their reputations as innovators at the regional, city or state levels.

It should be kept in mind that "the discoverability of an OER is an important aspect of how *open* it really is. In order for OER to be reused it is necessary for them to be found" (Hilton, Wiley, Stein & Johnson, 2010, p. 4). If an OER cannot be easily discovered and customized to the needs of its users, then it might as well be considered a closed, proprietary instructional resource (Hilton et al., 2010). The following section briefly explores key attributes and characteristics of OER, outlining what distinguishes them from closed proprietary instructional resources.

Key Attributes and Characteristics of OER

"The OER literature tends to be qualitative and descriptive in nature, with a focus on the varying definitions of OERs, copyright and alternative licensing of content" (DeVries, 2013, p. 24). As was stated before, the definition adopted for the purpose of this study was conceived by UNESCO (2017a): "OER are teaching, learning or research materials that are in the public domain or that can be used under an intellectual property license that allows re-use or adaptation (i.e., Creative Commons)" (para. 1). OER may therefore include full courses, course materials, modules, textbooks, streaming videos, tests, software and any other tools, materials or techniques used to support access to knowledge (Atkins, Brown & Hammond, 2007). One shortcoming of the UNESCO definition is that it is not implicitly clear that there is a need for OER to comply with Wiley's (2010a; 2013) 5Rs in order to be considered open. It is this researcher's understanding that for OER to be considered truly "open" they must comply with Wiley's 5Rs through use of open licenses, such as those afforded by Creative Commons.

To this point, "an OER cannot be merely either freely available or openly licensed–it must be both freely available and openly licensed (or in the public domain) to be an OER" (Vollmer, 2012, para. 3). OER proponents have recommended that all OER should be available in open file format to ensure that they are accessible and modifiable by anyone (Lamb, 2009; Wiley 2007). An open file format is a published specification for storing digital data, usually maintained by a standards organization. "Open format can be implementable by both proprietary and free and open source software using the typical software licenses used by each" (Porter, 2013, p. 7). In summary, the key attributes of OER include: that they be in a digitized or printed form (made available on the Internet or via another form of digitized or printed media) in order to be easily distributed and reused; that they be free and open to use, specifically under a licensing agreement, namely Creative Commons; and that they be easy to remix and share (Percy & Van Belle, 2012).

Weller (2010) characterizes OER into two distinct categories, which he has termed "little" and "big" OER: "'big' OER are institutionally generated … These are usually of high quality, contain explicit teaching aims, are presented in a uniform style and form part of a time-limited, focused project with portal and associated research and data" (p. 105). Conversely, "'little' OER are individually produced, low cost resources. They are produced by anyone, not just educators, may not have explicit educational aims, have low production quality and are shared through a range of third party sites and services" (p. 105). Weller's definition of "little" OER can be associated to the advent of the Web 2.0 (social web) during the first decade of the 21st century, which had a substantial impact on open education as it enabled participation, co-production and sharing for all

who had access to the Internet (Weller, 2014). Similarly, Rennie and Reynold (2014) have characterized OER as being either "bottom up" practitioner driven OER or "top-down" institutional driven OER (p. 17).

From the above discussion, one can see the main characteristics that differentiate OER from closed proprietary instructional resources. This discussion turns now to a brief exploration of important concepts associated with the use and creation of OER, which are OSS, open licenses and the move toward OEPs.

Open Source Software and Open Licenses

Open source software (OSS) is computer software that is freely available, including its source code. Examples of OSS software include the Linux operating system and LibreOffice, a powerful office suite. A key feature of OSS and OER use is the rights afforded by *open licenses*. While OSS uses open licenses such as GPL, BSD, Apache and Mozilla, OER use licenses provided through CC licenses (Creative Commons, 2015). Creative Commons is an organization dedicated to promoting open content, and the default licenses for OER, with over 500 million licensed works as of October 2013 (Harmon, 2013). Creative Commons provides different licenses to help creators of content license their work in ways that are compatible with their desire for openness. There are six main provisions of Creative Commons licenses: Attribution, Attribution-ShareAlike, Attribution-NonDerivatives, Attribution-NonCommercial, Attribution-NonCommercial-ShareAlike and Attribution-NonCommercial- NonDerivatives.

Open Educational Practices (OEPs)

The creation and use of OER requires a significant change in practice and the development of specific attributes, such as openness, connectedness, trust and innovation

(Hegarty, 2015). "When in place, these attributes translate in open educational practices" (Hegarty, 2015, p. 3). OEPs constitute the range of practices around the creation, use and management of OER with the intent to improve quality and innovate education (OPAL Consortium, 2011). Conole (2013) considers five principles of openness to be necessary for OEPs, which come in the form of tools and processes that foster: (a) collaboration and sharing of information; (b) connected communication about learning and teaching; (c) collectivity to grow knowledge and resources; (d) critique for the promotion of scholarship; and (e) serendipitous innovation.

Having provided an overview of OER-interrelated concepts, this discussion now turns to their roles and applications in the K-12 school system.

Innovation in K-12 Education

Educators in the K-12 sector are generally associated with the culture of their institution and its mission to produce new knowledge. OER may be viewed as a potentially disruptive innovation in the K-12 sector since their adoption and use may impinge upon educators' learned beliefs, values, practices or customs (Porter, 2013). There are a variety of factors that make up the complex ecosystem of K-12 education, including core values and beliefs about collaboration between institutions, the culture of sharing instructional material between teachers, willingness to use educational technology or other approaches for content development and delivery and institutional and technological support for new pedagogical practices. A key mid-range trend in accelerating educational technology in K-12 schools is the use of OER in classrooms, networks and school communities (Johnson et al., 2014); however, research by Petrides

et al. (2008) has indicated that educators are accessing and using OER materials for self-study but are less likely to take part in other behaviors, such as collaboratively creating new content and reusing others' content. There is also still a limited understanding of effective methods for converting users who do not create content into authors who do (Petrides et al., 2008). A recent study conducted by de los Arcos et al. (2016) investigating how K-12 teachers perceive and use OER, found that "mainstreaming OER in K-12 education is not only a matter of raising awareness but of changing teachers' habits" (Abstract). It is vital, then, that educators possess open mindsets towards innovation in education. These include: being open to change and having the ability to convince others to change; recognizing the value of collaboration, interaction and mutual respect; and being able to commit to solid technology infrastructures that align with the vision and economic realities of their institution (Downes, 2007; Talbott, 2001). OER uptake could also be facilitated by creating a culture of openness within institutions, through a focus on educational practices as well as the resources required for uptake, coupled with systemic investment in training educators to integrate new technologies into the school system (Collins & Halverson, 2009; Ehlers, 2011; Rossini, 2010). Keeping educational content closed will only be proof of a lack of innovation (dos Santos, 2009).

Despite the fact that open education and the use of OER in K-12 education have potential to broaden access to education and thereby promote social inclusion, Lane (2012) cautions that, in reality, access to open education is still exclusive and can lead to disempowerment and enlarge the already existing "educational digital divide" (p. 5). The term "educational digital divide" is used to describe the presence of communities that cannot reap the benefits of open education and/or OER due to economic, social and

cultural factors that limit their access to technologies afforded by the Internet. This notion is corroborated by the findings of a study of the open education movement conducted by Atkins et al. (2007), which found that prohibitively high Internet costs in many parts of Asia and Africa exclude potential learners from using OER. In a similar vein, Daniel and Uvalic-Trumbic (2012) posit that OER can serve as a form of neo-colonial violence, on account of the fact that developed countries are currently creating the majority of OER (Hatakka, 2009). Hatakka (2009) warns that this creates a problematic imbalance between developed and developing countries and their participation in open education. Weller (2014) also cautions against imposing practices via open education when he affirms:

> If OERs are only delivered from large projects out of elite institutions and these are simply accepted wholesale, then academia does not take ownership of any of the issues or opportunities they offer. They remain a practice of others imposed upon the education sector, rather than one owned by it. (p.164)

Thus, open education and the use of OER may widen the educational divide between those who have access to ICTs and those who do not, rather than helping to narrow it (Truong, 2015).

Another challenge to the use of OER relates to the languages most widely used on the Internet. English is the virtual *lingua franca* on the Internet and is often the predominant language (Cobo, 2013; Ou, 2012). Cobo (2013) conducted a comparative study of four OER platforms in English, Spanish, and Portuguese. The findings of his study reveal that, especially in the academic context, the dominant language is English. There are advantages to having a *lingua franca*, as this can be a driver for

communication and collaboration among individuals from different cultures (Cobo, 2013). The use of a single language can however create cultural barriers as well (Stacey, 2007); for example, non-native speakers face difficulties when searching for OER that are provided in a foreign language (Amiel, 2013).

The above challenges result in reduced engagement with OER among certain individuals and groups. These barriers need to be considered when introducing OER in K-12 education. Further researcher is required to find ways to overcome these obstacles in order to maximize the potential learning benefits for stakeholders. Seeking to understand how OER uptake aligns with the needs of Brazilian K-12 educators, the sections that follow provide a concise overview of the Brazilian educational landscape, including the PNE and the use of ICTs for educational purposes.

The Brazilian Basic Educational System

Brazil's basic educational system is divided into preschool, which covers children's social development of children through age 6, and fundamental learning (ensino fundamental), which is an eight-year cycle (for children aged 7 to 14 years) with two stages, grades 1–4 and 5–8 (Rossini, 2010). "National testing is conducted at the end of each stage with an increasingly diversified curriculum and instructional organization during the second half of the cycle" (Rossini, 2010, p. 28). The third division is a three-year intermediate cycle, "ensino médio," which consists of grades 10–12 and is intended for students aged 15–17 (Rossini, 2010). "The National Education Law - LDB (Lei de Diretrizes Básicas) - describes ensino médio as the *final phase of basic education* to which all citizens are guaranteed access" (Rossini, 2010, p. 28). The 1988 Constitution

guidelines and the 1996 National Education Law (LDB) determine that the municipal and state governments share responsibility for financing grades 1–9 (7 to 14 years old), while state governments are primarily responsible for financing grades 10–12 (Rossini, 2010).

The Brazilian National Education Plan (PNE)

The National Congress sanctioned the PNE on June 26, 2014. The PNE calls for 10% of the gross domestic product (GDP) to be devoted to education (Brasil, 2014) and consists of 10 guidelines and 20 goals that include all levels of education, supporting and emphasizing several of the rights already guaranteed by the Federal Constitution (Brasil, 2014). There is also special emphasis on goals 5 and 7, which currently mention the use of OER. Goal 5 aims to familiarize all children with the alphabet in the fundamental learning cycle and goal 7 speaks to the overall improvement in quality of basic education (Brasil, 2014). Currently, programs under the PNE include: "equipping schools with the necessary structure to use computers and Internet connection; enhancing teacher education and training stressing the development of information technology skills; providing open and distance learning opportunities; and offering free and quality digital learning resources" (Rossini, 2010, p. 34). According to dos Santos (2011), the Brazilian Ministry of Education (MEC) foreground the following aims:

- to widen participation at all stages of national education;
- to increase schooling hours;
- to qualify teachers at the graduate level to teach basic education stages; and
- to increase teachers' access to digital content in order to improve teaching quality and the use of ICTs in education. (p. 71)

The Use of ICTs for Educational Purposes

It should be understood that the technological system is not just about devices and networks, but is appropriate in sociotechnical spaces as well (Kling, 2000). Put differently, one cannot determine how a device will be used in all contexts, particularly which configurations will emerge when different groups of people and devices are joined together with varying objectives and activities to undertake. If ICTs are employed taking into consideration the sociotechnical spaces and corresponding constraints of a particular educational environment, they have the potential to empower both teachers and students by enabling equitable and free access to knowledge and information (Wims & Lawler, 2007). There are other compelling arguments in their favor as well. Wims and Lawler (2007) have outlined some benefits to ICT use in education. These include:

> ▪ lending itself to adopting a more personal or learner-centered approach to education;
>
> ▪ facilitating a pedagogical shift entailing an educational interaction between teachers and learners that encourages and supports a meaningful two-way, informational flow between teachers and learners, moving away from the old "banking" method of teaching where knowledge is simply transferred from teacher to student without any space for critical analysis on the part of the learner (cf. Freire, 1968; 1970; 1972); and
>
> ▪ producing ICT-literate students and a versatile, adaptable workforce, which is also consistent with the human capital theory of education. Increasing the skills of the workforce in this way has the potential to benefit the economy at large and also improve the individual student's earning and employment potential. (para. 9)

Additionally, ICTs can be used to "accelerate teacher training; to increase student learning outcomes; to make school curriculum more interesting; and to provide teachers and students with access to educational content and up to date resources" (Wims & Lawler, 2007, para. 10).

Despite these opportunities, studies have revealed that "even in advanced schools in industrialized countries, ICTs are generally not considered central to the teaching and learning process" (World Bank, 2013, para. 1). These findings are not surprising since ICTs may be important but not central to the teaching and learning process of traditional face-to-face K-12 schools. Other major obstacles to ICT use and adoption are related to lack of computers and lack of knowledge among teachers about how to use ICTs (Pelgrum, 2001). These concerns notwithstanding, "there is general consensus that both teachers and students feel ICT use greatly contributes to student motivation for learning" (Trucano, 2005, para. 13) and that TPD in ICT can have a positive impact on ICT uptake (Trucano, 2005). In fact, the use of ICTs has the potential to contribute to student motivation inasmuch as students "help bridge forms of knowledge and literacy by intersecting places of learning–home, school, work and community" (Livingstone, 2012, p. 10). Their use in education also affords teachers and students the possibility of breaking free from the 20th century educational paradigm of fear, isolation and monotony, where for both students and teachers, procedure is emphasized over innovation, uniformity over individual expression and control over empowerment.

A long-lasting difficulty of using technology for educational purposes is that educational planners and technology proponents tend to initially place more emphasis on technology itself and only later investigate the technology's educational applications

(Amiel, 2011; Farias, 2016; Trucano, 2005). Thus, for ICT use to achieve a positive impact, they must be implemented and used taking into consideration the existing pedagogical philosophy of teachers in addition to how the use of ICT can appropriately complement teaching and learning activities. In other words, clear goals must be set for its use (Amiel, 2011; Trucano, 2005). Due to a lack of clear goals for ICT use, misalignment between technology and teachers' pedagogical philosophies and teachers' general lack of knowledge about ICT use (Pelgrum, 2001; Trucano, 2005), most schools end up using available ICTs for menial or simple tasks (Rossini, 2010). Changes in the ways teachers are trained, the way they teach, and the way they are rewarded can promote ICT uptake (Rossini, 2010). Finally, OER are primarily delivered by means of ICTs and the use of OER may improve the skills of teachers with ICTs or other educational technologies (Comunidade REA-Brasil, 2015; dos Santos, 2011; Rossini, 2010).

Another problem Brazil faces with ICT use is related to the fact that the Microsoft software system dominates the education market by often making donations or selling computers at competitive prices to K-12 schools (Rossini, 2010). "Proprietary systems such as Microsoft place major restrictions on their use, such as not allowing users to install software, a problem shared by local administrations and governments" (T. Amiel, personal communication, April 6, 2018). Such restrictions are not aligned with the underpinnings of the OER movement or with OEPs. While OER can be created using closed source systems (closed software and closed applications), there are proprietary issues with doing so that go against the core principles of openness. Yet, "locked-in Web 2.0 apps such as Facebook, Google Docs, Twitter, LinkedIn, YouTube, EdX, Flickr,

Coursera, to cite a few, are potentially very harmful to openness, worse than anything Microsoft ever inflicted" (J. Dron, personal communication, February 18, 2016). Web 2.0 applications and known sites can be therefore categorized into three types of degrees of openness: those that are genuinely open, such as Wordpress blogs, known sites and MediaWiki wikis; those that give the semblance of openness while subtly locking in, or that allow export but subtly constrain re-use, such as GitHub, YouTube, Flickr Commons, EdX and Google Docs; and those "that are positively evil in their closed locked-in models such as Facebook, Office365, and Coursera" (J. Dron, personal communication, February 18, 2016). While the Brazilian education market may be dominated by closed, proprietary systems such as Microsoft and its users may have to forgo using OSS such as LibreOffice, users are still free to use a variety of OSS provided they possess the knowledge and skills to do so.

In sum, there is need for investment in TPD for learning how to teach, develop and deliver content through the use of ICTs. While ICTs hold the potential to motivate student learning, make the school curriculum more interesting, afford equitable access to knowledge and information and increase the skills of the workforce, to name a few of their benefits, there are several barriers associated with the socio-economic, cultural and technical factors of the school environment. It would be unrealistic to undertake an intervention geared towards promoting OER use in a Brazilian K-12 public school system and expect that all teachers would be open and willing to embrace ICT use. It is important to address teachers' misconceptions regarding ICT use in a timely manner. Overall, ICT use is not a one-size-fits-all technology. While there may be cutting edge technology available in the market, some schools may require simpler or more basic

technology to get started. Technology can also be implemented in small increments and according to the available technological-infrastructure so as to slowly increase adoption rates. Finally, there is a need to build a culture for OSS use, which is more in harmony with OER uptake. The next section sets out to examine topics and issues in the literature strictly related to OER uptake in the Brazilian context.

OER in the Context of Brazil: Challenges, Barriers and Opportunities

The review of the literature focuses on examples of Brazilian K-12 OER initiatives in order to provide the reader with information that is relevant to the development and growth of the OER movement in Brazil. Other issues that may impact OER uptake are addressed as well; these include copyright law in Brazil and the importance and role of textbooks in Brazilian K-12 education.

Copyright Law in Brazil

Law n. 9610/98 of the Brazilian Constitution "regulates copyright and adopts the system of exceptions and limitations to grant rights to those who access knowledge" (Rossini, 2010, p. 35). Copyright is "the legal right to be the only one to reproduce, publish, and sell a book, musical recording, etc., for a certain period of time" ("Copyright," 2015, para. 1). However, "the exclusive rights are not absolute; they are limited by exceptions and limitations to copyright law, which refer to situations in which the exclusive rights granted to copyright holders under copyright laws do not apply" (Rossini, 2010, p. 36). Brazil recognizes both moral and patrimonial rights. Currently, Brazil protects copyright for 70 years, starting on January 1st of the year subsequent to the copyright holder's death. "The actual maximum would be the age of the oldest

person, minus the age at which they might produce something plus 70 years, which almost certainly means the potential is over 170 years" (J. Dron, personal communication, 2016, February 18, 2016). "Since Brazil recognizes moral rights; part of these rights–such as the right to attribution–lasts indefinitely" (Rossini, 2010, p. 36). According to Rossini (2010), the exceptions and limitations incorporated into law n. 9610/98 are divided into three groups: "(a) derivative works, (b) partial or full reproduction, and (c) performing rights" (p. 37). Nonetheless, there are no clear and general limitations regarding the use of works specifically for education, such as those developed in countries like the USA and Canada under the fair use statuary exception (Rossini, 2010). Fair use is a legal statuary exception that permits that "portions of copyrighted materials may be used without permission of the copyright owner provided the use is fair and reasonable, does not substantially impair the value of the materials, and does not curtail the profits reasonably expected by the owner" ("Fair use," n.d., para. 1). To illustrate the above point regarding unclear limitations, under the 1940 Brazilian Penal Code, amended in 2003, it is not considered a crime to make a single copy of a work for the private use–without intent of direct or indirect profit–of the copyist (Rossini, 2010). Yet, as Rossini (2010) points out "this still is an infringement at the civil sphere, opening compensations and search and seizure rights to the copyright owner who sees a whole copy of her/his work taken" (p. 38). The lack of clear exceptions and limitations of copyright law for educational purposes and the lack of a uniform governmental copyright policy generate "great uncertainty within groups of teachers in regard to the access, use and copying of resources for educational purposes" (Rossini, 2010, pp. 38–39). Despite the lack of fair use for Brazilian educational purposes, the photocopying of textbooks or

other works and their unregulated distribution to students is common practice in academia (dos Santos, 2012).

The Importance of Textbooks in Brazilian K-12 Education

Choppin (2004) argues that textbooks assume four main roles within the Brazilian K-12 educational context. The first role refers to its use as a reference designed to provide the required support for educational content. The second role refers to the implicit instructional design contained in textbooks that guides the learning process of students by means of activities and exercises. The third and oldest role refers to the condition of textbooks as instruments of ideological circulation and culture, and that reflect the values of the leading social classes. The fourth role, connected to the professional development of the teacher, is document-oriented. The textbook provides text or iconic documents aimed at developing students' critical thinking skills. Thus, in Brazil, a textbook is regarded as an "organized *corpus* with specific objectives, and is rooted in a coherent methodology" (Rossini, 2010, p. 44). "The methodology of teaching with textbooks follows a defined path: the ruling systems make a choice of books that have a direct relationship with the political system and teaching supported by the ruling system" (Rossini, 2010, p. 44).

The Federal Government annually invests millions of taxpayer's Reais (local currency) in the purchasing of textbooks, digital objects for learning and software. Even though these instructional materials are purchased for collective use, they have largely been closed and restricted to public school use (Comunidade REA-Brasil, 2015). Fortunately, this scenario has recently changed; in 2017 a law was approved by the

Brazilian MEC[6] that determines that all supplementary digital material of teachers' textbooks be licensed under a Creative Commons Attribution Non-Commercial License (CC-BY-NC) (Iniciativa Educação Aberta, 2018).

Brazilian K-12 OER Initiatives

The research presented in this section describes a few Brazilian OER K-12 initiatives, particularly those that are under unified open licensing policy and comply with the definition of OER. National K-12 OER initiatives include a wide variety of projects that offer digital educational content repositories, OER and OSS across different subjects to both teachers and students. Some noteworthy initiatives include: *A Física e Cotidiano* (Physics and Daily Life–offers digital education content in Physics to be used as support for augmentation of public teachers' instructional practices); *Ambiente Educacional Web* (Web Educational Environment); *Conteúdos Educacionais Digitais* (Digital Educational Content–offers a wide range of digital and multimedia educational content to enrich the K-12 curriculum); *Currículo+* (Curriculum + - provides videos, animations, games, info graphics and audio samples that can be used to complement the K-12 curriculum of the State of São Paulo); *Escola Digital* (Digital School); *Matemática Multimídia* (Multimedia Mathematics); *Porto Open Courseware* (repository of Open Courseware offered by the school Visconde de Porto Seguro in São Paulo); *REA Dante* (repository of OER offered by the school Dante Alighieri in São Paulo); *Secretaria de Educação do Município de São Paulo* (the Municipal Secretariat of Education in São Paulo offers developed intellectual works focused on educational objectives); Wikimedia Brazil; and *Portal Teca* (provides access to instructional material such as images,

[6] MEC – Ministério da Educação

animations, audio, video and text) (Recursos educacionais abertos, 2015). Other more recent initiatives include: (a) a Portuguese OER booklet/guide geared towards teaching K-12 teachers where to find OER and how to use, create and license it; (b) "EduCAPES, which is a repository of OER and courseware offered by the Open University System of Brazil UAB" (OER Regional Consultation, 2017, p. 11); (c) "Ciênsação, which is an initiative to promote practical experiments in public schools in Brazil all licensed with a Creative Commons BY-SA license" (OER Regional Consultation, 2017, p. 11); and (d) RELiA, the very first OER Brazilian repository, which was launched in April 2018.

This literature review has indicated that issues such as copyright and the importance placed on the use of textbooks in the Brazilian K-12 public education sector have an impact on OER uptake. First, there is a need to educate K-12 public school teachers on copyright law and its application to education. Once teachers have a better understanding of the lack of clear exceptions and limitations of copyright law for educational content, some of them may prefer to use OER so as to avoid breaching copyright restrictions. This issue therefore can be seen as an opportunity to promote OER uptake. Second, although textbooks can indeed serve as useful instruments, particularly for teachers who are beginning their careers, more experienced K-12 public school teachers may prefer to use alternative educational resources to deliver or supplement their lessons. While teachers can decide which textbooks to use, the government, in partnership with universities (and now educational "specialists") has the power to vet them and offer them options. If neither the government nor "specialists" perceive the adoption or use of OER as being positive, this could be perceived as a barrier to OER uptake, since Brazilian public school teachers, K-12 or others, seldom question the ruling

system's decisions. However, if public school teachers are able to perceive the manifold benefits of using OER to supplement their lessons, then there is no need to stop using textbooks, which could themselves be developed as open access.

Having discussed the challenges of, barriers to and opportunities for OER in Brazil, this discussion now turns to the importance of TPD, focusing on a shift that has happened within the movement, away from questions about technical and management details and towards understanding the learner's role in dealing with OER (Dinevski, 2008; Panke & Seufort, 2013).

Teacher Professional Development (TPD)

Use of OER in the learning arena has received relatively little attention to date, a fact that is compounded by several factors that hinder or enable OER adoption for the average K-12 public school, and which stress the need for TPD in OER, as previously addressed in *Chapter 1: Introduction* (Panke & Seufort, 2013). Capacity-building through ongoing TPD is essential to ensure effective practices that result in sustained change and reform for stakeholders. This review begins by identifying the key elements that make up professional development systems, and then considers the current state of TPD in the Brazilian K-12 public school sector. The review looks into how TPD has been effective according to a couple of studies and reports that describe characteristics of TPD programs. Lastly, the review describes the learning theories and recommended TPD practices that laid the foundation for the ODP.

Defining TPD and its Characteristics

Borko (2004) identified the following key elements of professional development systems: "the professional development program; the teachers, who are the learners in the system; the facilitator, who guides teachers as they construct new knowledge and practices; [and] the context in which the professional development occurs" (p. 4). In a broad sense, professional development refers to a person's development in his or her professional role (Villegas-Reimers, 2003). In contrast to career development, which is defined as "the growth that occurs as the teacher moves through the professional career cycle" (Glatthorn, 1995, p. 41 as cited in Villegas-Reimers, 2003, p. 11), professional development includes formal learning experiences (workshops, professional meetings, mentoring) as well as informal learning experiences (reading professional publications, watching television documentaries related to an academic discipline) (Villegas-Reimers, 2003). The concept of professional development is also broader than staff development, which means "the provision of organized in-service programs designed to foster the growth of groups of teachers; it is only one of the systematic interventions that can be used for teacher development" (Glatthorn, 1995, p. 41 as cited in Villegas-Reimers, 2003, p. 11).

These distinctions between the concepts of professional development are important, since for a long time the only form of *professional development* available to teachers was "staff-development" or "in-service training," which usually consisted of workshops or short-term courses that would offer teachers new information on a particular aspect of their work (Villegas-Reimers, 2003). Hence, "only in the past few years has the professional development of teachers been considered a long-term process

that includes regular opportunities and experiences planned systematically to promote growth and development in the profession*"* (Villegas-Reimers, 2003, p. 12).

Villegas-Reimers (2003) conducted a thorough literature review of the most current information on the professional development of teachers in several English and Spanish-speaking countries. Findings of Villegas-Reimers' (2003) comprehensive report demonstrated that this new perspective of professional development has several characteristics that are useful for informing educators and researchers. Villegas-Reimers has provided a description of the characteristics of some *effective* professional development programs, outlined in the following bullet points:

- Based on constructivism rather than on a "transmission-oriented model." This implies that teachers are treated as active learners as opposed to passive learners.

There are, however, caveats associated with this proposition. The constructivist family of theories, linked by epistemological foundations that take it as a given that knowledge is constructed, as well as von Glaserfeld's more radical version, advocate that human beings generate knowledge and meaning from their experiences. From the perspective of constructivism, the activity that generates knowledge is called *operating*, and it is the operating of that cognitive entity that organizes its experiential world by organizing itself (von Glasersfeld, 1984). This implies that we have no access to an objective truth, and that all knowledge is subjective and learner-dependent. Personal knowledge, in this sense, is described in terms of compatibility with the experiential world (Proulx, 2006). As such, one of the key tenets of constructivism is that "understanding is in our interactions with the environment" (Savery & Duffy, 1995, p. 1). Other core principles that drive the constructivist family of theories as applied to

learning include: (a) interactive learning (Huang, 2002); (b) learning as a social, collaborative activity (Panitz, 1996); (c) the role of the instructor as a facilitator of the learning process (Huang, 2002); (d) authentic learning (Mayer, 1999); (e) learner-centered learning and ownership in learning (Mayer, 1999); and (f) high-quality learning that fosters higher-order thinking skills (Huang, 2002).

Following this line of thought, Proulx (2006) has argued that constructivism is not a theory of teaching *per se*, but rather a theory of learning. Put differently, "constructivism brings a proscriptive discourse on teaching, one that sets boundaries in which to work, but does not prescribe teaching actions" (Proulx, 2006, Abstract). Likewise, Davis and Sumara (2003) have asserted that constructivism "says little about what a teacher *must* do, although it does have something to say about what a teacher *cannot* do. In particular, a teacher cannot control learning" (130). This means that constructivism "does not dictate how to teach - it is a perspective on knowing, not a set of theories of teaching or learning" (J. Dron, personal communication, February 18, 2016). Nevertheless, these arguments do not imply that the numerous approaches to teaching, such as problem-solving, discovery learning, project driven learning and even lecturing cannot not be called *constructivist*, or that this perspective on knowing as applied to TPD is in any way negative. Proulx (2006) has further argued that "constructivism sets the ground for an enriched understanding of the learners with whom we interact as teachers, a space of interaction and of teaching in which the learner is considered a 'subject of production' and not an 'object of reproduction'" (p. 14).

Two types of constructivist teaching and learning strategies, which may be used to create an effective TPD learning environment are: Piaget's (1953) cognitive

constructivism and Vygostky's (1962) social constructivism (Powell & Kalina, 2009). "Similarities of both strategies include using inquiry teaching methods that foster learners to create concepts built on existing knowledge that are relevant and meaningful" (Powell & Kalina, 2009, Abstract). Inquiry learning is an approach in which the teacher or facilitator presents relevant, authentic problems or questions and students work collaboratively to solve them (Hmelo-Silver, Duncan & Chinn, 2007). "Differences include language development theory where thinking precedes language for cognitive constructivism and language precedes thinking for the theory of social constructivism" (Powell & Kalina, 2009, Abstract). It is important to make these distinctions, since constructivism is only one approach out of many that can be employed in TPD programs. The remaining characteristics of some *effective* professional development programs Villegas-Reimers (2003) espouses are as follows:

- That it is perceived as a long-term process, as it acknowledges the fact that teachers learn over time.
- That it is perceived as a process that takes place within a particular context. This implies that the professional development program is related to actual classroom experiences and the daily activities of teachers and learners.
- That it is a process that is intimately linked to school reform (Guskey, 2002; Loucks-Horsley, Hewson, Love & Stiles, 1998), as professional development constitutes a process of culture and disposition building (Cochran-Smith & Lytle, 2001; King & Newmann, 2000) that is impacted by the strength of the school's professional community and the coherence of the school program (King & Newmann, 2000).

- That teachers are conceived of as reflective practitioners, people who enter the profession with a certain knowledge base, and who will acquire new knowledge and experiences based on that prior knowledge (Schön, 1983). The reflective practitioner is one who can think while acting and thus respond to the uncertainty, uniqueness and conflict involved in the situations in which professionals practice (Schön, 1983). Nonetheless, Freire (1970) suggested that consciousness alone is not sufficient; it must coexist with meaningful *praxis*. Praxis may be defined as the dialectical union of reflection and action (Hoffman-Kipp, Artiles, & López-Torres, 2003); praxis is at the heart of human nature since human activity "consists of action and reflection: it is praxis; it is transformation of the world. And as praxis it requires theory to illuminate it" (Freire, 1970, p. 96). The dialectical union of reflection and action (Hoffman-Kipp et al., 2003) relates to Schön's (1983) concept of reflection-in-action.
- Professional development is conceived as a collaborative process wherein teachers integrate theory with classroom practice (Darling-Hammond & McLaughlin, 1995).
- There is not one form or model of professional development that is better or more appropriate to implement in any institution, area or context. Professional development has to be considered within a framework of social, economic and political trends and events (Woods, 1994 as cited in Villegas-Reimers, 2003, p. 15).

The findings of Villegas-Reimers' (2003) study resonated with those of Grubb and Tredway (2010), who also stressed the importance of carrying out more participatory, teacher-generated professional development. Indeed, learning may be defined as the

process of making a new or revised interpretation of the meaning that guides subsequent understanding, appreciation and action (Mezirow, 1990). As Mezirow (1990) contended, "we learn differently when we are learning to perform than when we are learning to understand what is being communicated to us" (p. 1).

In sum, collaborative, interactive, participatory and hands-on learning may be more conducive to meaning-making and ongoing critical reflection problem-solving than passive learning, working in insolation and information transfer learning are. Malcom Knowles' (1984) theory on Andragogy provides a conceptual framework for this argument. Andragogy, the science of adult learning, emphasizes the role of the adult educator as a facilitator who is responsible for creating a comfortable physical climate as well as a psychological climate of mutual trust and respect, collaboration, supportiveness, openness, authenticity and pleasure (Merriam, 2001). According to Merriam (2001), there are five underlying assumptions in Andragogy, which describe the adult learner as a person that:

1) has an independent self-concept and is able to direct his or her own learning;

2) has accumulated a reservoir of life experiences that is a rich resource for learning;

3) has learning needs closely related to changing social roles;

4) is problem-centered and interested in immediate application of learning; and

5) is motivated to learn by internal rather than external factors. (p. 5)

While Andragogy is intended to facilitate a learner-centered approach, not all adults are self-directed. In fact, some adults are "highly dependent on teachers for structure and may be externally motivated to learn, as in attending training sessions to keep their job,

for example" (Merriam, 2001, p. 5). With this in mind, TPD programs should also include a more structured, teacher-centered approach that caters to the needs of those adults that are not self-directed. Moreover, "teachers are also very busy professionals and being pragmatic they may prefer a teacher-centered approach because it is familiar and may save time–which of course they never have enough of" (C. Blomgren, personal communication, June 20, 2017).

The recommendation for working collaboratively as opposed to working in isolation so as to foster meaningful learning and ongoing critical reflection problem solving resonates with collaborative learning. For the sake of clarity, it is important to distinguish between collaborative and cooperative learning. While collaborative learning "is based upon consensus building through cooperation by group members" (Panitz, 1999, p. 4), cooperative learning consists of "a set of processes which help people interact together in order to accomplish a specific goal or develop an end product, which is usually content specific" (Panitz, 1999, p. 5). Collaborative learning specifically refers to an instruction method in which teachers or students work together in small groups toward a common goal. "The teachers (or students) are responsible for one another's learning as well as their own. Thus, the success of one teacher helps other teachers to be successful" (Gokhale, 1995, para. 1). Moreover, group diversity in terms of knowledge and experience is a factor that positively affects the learning process (Vygostky, 1978). Having identified the key elements that make up any professional development system and addressed a learning theory that provides clearer grounding to characteristics of some *effective* TPD programs, the next section focuses on the state of TPD in the context of

Brazilian *fundamental education* public schools, outlining its current policies, practices and challenges.

TPD in the Brazilian *Fundamental Education* Public School System

Teacher education in Brazil has suffered from long-standing challenges. First, the education curriculum does not prepare teachers to effectively teach upon completion of their bachelor's degrees (Brzezinski, 2008; Freitas, 2002; Gatti, 2008; Kuenzer, 1998; Saviani, 2009). The reality of the figures of the so-called "lay teachers" teaching in *fundamental education* is astounding (Brzezinski, 2008). "Lay teachers" are individuals who neither possess an undergraduate degree in Education nor have had any previous formal teacher training. Research in the field indicates that the number of "lay teachers" working in public schools has substantially decreased over the years due to several government TPD initiatives, from "64.830 in 1995" (INEP/MEC, 1995 as cited in Brzezinski, 2008, p. 1151) to 45.000 in 2001 (de Menezes & dos Santos, 2001).

In Brazil, the federal, state and municipal governments are responsible for the organization of the Brazilian educational system. National education policies implemented by "The National Education Law—LDB" (Lei de Diretrizes Básicas), "The National Curriculum Guidelines for Licentiate" (Diretrizes Curriculares Nacionais para os Cursos de Licenciatura) and institutional actions and policies of the "National Council of Education–CNE" (Conselho Nacional de Educação) and the "Coordination for the Improvement of Higher Education Personnel"–CAPES" (Coordenadoria de Aperfeiçoamento de Pessoal de Nível Superior) are all aimed at providing formal and informal TPD programs. A wide variety of TPD programs are also offered by State and Municipal Secretaries of Education, and by non-profit organizations. The vast majority

of these programs are geared toward making up for the deficiencies of higher education by providing ongoing professional development and have been somewhat successful in reducing the rates of "lay teachers" in the public school system (Brzezinski, 2008; Gatti, 2008). Under the umbrella of TPD programs that are currently offered to beginner or pre-service teachers, there are courses such as a variety of extension courses; professional diploma degree programs; post graduation degree programs (not Master's or Doctoral degree programs); and other courses held during the teachers' *HTP* activity time (Gatti, 2008). Some of these courses are offered entirely online, some are offered in a blended-learning format, and others are offered through printed materials as well (Gatti, 2008). Whereas in most developed countries TPD is provided due to the constant need to be updated on new knowledge afforded by ICTs and changes in the work world, in Brazil TPD is still focused on supplementing knowledge and skills to pre-service teachers who received low-quality, poor or no prior formal education (Brzezinski, 2008; Freitas, 2002; Gatti, 2008; Saviani, 2009). Put differently, TPD that focuses on enhancing teachers' skills and knowledge to deal with 21st century learners is sporadic. This type of TPD, also known as the "deficit approach," is generally viewed as being a solution to problems that arise in the public school network due to teachers' lack of a solid educational background. It is important to underline that the socio-economic gap between states and different regions in Brazil is tremendous. Better TPD results have been observed in less-developed regions of the country, where more interventions are needed, compared to developed regions where there appears to be less enthusiasm for these interventions (Davis, Nunes & Almeida, 2011; Gatti, 2008). This is largely due to the fact that teachers

coming from more developed regions usually received better formal education and training than those coming from less-developed regions of the country.

There is also controversy as to whether the TPD programs offered to teachers do indeed improve students' learning outcomes (Davis, Nunes & Almeida, 2011). In a study conducted by Davis et al. (2011), which focused exclusively on the choices for a TPD program by State and Municipal Secretaries of Education, the researchers found that a common and recurring practice by all secretaries was to provide TPD based on the results of three state and national exams: the *Evaluation System of Basic Education* (SAEB)[7], the *National Exam of High School* (ENEM)[8], and above all, on the marks for the *Index for Basic Education* (IDEB)[9]. These findings are consistent with a series of field case studies undertaken by André (2015) in several state and municipal *fundamental education* public schools where the main focus was on offering TPD programs in Portuguese Language and Math, which are the two main subjects of these exams. The Federal Government's programs are the main drivers for TPD programs. Findings from Davis et al's. (2011) study have also indicated that: (a) there is a need for qualified teams to undertake professional development; (b) the ability to count on a team of professionals that already work in the public school system leaves the state or municipal secretary less susceptible to eventual changes in the government administration; (c) the types of TPD considered to be most effective are long-term interventions held regularly on school premises; (d) no TPD programs were found that were geared toward strengthening or increasing teachers' ethical or professional stances, and neither did they focus on responsibility for the collective or on citizenship issues; (e) in general terms the state or

[7] SAEB – Sistema Nacional de Avaliação Básica.
[8] ENEM – Exame Nacional do Ensino Médio.
[9] IDEB –Índice de Desenvolvimento da Educação Básica.

municipal secretaries do not evaluate teachers upon completion of the TPD program; and (f) there is no follow-up or assessment of work carried out in the classroom once the TPD program has terminated (Davis et al., 2011). Ultimately, this lack of systematic evaluation and follow-up makes it difficult to determine whether the TPD program has indeed improved students' learning outcomes.

During the past few years there has been an increased interest in TPD in Brazil, which is evidenced by the number of studies that have been conducted in the field of education. In fact, research in this field has grown from 6% of all published works in the 1990s to 22% in the 2000s (André, 2015). Despite this, specific policies for TPD that take into account factors such as available resources in schools; a school administration that provides physical, emotional, and pedagogical support; a dignified salary, adequate working conditions; and attractive career options have received little, if any, attention (André, 2015). This is very much in line with the findings of Davis et al.'s (2011) research, which underscores the responsibility of the pedagogical coordinator in regard to teacher education. The pedagogical coordinator plays a central role in articulating the TPD program in the school, which should focus on the development of the pedagogical team as a whole and not only on the teacher (Davis et al., 2011). However, the pedagogical coordinator is not always able to undertake this role, since there are times when he or she needs to focus on government programs, which have priority. There are also instances in which groups of teachers resist the TPD program that is suggested to them (André, 2015; Davis et al., 2011). The pedagogical coordinator has other duties in the school, including overseeing the preparation and implementation of the political-pedagogical project and monitoring the development of the curriculum and teaching and

learning activities (André, 2015; Davis et al., 2011). This rather broad scope often compromises the pedagogical coordinator's work and negatively affects teacher training and collaborative actions between teachers (André, 2015; Davis et al., 2011). Ideally, a TPD program should be designed to encourage teachers to work collaboratively toward implementing changes in schools. Thus, it is important to highlight that the provision of TPD is an important factor in the professional development of the teacher, albeit not the only one. Factors such as salary, career and the ability to actively take part in the decision-making process as well as the work environment are equally important (André, 2015). In the absence of free time, teachers are sometimes required to leave class to participate in TPD programs, which is an issue. Efforts to resolve this by delivering TPD programs at night or during weekends also greatly increase teacher resistance (André, 2015).

The Federal Government should be giving more attention to policies that support new teachers in conjunction with partnerships established between universities and schools (André, 2015; Saviani, 2009). According to Nóvoa (2007), Brazil takes very bad care of new teachers, since when they start working they are often sent to the worst schools, work during the worst hours and supervise the most problematic students. As Nóvoa (2007) says:

> If we are not able to build forms of integration that are more harmonious and more coherent for these teachers, we are going to emphasize, in these early years of profession, an individual survival dynamics, which leads to an individualistic, closed teacher. (p.14)

The challenges in implementing TPD in the Brazilian *fundamental education* public school system should be addressed by the government, in the form of efforts to reformulate the nation's educational system by investing more in basic public education and by providing more opportunities for professional development. Teachers do not have the power to change the current status of education by themselves. However, more investment, more support from the administration and more ongoing TPD programs may enable teachers not only to be better prepared for their work but also to contribute to the construction of schools by being better prepared to propose and implement the actions that are required for change. The next section explores some *best practices* in TPD.

Best Practices in TPD

During the past decade, a considerable body of literature has emerged describing some *best practices* in professional development. Although there has been a great deal of research into alternate TPD, "moving away from the traditional in-service teacher training model" (Avalos, 2011, p. 17), "this research is scattered and does not give one clear direction" (C. Blomgren, personal communication, February 18, 2016). "This is equally true of almost all educational research where alternative approaches are likely at least common as mainstream approaches" (J. Dron, personal communication, November 13, 2017). Avalos (2011) conducted a review of studies on *Teaching and Teacher Education* over ten years (2000–2010). Avalos' review indicates several factors that impact the complex process of teacher learning and development. Avalos (2011) finds that:

- At the center of the professional development process, teachers continue to be both the subjects and objects of learning.

- The way in which teachers engage in professional development depends largely on their learning needs, traditions, cultural mores, policy environments and school conditions.
- Diverse formats of professional development have effects of some kind or degree, yet little is known about how pervasive any change may be and to what degree it sustains continuous efforts to move ahead.
- Prolonged interventions are more effective than shorter ones, and combinations of tools for learning and reflective experiences serve this purpose better.
- To move from co-learning through talk to co-learning through observation and feedback is necessary as well as effective. This underlines the need for networking, interchanges, peer coaching or support collaboration and joint projects among schools for educational purposes. (pp. 17–18)

While what constitutes high-quality TPD is obviously open to debate and may be predominantly determined by educational context and its underlying constraints, "research that has been conducted, along with the experience of expert practitioners, provides some preliminary guidance about the characteristics of high-quality professional development" (Garet et al., 2001, p. 917) (see also Loucks-Horsley, Hewson, Love & Stiles, 1998). Earlier research on TPD conducted by Hiebert (1999) has determined several core features of the learning of new teaching methods:

- ongoing (measured in years) collaboration of teachers for purposes of planning;
- with the explicit goal of improving students' achievement of clear learning goals;
- anchored by attention to students' thinking, the curriculum, and pedagogy;

- with access to alternative ideas, methods and opportunities to observe these in action and to reflect on the reasons for their effectiveness. (p. 15)

Professional development for teachers is recognized as a vital component of policies aimed to enhance the quality of teaching and learning in schools. As a result, there is increased interest in research that identifies features of efficient professional learning (Ingvarson et al., 2005).

In a large-scale empirical comparison study conducted by Garet et al. (2001) with 1,027 mathematics and science teachers from the federal *Eisenhower Professional Development Program*, researchers concluded that there are three core features of professional development activities that have significant and positive effects on teachers' self-reported increases in knowledge and skills and changes in classroom practice. These include: (a) focus on content knowledge; (b) opportunities for active learning; and (c) coherence with other learning activities such as connections with goals, alignment with state and district local policies and communication with other teachers engaged in similar initiatives. It is primarily through these core features that the following structural features substantially affect teacher learning: (a) the form of the activity (e.g., workshop vs. study group); (b) collective participation of groups of teachers from the same school; and (c) the duration of the activity (Garet et al., 2001).

Research on professional development indicates that focusing on subject matter content and how students learn is vital in improving teacher practice (Garet et al., 2001). Since activities focus primarily on new curricula, new teaching methods or new instructional material development methods, "focusing on students also helps keep

teachers and administrators from spending crucial time on peripheral issues that can distract them from this central goal" (Guskey, 1997, pp. 36). This is due to the fact that many Brazilian teachers, especially novice teachers, lack strong content-specific teaching skills. As Rhine (1998) stressed, "[r]eform-minded teachers are hungry for continuing education that provides novel ways to address content" (p. 27). Active learning can be promoted by providing opportunities for teachers to become actively engaged in meaningful discussion and communication with other teachers, planning new activities for classroom implementation and through practical implementation actions. Findings from a number of studies corroborate the notion that active learning should be consistently fostered in professional development programs (Garet et al., 2001; Grubb & Tredway, 2010; Ingvarson et al., 2005). However, what active learning really means or entails is not always clear, and the concept warrants a definition. Andrews, Leonard, Colgrove and Kalinowski (2011) have defined active learning as a process "that essentially occurs when an instructor stops lecturing and students work on a question or task designed to help them understand a concept" (p. 394). Andrews et al. conducted a study with introductory biology students from 77 higher education institutions to assess the effectiveness of using active learning to teach students. The study gleaned two important insights. First, "no one can assume they are teaching effectively just because they are using active learning" (p. 403). It is necessary for teachers to "carefully assess their instruction to determine whether active learning is reaching its potential" (Andrews et al., 2011, p. 403). Second, instructors need to address students' misconceptions regarding preexisting ideas about learning so that more meaningful learning can take place (Andrews et al., 2011). The researchers concluded that "active learning is not a

quick or easy fix" (p. 403) for teaching and learning any subject. "Effectively using active learning requires skills, expertise, and classroom norms that are fundamentally different from those used in traditional lectures" (Andrews et al., 2011, p. 403). Such findings indicate that success may be more dependent on how skillfully teachers use active learning than what approach is actually used. Put differently, any teaching strategy may be effective provided that the teacher possesses the knowledge and skills to use it.

Finally, "a professional development activity is more likely to be effective in improving teachers' knowledge and skills if it forms a coherent part of a wider set of opportunities for teacher learning and development" (Garet et al., 2001, p. 927). A major dimension of this coherence is related to the "ways in which professional development activities encourage professional communication among teachers who are engaged in efforts to reform their teaching in similar ways" (Garet et al., 2001, p. 928).

The researchers defined a workshop as a structured approach to professional development, which "generally involves a leader or leaders with special expertise and participants who attend sessions at scheduled times and is generally held after school, on the weekend, or during the summer" (Loucks-Horsley et al., 1998, pp. 42–43). In contrast, reform activities such as mentoring or coaching usually take place during regularly scheduled teacher planning time (Garet et al., 2001). Garet et al. (2001) argued that by locating opportunities for professional development within a teacher's regular workday, reform types of professional development may foster deeper connections with alternative instructional material development practices, "which may be easier to sustain over time" (p. 921). By focusing on a group of teachers from the same school, professional development may help sustain changes in practice over time, as the newly

acquired knowledge and practices can be transmitted to new faculty members. Other benefits of collective participation are the contribution to a shared professional culture and the fostering of debate and improved understanding (Ball, 1996).

In a similar vein, a study by Ingvarson et al. (2005) reported on the effects of structural and process features of professional development programs on teachers' knowledge, practice and efficacy. The authors' findings were based on four studies conducted during 2002–2003 undertaken through the *Australian Government Quality Teacher Program*, designed to enhanced teacher quality (Ingvarson et al., 2005). Their study was similar in methodology to that of Garet et al.'s (2001) study. Ingvarson et al.'s (2005) study corroborated the findings of Garet et al.'s, concluding that content focus and active learning have a significant impact on knowledge. Although Ingvarson et al. did not include a measure like Garet et al.'s *coherence*, they did include a measure of the extent to which a professional development program facilitated the development of a professional community at the school level, which turned out to be a significant mediating variable. Both studies support the findings of the report written by Villegas-Reimers (2003) on the characteristics of *effective* professional development programs including the following: active learning, collaborative learning, community building to foster learning, the need for coherence in a school program and the development of a professional development program that is aligned with the school's objectives and jurisdictional-level/region curriculum standards. This section examined how TPD has been effective in a couple of studies; the next section delves into best practices and approaches for TPD when implementing OER.

Best Practices in TPD for OER Uptake

Unwin (2005) and Davis, Preston and Sahin (2009) proposed some best practices and approaches for teacher education when implementing technology and new educational practices, such as OER initiatives in the school system. The researchers suggested that *effective* TPD programs are those that:

- focus on pedagogy, rather than technology, promoting active, independent, inquiry-based and collaborative classroom learning, and exploiting the potential of OER to support it;
- provide ongoing, collaborative and active learning opportunities for teachers;
- are culturally and locally contextualized, through being based in teachers' own schools and classrooms, incorporating tasks linked to participants' professional practices and the curriculum; and
- infuse technology into an entire teacher education program using blended solutions.

These propositions are aligned with the results of studies conducted by Petrides et al. (2010) and Haßler, Hennessy and Lubasi (2011). Findings of the study carried out by Petrides et al. have implications for "how OER can be integrated as a model for innovation in teaching–particularly in terms of the design and implementation of professional development and models" (pp. 5–6). Teacher knowledge sharing, collaborative learning, access to sharable, adaptable resources and ongoing support are central to the design and implementation of a professional development program that focuses on building capacity for OER. Further, Petrides et al. also stressed the

importance of identifying and assessing ways to inspire teachers - beyond an initial group of OER leaders or champions - to form OER communities around personal teaching challenges and pedagogical approaches for collaborative problem-solving. Haßler et al. (2011) concluded that it is important for teacher development programs to model interactive pedagogical approaches as well as school-based learning opportunities and research support. Finally, Moon (2010) has suggested that resource production, rather than mere use, can ensure good learning outcomes and the improvement of teacher morale and motivation can benefit from a communal rather than individualistic response. On par with ensuring best practices in TPD for OER is ensuring effective evaluation of TPD programs by reflecting on expected, unexpected, good and bad results. One of the goals of evaluating any TPD course is to assess whether or not the learning objectives are achievable (Dede, Ketelhut, Whitehouse, Breit & McCloskey, 2008; Desimone, 2009; Guskey, 2000; Muijs & Lindsay, 2008); the following section discusses how evaluation of TPD is not fully explored and presents a framework for evaluating change and innovation in a school system.

Evaluation of TPD

While there is consensus among professionals that TPD is vital to ensure effective practices and foster reform activities, evaluations of its impact are rarely undertaken in a systematic and focused manner (Guskey, 2000; Muijs & Lindsay, 2008). “The research evidence about evaluation practices in relation to teacher professional development shows that current practice in many cases is limited in a number of ways” (Muijs & Lindsay, 2008, p. 196). Moreover, although the field of education has made great

progress "in defining what counts as professional development, as well as delineating the conceptualizations of how TPD works, more work is needed on which aspects of teacher knowledge are critical and how to measure them" (Desimone, 2009, p. 191). For example, "currently much research on how a teacher's classroom practice is affected by professional development is based on self-reports" (Dede, et al., 2009, p. 15). As Dede et al. (2009) point out:

> Although self-reports offer one kind of insight—namely a teacher's perspectives on his or her own practice—they do not provide data that can be used to assess teachers' knowledge or compare teachers' practices to a standard or to goals for improvement or to other characteristics that a researcher might wish to observe. (p. 15)

Thus, "the field needs to refocus priorities and develop additional measures of teacher change that are more objective to complement self-reports, and funding needs to be provided for this purpose specifically" (Dede et al., 2009, p. 15). Guskey (2000) also criticized the way TPD evaluation is usually undertaken and outlined a list of the limitations of TPD evaluation, which can be summarized as follows:

> 1. Most "evaluation" consists merely of summarizing the activities undertaken as part of the TPD program: courses attended, credits accrued etc. This clearly gives no indication of the effectiveness of the activities undertaken, making this form of data collection inadequate for examining the effects of TPD.

> 2. Where some kind of evaluation does exist, it usually takes the form of participant satisfaction survey questionnaires. While these surveys allow one to measure whether participants consider the event to have been enjoyable and successful, this method rarely engages with issues such as gains in knowledge or noticeable changes in practice expected from the TPD program. In addition, these surveys fail to evaluate whether there have been associated changes in student learning outcomes.
>
> 3. TPD evaluations are also typically brief, one-off events, often undertaken post hoc. As most meaningful change will tend to be long-term, and many TPD activities will take place over a longer period of time, evaluation efforts need to reflect this and likewise take place over time. TPD Evaluation also needs to be built in to run alongside professional development activities. (pp. 8–10)

Desimone (2009) weighed the pros and cons of different evaluation measures of TPD such as direct observation, interviews, and surveys. While observations can provide great objective insight into the effects of TPD in the classroom, they are also "burdensome and expensive" (Desimone, 2009, p. 190). Interviews hold the potential to provide "powerfully rich explanations, examples, and hypothesis for models about how a system works but require sophisticated analytic techniques" (Desimone, 2009, p. 190). Surveys provide cost-effective data on behavioral variables, but data gleaned from them may be limited in its ability to explain how teachers change their knowledge and skills to transform practice (Desimone, 2009). Because of this, there is need "to employ the general lessons of when and how to apply certain data-collection techniques to the study

of professional development" (Desimone, 2009, p. 191). Desimone (2009) has argued that:

> As a field we have reached an empirical consensus on a set of core features and a conceptual framework for teacher learning, and that we should use the framework in future studies of the effectiveness of professional development while allowing for individual adaptation. These points of consensus would serve as a guide for what is essential to measure, and allow comparison across studies, to build our knowledge base. (p. 192)

Consequently, "where evaluation does occur this is no guarantee of quality" (Muijs & Lindsay, 2008, p. 197). Data to demonstrate program outcomes is essential in order for any program to make a case for continued or increased funding, as well as to build the knowledge base about what constitutes an effective program (Scott-Little, Hamann & Jurs, 2002). This could equally be applied to TPD programs, as authorities are unlikely to continue providing funding for programs that show little or no increase in teachers' knowledge and skills. Fundamentally, evaluation must be a systematic process that involves both summative and formative data collection over a period of time, measuring gains in knowledge and skills or changes in practice. The framework for evaluation of TPD presented in the next section affords educators a more comprehensive and holistic approach for evaluating the impact of innovation and reform on professional development. One framework for ICT competency is also reviewed, as possessing digital literacy and having access to ICTs may allow for the development of skill sets required to connect with digital resources such as an OER, make use of them and/or produce new

content (Warschauer, 2002). The appropriation of ICTs, whether these are open or not, to access online repositories and create educational content may be conducive to OER uptake. The following section addresses Guskey's (2002) framework for evaluation of TPD.

Guskey's Multilevel Evaluation Framework

Guskey (2002) developed a multilevel framework to evaluate TPD based on a modified version of Kirkpatricks' (1959) model for evaluation of training and development in business organizations (Kirkpatrick, 1994). Guskey (2002) has laid out five levels, as illustrated in Table 1. These levels are:

1. Level 1- Participants' reactions: assesses whether participants liked the experience.
2. Level 2 - Participants' learning: focuses on measuring the knowledge and skills that participants gained.
3. Level 3 - Organizational support and change: focuses on questions about the organization characteristics and attributes necessary for success.
4. Level 4 - Participants' use of new knowledge and skills: is geared toward finding out if the new knowledge and skills that participants learned made a difference in their professional practices. The key to gathering information at this level is specifying clear indicators of both the degree and the quality of implementation.
5. Level 5 - Students' learning outcomes: addresses how the professional development activity affected student-learning outcomes. (pp. 48–49)

Table 1: Guskey's Five Levels of Professional Development Evaluation

Evaluation Level	What Questions Are Addressed?	How Will Information Be Gathered?	What Is Measured or Assessed?	How Will Information Be Used?
1. Participants' reactions	Did they like it? Was their time well spent? Did the material make sense? Will it be useful? Was the leader knowledgeable and helpful? Were the refreshments fresh and tasty? Was the room the right temperature? Were the chairs comfortable?	Questionnaires administered at the end of the session	Initial satisfaction with the experience	To improve program design and delivery
2. Participants' learning	Did participants acquire the intended knowledge and skills?	Paper-and-pencil instruments, Simulations, Demonstrations, Participant reflections (oral and/or written), Participant portfolios	New knowledge and skills of participants	To improve program content, format, and organization
3.Organization support & change	Was implementation advocated, facilitated, and supported? Was the support public and overt? Were problems addressed quickly and efficiently? Were sufficient resources made available? Were successes recognized and shared?	District and school records, Minutes from follow-up meetings, Questionnaires, Structured interviews with participants and district or school administrators, Participant portfolios	The organization's advocacy, support, accommodation facilitation, and recognition	To document and improve organization support To inform future change efforts

	What was the impact on the organization? Did it affect the organization's climate and procedures?			
4. Participants' use of new knowledge and skills	Did participants effectively apply the new knowledge and skills?	Questionnaires, Structured interviews with participants and their supervisors, Participant reflections (oral and/or written), Participant portfolios, direct observations, Video or audio tapes	Degree and quality of implementation	To document and improve the implementation of program content
5. Student learning outcomes	What was the impact on students? Did it affect student performance or achievement? Did it influence students' physical or emotional wellbeing? Are students more confident as learners? Is student attendance improving? Are dropouts decreasing?	Student records, School records, Questionnaires, Structured interviews with students, parents, teachers, and/or administrators Participant portfolios	Student learning outcomes: - Cognitive (performance & achievement) - Affective (Attitudes & Dispositions) - Psychomotor (skills & behavior)	To focus and improve all aspects of program design, implementation, and follow-up To demonstrate the overall impact of professional development

Note: From *Does it make a difference? (p. 48)* by T. R. Guskey, 2002. Copyright T.R. Guskey. Adapted with permission.

According to Guskey (2000), most evaluations of professional development occur at Level 1 (initial participant reactions), since it is the easiest level to assess. Data gathered from the lower levels are not helpful for measuring the impact of professional development on subsequent practice. Guskey has stressed that it is challenging to make a

connection between professional development and real change in practice due to the multiple factors that impact educators in the educational environment:

> Educators work in complex environments where multiple factors affect their behaviors. Changes in leadership, occurrences in one's personal life, other learning opportunities, or changes in professional assignment could alter participants' behaviors and activities quite apart from the influence of professional development. Isolating the professional development experience as the true cause of change in practice is a challenging aspect in any evaluation effort. (2000, p. 187)

This study was geared toward meeting this challenge, and designed to gather data that not only informed the overall quality of the TPD intervention in terms of achieving its learning objectives but also what other variables were at play that have the potential to effect real change in teachers' practices. Open-ended focus group questions were loosely based on Guskey's (2002) Levels of Professional Development Evaluation, which in turn helped generate core coding categories for analysis of the focus groups conducted after the intervention. The next section addresses an ICT framework that was used to establish coding categories for data obtained from the ODP.

Warschauer's Framework for Effective Use of ICT

Warschauer's (2002) seminal work "Technology for Social Inclusion" appears to be a good fit with the socio-economic and cultural reality of Brazilian K-12 public schools, and suggests that providing technology for free does nothing to improve the lot of disadvantaged learners. On the contrary, it serves to further expand the *digital divide* between those people that have had the economic and educational opportunity to become literate with ICT skills and those who do not. This same idea could be applied to those

people who have had the opportunity to learn how to read and write. In this sense, Warschauer's (2002) work is very much aligned with Freire's (1970) work with illiterate people aimed at promoting social inclusion. According to Warschauer (2002), several similarities can be drawn between literacy and ICT access, as enumerated below:

> First, both literacy and ICT access are closely connected to advances in human communication and the means of knowledge production. Second, just as ICT access is a prerequisite for full participation in the informational stage of capitalism, literacy was (and remains) a prerequisite for full participation in the earlier industrial stages of capitalism. Third, both literacy and ICT access necessitate a connection to a physical artifact (i.e., a book or a computer), to sources of information that get expressed as content within or via that physical artifact, and to a skill level sufficient to process and make use of that information. Fourth, both involve not only receiving information but also producing it. Finally, they are both tied to somewhat controversial notions of societal divides: the *great literacy divide* and the *digital divide.* (para. 7)

What does lead to meaningful access and engagement with ICTs is being in possession of literacy (Warschauer, 2002). Warschauer (2002) conducted a series of case studies on the meaning of literacy in regards to ICT access in Hawaii, Egypt, California, Brazil and India. From his findings, he concluded that:

- there is not just one, but many types of literacy;
- the meaning and value of literacy varies in particular social contexts;

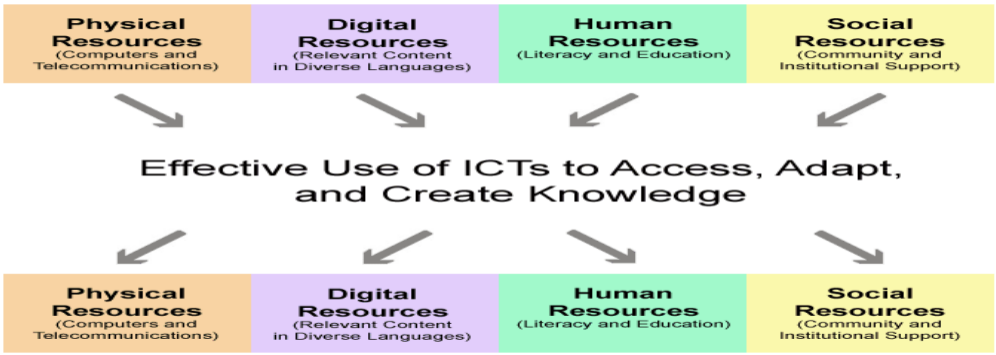
- literacy capabilities exist in gradations, rather than in a bipolar opposition of literate versus illiterate;
- literacy alone brings no automatic benefit outside of its particular functions;
- literacy is a social practice, involving access to physical artifacts, content, skills, and social support; and
- acquisition of literacy is a matter not only of education, but also of power. (para. 10)

From these findings, Warschauer (2002) created a model for *Effective Use of ICTs*, which contains specific categories of resources that are necessary in order to ensure that the ICTs are used effectively. The categories are as follows: (i) Physical Resources, (ii) Digital Resources, (iii) Human Resources and (iv) Social Resources. Warschauer (2002) provides us with a clear explanation of what each of these resources entail:

> Physical resources encompass access to computers and telecommunication connections. Digital resources refer to digital material that is made available online. Human resources revolve around issues such as literacy and education (including the particular types of literacy practices that are required for computer use and online communication). Social resources refer to the community, institutional and societal structures that support access to ICT. (para. 10)

Figure 3 illustrates Warschauer's Framework for Effective Use of ICT. The categories in this model were used to code qualitative data gathered from the three design thinking workshops.

Figure 3. Warschauer's Framework for Effective Use of ICT



Note: From Reconceptualizing the Digital Divide (para. 10), by M. Warschauer, 2002. Copyright M. Warschauer. Adapted with permission.

"In considering these four sets of resources, it is important to realize their iterative relation with ICT use" (Warschauer, 2002, para. 10). The presence and accessibility of each of these resources can contribute to the effective use of ICTs (Warschauer, 2002). "Access to each of these resources is a *result* of effective use of ICTs" (Warschauer, 2002, para. 10). On the other hand, lack of or inability to access one or more of these resources may impede ICT use. "If handled well, these resources can thus serve as a virtual circle that promotes social development and inclusion. If handled poorly, these elements can serve as a vicious cycle of underdevelopment and exclusion" (Warschauer, 2002, para. 10). This framework enables us to "re-orient the focus from that of gaps to be overcome by provision of equipment to that of social development to be enhanced through the effective integration of ICT into communities and institutions" (Warschauer, 2002, para. 11). The framework provides a sound foundation for assessing how each of these physical, digital, human and social resources are impacting the use of ICTs in an institution through their presence and accessibility or lack thereof, enabling researchers

to design interventions that will promote effective and meaningful use of ICTs, ultimately promoting and driving OER use as well.

As Warschauer (2002) has noted, the concept of literacy takes on different forms in different social contexts. This study employs a definition of digital literacy that aligns more closely with the desired digital literacy and skills for Brazilian *fundamental education* teachers when assembling and repurposing OER through use of ICTs. Digital literacy is thus defined as "the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyse and synthesize digital resources, construct new knowledge, create media expressions, and communicate with others" (Martin, 2005, p. 135). Digital literacy includes: carrying out of tasks such as being able to *read* instructions from graphical displays in user interfaces; being able to use digital reproduction to create new, meaningful materials from existing ones; constructing knowledge from a nonlinear, hypertextual navigation; evaluating the quality and validity of information; and having a mature and realistic understanding of the *rules* that prevail on the Internet (Eshet-Alkalai, 2004). Digital literacy can be analogous to learning how to read since "it constitutes a series of developmental levels that go beyond software skills such as adaptability, problem-solving, connection and reflection" (Turner, 2013, p. 3). Digital skills "focus predominantly on what tools to use and how to use them" (Bali, 2016, para. 3) and encapsulate four skill clusters and corresponding definitions: "set of basic skills in using Internet technology; skills to handle the structures of digital media and skills of navigation and orientation; skills to locate information in digital media; and skills to

employ the information contained in digital media toward personal and professional development" (Van Deursen & Van Dijk, 2011, p. 895).

The researcher deemed it appropriate to use Warschauer's (2002) Framework for *Effective Use of ICT* to establish categories for coding qualitative data gathered during the ODP. This framework helped shed light on what particular resources were lacking in this setting and what impact they had on OER uptake in this context. Justifications for this choice are presented in *Chapter 3: Methodology*. This study used all the same data-collection methods as Guskey: questionnaires, interviews with participants, participant reflections, observational data collection and video and audiotapes. Guskey's model was also used to guide the semi-structured, open-ended interview questions of the focus groups, which were conducted in order to assess whether there were any changes in participants' attitudes toward and conceptions of OER use upon completion of the ODP.

This section addressed how the ODP was evaluated and the specific framework used to code qualitative data from the design thinking workshops, and provided a distinction between the concepts of digital literacy and digital skills, both of which are central to effective ICT use when assembling and repurposing OER from online repositories using OSS or closed proprietary software. The next section briefly addresses two learning theories congruent with characteristics of some *effective* professional development programs that laid the foundation for the ODP.

Learning Theories Underpinning the ODP

Instructional strategies that are aligned with existing learning theories are imperative to enhance teacher motivation and foster cognitive engagement (Blumenfeld

et al., 1991) in a skillfully planned enterprise (Gagné & Merril, 2000). Gagné and Merril (2000) define an enterprise as being "a purposive activity that may depend for its execution on some combination of verbal information, intellectual skills, and cognitive strategies, all related by their involvement in the common goal" (p. 25). Thus, the design of any enterprise schema "begins with the identification of learning goals" (Gagné & Merril, 2000, p. 23) and usually comprises multiple integrated goals. In line with this, the researcher identified the goal of the enterprise along with its component skills and knowledge in order to design instruction that enabled teachers to learn effectively, taking into consideration multiple or integrated learning objectives (Gagné & Merril, 2000). As the common goal of this enterprise was to raise awareness and build capacity and/or knowledge on OER use, the researcher's main task was to design instruction that ensured that teachers were able to make an informed decision about adopting and using OER in their practices and subsequently apply this knowledge to their practices, if they chose to do so. Bearing in mind that adult learners are more interested in learning subjects that are relevant or have immediate impact to their jobs or professional careers (Knowles, 1984), the ODP was developed using a design thinking approach that incorporated adult learning principles of Andragogy,including the understanding that "some learning problems require highly prescriptive solutions, whereas others are more suited to learner control of the environment" (Karagiorgi & Symeou, 2005, p. 23). While the design thinking approach is well-suited for participant control of the learning environment, a more structured, teacher-centered approach was also employed, which is congruent with the learning principles of Andragogy. In order to meet teacher needs and expectations, the researcher provided guided discussion topics at the beginning of each workshop. This

teacher-centered approach also guided the decision to deliver the ODP during teachers' one-hour *HTP* activity time, which helped mitigate the study's time constraints. The guided discussion topics, which were more instructivist and teacher-centered in nature, were employed so as to accommodate less self-directed learners. In addition, the researcher facilitated the overall learning experience by creating a comfortable physical climate as well as a psychological climate of mutual trust and respect, collaboration, supportiveness, openness and authenticity (Merriam, 2001). Once the researcher provided the necessary instructions for the activities at the beginning of each workshop, participants were encouraged to work in groups on assigned topics for meaning-making and constructing of new knowledge to be shared and reflected upon with others.

In order for teachers to be more actively engaged in creating their personal knowledge and thereby "become general problem solvers and better group workers" (Zafirov, 2013, p. 298), constructivist instructional strategies were used. These include discovery learning, active learning and collaborative learning. These learning strategies are aligned with the recommendation for collaborative, interactive, hands-on and participatory learning in TPD programs. The design thinking skills used in the ODP are very much in harmony with the theoretical traditions of constructivism (Razzouk & Shute, 2012). Thus, a blend of teaching methods from cognitive constructivism and social constructivism were employed. The epistemological stance of constructivism provides an explanation for how individuals construct knowledge through interactions with their environment even though each individual's knowledge construction is different. Through conducting investigations, conversations and activities, an individual is learning, constructing new knowledge by building on prior knowledge (Harel &

Papert, 1991; Perkins, 1991; Vygotsky, 1978). Proponents of constructivism claim that individuals learn best when they are constructing artifacts that can be shared with others and reflected upon (Kafai & Resnick, 1996; Piaget, 1969). Moreover, they propose that these artifacts must be personally meaningful in order to engage learners, and suggest that projects should be learner-centered as opposed to teacher-centered (Bransford, Brown & Cocking, 2000; Moursund, 1998). As described in the section on TPD, both cognitive and social constructivism are akin to the inquiry learning approach. In line with these propositions, the participants of the study were offered multiple opportunities through to construct new knowledge and share their reflections on this new knowledge, basing these reflections on the design thinking processes. All workshop activities were exclusively learner-centered.

The ODP also made use of instructional strategies that fostered collaborative, cooperative and collective reflection, active negotiation and meaning-making as per the three phases of the design thinking approach: discovery and interpretation, ideation and building prototype (Design Thinking for Educators, 2013). The details for how each phase was carried out are addressed in the Design Thinking Workshops section in *Chapter 3: Methodology*.

Conclusion

This review sought to deepen understanding and advance knowledge about the inherent complexities surrounding OER uptake in the Brazilian K-12 public school system. The challenges, barriers and opportunities presented here underline the need for *effective* TPD practices that result in sustained reform. The review highlighted

collaborative, cooperative, interactive, participatory and hands-on learning as being more conducive to OER uptake in this setting. "*Effective* TPD appears to reinforce the concept of the "Commons" although locally (i.e., school) based; and the connection to design-based thinking (i.e., a "problem to solve") and TPD" (C. Blomgren, personal communication, January 10, 2018). While the goal of this study was to raise participants' awareness and build capacity and/or knowledge on OER use, teachers need to possess certain ICT-related skills before OER can be considered. Through proper training on ICT use, teachers may be able to obtain the skills required to search for OER in online repositories and use and repurpose them using a variety of OSS. The review has shown that issues related to the use of OER for teaching and learning practices as well as ICT use are novel to Brazilian teachers' pedagogical practices. TPD practices should therefore take into account the reality of the Brazilian *fundamental education* public school system to achieve effective outcomes. The review has also underscored the need to evaluate the effectiveness of a TPD intervention after it has been completed. Guskey's (2002) model for TPD evaluation was used as a basis for the open-ended focus group questions conducted post intervention. Lastly, the literature review drew on the learning theories Andragogy and Constructivism to provide a rationale for how these theories aligned with some of the characteristics of *effective* TPD programs underpinned the ODP. This is described in more detail in the section Design Thinking Workshops in *Chapter 3: Methodology.* The literature review provides the theoretical background and foundation for the research methodology described in Chapter 3.

Chapter 3: Methodology

Introduction

This chapter begins by describing the methodology employed in this research and explaining why it is suited to the purposes of the study. The idea of mixed-methodology is introduced and a rationale for its selection is provided. This is followed by the study research paradigm and research design, which illustrates the data collection and analysis process. The population sampling technique is presented and other types of research are compared and contrasted; limitations of case study are discussed as well. Finally, this section addresses the conceptual frameworks that guided this study, quantitative and qualitative data collection and analysis procedures, ensuring trustworthiness, ethical considerations, the role of the researcher and limitations of the study.

Chosen Methodology and Rationale

Several limitations inherent in case study research have led researchers and scholars to debate whether case study is a method or a methodology (Hyett, Kenny & Dickson-Swift, 2014). This is partly due to the fact that "case study research has a level of flexibility that is not readily offered by other qualitative approaches such as grounded theory or phenomenology" (Hyett et al., 2014, p. 1). A case study can combine both qualitative and quantitative methods to more thoroughly understand the case in its unique context (Cohen et al., 2011; Stake, 1995; Yin, 2009). It is important to emphasize that, although this research study is situated in a pragmatic worldview due to the fact that it uses mixed methods to collect and analyze quantitative and qualitative data, this study's

research design utilizes a case study methodology, and not a case study method. According to Creswell (2007), the use of case study methodology is appropriate when the researcher aims to explore "a real-life, contemporary bounded system (a case) over time, through detailed, in-depth data collection involving multiple sources of information and reports a case description and case themes" (p. 73).

Stake (1995) elaborated further on the meaning of a "bounded system." In his words:

> The case is specific. Even more, the case is a functioning specific. The case, in the words of Louis Smith (1978), is a "bounded system." In the social sciences and human services, it has working parts, it probably is purposive, even having a self. It is an integrated system. The parts do not have to be working well, the purposes may be rational, but it is a system. Its behavior is patterned. (p. 2)

A Brazilian *fundamental education* public school is therefore a bounded system. The Brazilian *fundamental education* public school system is a homogenous and unified system primarily aimed at delivering instruction to students so as to prepare them for high school and afterward for Higher Education. The delivery of instruction includes several related "systems such as teachers' knowledge and skills, their professional values and commitments, and the social and physical resources of practice that are driven by a set of policies" (Cohen, 1995, p. 16). The schools' procedures, rules and organization also play a role in this delivery.

Stake (1995) and Yin (2003; 2009) each propose case study approaches that have the potential to guide case study methodology. Stake (1995) approaches case study methodology from an interpretivist tradition, which implies that the researcher, those

individuals being researched and the reader interpret information differently (Creswell, 2009). Yin (2003; 2009) meanwhile comes from a positivist tradition. The positivist approach differs significantly from the interpretivist approach in that:

> Positivist researchers believe in multiple perspectives from participants rather than a single reality and use multiple types of data analysis for rigor, employ computer programs to assist in their analysis, encourage the use of validity approaches, and write their qualitative studies in the form of scientific reports, with a structure resembling quantitative approaches (e.g., problem, questions, data collection, results, conclusions). (Creswell, 2009, p. 20)

There has been a great deal of debate and controversy on the need to adopt one philosophical position (interpretivist or positivist) for cases in which a study makes use of both quantitative and qualitative methods to address real-world issues (Saunders, Lewis & Thornhill, 2009). The rationale behind this, as espoused by Sanders et al. (2009), Tashakkori and Teddlie (2003), and Creswell and Plano Clark (2011) is that adopting one position or the other is not ideal, because some research questions require a combination of methods to be answered. In qualitative research, researchers generally accept as valid the value-laden nature of the study and are expected to report their impressions about the study along with the value of the knowledge obtained (Creswell, 2009; Saunders et al., 2009). In quantitative research however, the researcher's values are not expected to receive mention. This implies that objective criteria largely determine in what ways and how the researcher is going to conduct the research (Creswell, 2009). One's values largely determine the philosophical perspective, approach, method and

data-collection techniques one employs (Saunders et al., 2009), and therefore the pragmatist perspective holds that choosing between one position (epistemology, ontology or axiology) and another is somewhat unrealistic. Research questions have also been proposed as a major determinant of perspective and approach (Creswell & Plano Clark, 2011; Saunders et al., 2009). Fetters, Curry and Creswell (2013) argue that "the nature of the case, feasibility issues, and the research questions determine when mixed methods are appropriate in case study" (p. 2138). If the research questions do not clearly suggest either a positivist or interpretive philosophy from within an epistemological perspective, then the pragmatist approach is found to be more effective. Such was the case for this study.

Research Paradigm

This study was framed within a pragmatic research paradigm, and "individuals holding this worldview focus on the outcomes of the study rather than on antecedent conditions" (Creswell, 2007, p. 22). For pragmatist researchers, "values and visions of human action precede a search for descriptions, theories, explanations, and narratives" (Cherryholmes, 1992, p. 13). Pragmatists "look to the *what* and *how* to research, focused on the intended questions–where they want to go with it" (Creswell, 2009, p. 11). Mixed-methods research applies pragmatism as its worldview. The methodologically eclectic, pluralistic approach employed by pragmatism enables researchers to draw on positivist and interpretive epistemologies based on their fitness for purpose and applicability, which allows "reality" to be regarded as both objective and socially constructed (Johnson & Onwuegbuzie, 2004).

Pragmatism was selected because one of the goals of this study was to understand Brazilian *fundamental education* public school stakeholders' values, beliefs, knowledge and challenges in terms of OER, and whether they would be open to embracing such practices. The latter question implies exploring the political, social and technological barriers to and challenges of OER, and indeed, "Values, aesthetics, politics, and social and normative preferences are integral to pragmatic research" (Cherryholmes, 1992, p. 13). The social-political context of the K-12 public school system and how communication and participation are established with stakeholders is vital to understanding what strategies could be implemented so as to support stakeholders' willingness to uptake OER.

Dewey viewed "communication-as-participation [as] offering us both an analytical framework and an agenda for action" (Biesta, 2010, p. 718). In this context "a shared world is not an identical world, but a world in which everyone who shares it, participates in it in his or her own unique way" (Biesta, 2010, p. 724). The stakeholders that took part in this study were actively invited to participate in the process in order for there to be significant communication, development and participation among them. The objective was to foster a shared worldview around the use of OER in education, despite the plurality of beliefs and ideas held by those involved in it.

The theoretical prowess of pragmatism is in "translating useful knowledge of real-life problems into action" (Taatila & Raij, 2012, p. 835). To achieve this, people must be open to acquiring new knowledge and skills (Taatila & Raij, 2012). Learning is key within a pragmatic framework and its goal is to aid people in building competencies to fit their particular situation or educational context (Taatila & Raij, 2012). Pragmatism was a

good fit for this study not only because it accommodates shared mutual interests, understandings and behavior, but also because it aided the participants of the study in building new knowledge and skills.

Yin (2009) also posited that a case study methodology is appropriate when the investigator has minimal or no control over the behavior of the participants in the research, and when the study focuses on contemporary rather than historical events. This is very much in line with this study's purposes since the researcher had minimal, if any, control over the participants' behavior. In addition, the use of OER in Brazilian or other K-12 public schools can be perceived as a contemporary issue rather than as a historical one. As previously discussed in *Chapter 2: Review of the Related Literature*, TPD in the Brazilian *fundamental education* public school system is usually delivered by a team of professionals that already work in the public school system (Davis et al., 2011). As an outsider to the public school system, the researcher had minimal control over the behavior of the participants. The study focuses on a contemporary phenomenon occurring in a single setting (Eisenhardt, 1989). In addition, the content of a case study report hinges on its purpose, use, level and audience (Lincoln & Guba, 1985).

Following Hyett, Kenny and Dickson-Swift's (2014) determination that "classification of the case and case selection procedures informs the development of the study design and clarifies the research question" (p. 2), this case study was fundamentally focused on studying a process for TPD in OER. Yin (2003) classifies case studies as being explanatory, exploratory or descriptive. He also differentiates between single, holistic, and multiple case studies. The exploratory case approach is specifically helpful when the research topic is relatively new, or when the topic suffers from a shortage of information

and literature (Yin, 1994), which is the case in this study, as there is no literature on TPD for OER in the Brazilian *fundamental education* public school system.

According to Stake (1995), there are three kinds of cases and study design frameworks: the intrinsic case, the instrumental case and the collective case. The intrinsic case is used to understand the particulars of a single case, rather than what the case itself represents (Stake, 1995). "The instrumental case provides insight on an issue or is used to refine theory. A collective case refers to an instrumental case that is studied as multiple nested cases, observed in unison, parallel or sequential order" (Hyett, Kenny & Dickson-Swift, 2014, p. 2). For example, in a collective case study design "more than one case can be studied at the same time; however, each case study is a concentrated, single inquiry, studied holistically in its own entirety" (Hyett, Kenny & Dickson-Swift, 2014, p. 2).

This case study is considered a single, exploratory, instrumental case as it aimed to provide insight using multiple forms of data collection–quantitative, qualitative and in-field observational. "Observational data collection enables the systematic, detailed observation of people and events to learn about behaviors and interactions in natural settings" (Curry, Nembhard & Bradley, 2009, p. 1446), and is particularly useful for researchers in understanding the different views and cultural aspects of a specific setting (Curry et al., 2009). This case study was also focused on generating and refining theory for TPD in OER for Brazilian *fundamental education* public schools. This study explores how effective the ODP was in achieving its goals and provides insight into how TPD in OER could be more effective in this context. In short, "case studies are methodologically eclectic; can use a range of methods of data collection, and indeed different types of data

and ways of analyzing data, and can be short term or long term" (Cohen et al., 2011, p. 296). Having provided an overview to the case study methodology and a justification for its use in this study, the next section addresses the quantitative and qualitative methods used in this study and provides an overview of the research design.

Quantitative and Qualitative Methods

The field studying complex learning environments experiences constant calls for research designs that transcend the quantitative and qualitative research paradigms (Salomon, 1991). With this in mind, the purpose of the research design is to identify a unique variance that might otherwise have been neglected if a single approach had been used (Hanson, Creswell, Clark, Petska & Creswell, 2005). Yin (2003) and Stake (1995) also recommend using mixed methods for case study research and argue that a combination of qualitative and quantitative data can be used to build a comprehensive understanding of the case. Fetters, Curry and Creswell (2013) posit that "the nature of the case, feasibility issues, and the research questions determine when mixed methods are appropriate in case study" (p. 2138).

A strong argument can be made for taking a mixed-methods approach to implementing innovative practices in a Brazilian *fundamental education* public school, which can be characterized as a complex learning environment (André, 2015; Davis et al., 2011) in which the researcher has limited access and minimal, if any, control over the behavior of the participants of the study (Yin, 2009). In such a setting, "several advantages can accrue from integrating multiple sources of data, including the capacity to help explain qualitative data" (O'Cathain, Murphy & Nicholl, 2010, p. 2135) and its

correlation with quantitative data so as to yield a set of coherent data that informs how TPD in OER can be best implemented in this context. This study employed both quantitative and qualitative data-collection approaches to answer the underpinning research questions and to extract from the data a set of evidence-based OER guidelines. The intervention undertaken at the *Fundamental Education* Municipal School lasted one year, beginning in September 2016 and concluding in September 2017.

Particularly within the social sciences, educational research is concerned with evaluating learning and teaching and making enhancements to practice (Creswell, 2012). Creswell (2012) further notes that it is important to remain true to the research paradigm throughout the research process in order to maintain congruence between the philosophical viewpoint, the methodology and the methods used. How this congruence was maintained is described in the next section, in which the study's research design is presented.

Research Design of the Study

This research is positioned within a pragmatic research paradigm. Pragmatism is primarily problem-centered and real-world practice oriented (Creswell, 2009). The use of this worldview enabled the researcher to place emphasis on the research problem and use different approaches to understand the central problem through real-world practice (Creswell, 2009). The use of a variety of sources "facilitated the exploration of the phenomenon within its context" (Baxter & Jack, 2008, p. 544). Quantitative methods included the use of a survey instrument. Qualitative methods included the use of observational notes, qualitative data collection and analysis from the design thinking

workshops and from focus groups conducted post intervention, following the principle that "immersion in context is the hallmark of qualitative research methods" (Kaplan & Duchon, 1988, p. 572). The use of qualitative data approaches helped the researcher better understand how participants' construed, conceptualized and understood the TPD intervention. The use of qualitative data to elucidate findings is also in line with Cook and Campbell (1979), who advocated, "field experimentation should always include qualitative research to describe and illuminate the context and conditions under which research is conducted" (p. 93). The combination of these data-collection methods contextualized the research and allowed the data to be more testable (Kaplan & Duchon, 1988). The collection and combination of different sources of data to investigate the phenomenon under study therefore provided a wider range of coverage, which hopefully allowed for a fuller picture of this bounded context than would have been achieved if a single method of data collection had been used (Bonoma, 1985; Kaplan & Duchon, 1988).

Considering the complex nature of TPD for OER adoption and use, which are variables in this study, the research design did not place more priority on one particular method of data collection. Rather, it made use of both quantitative and qualitative data-collection methods to uncover unknown variables and to augment the researcher's understanding of how professional development aimed at introducing innovative practices is best carried out within this particular context. Figure 4 provides an overview of the research design.

Figure 4. Research design of the study

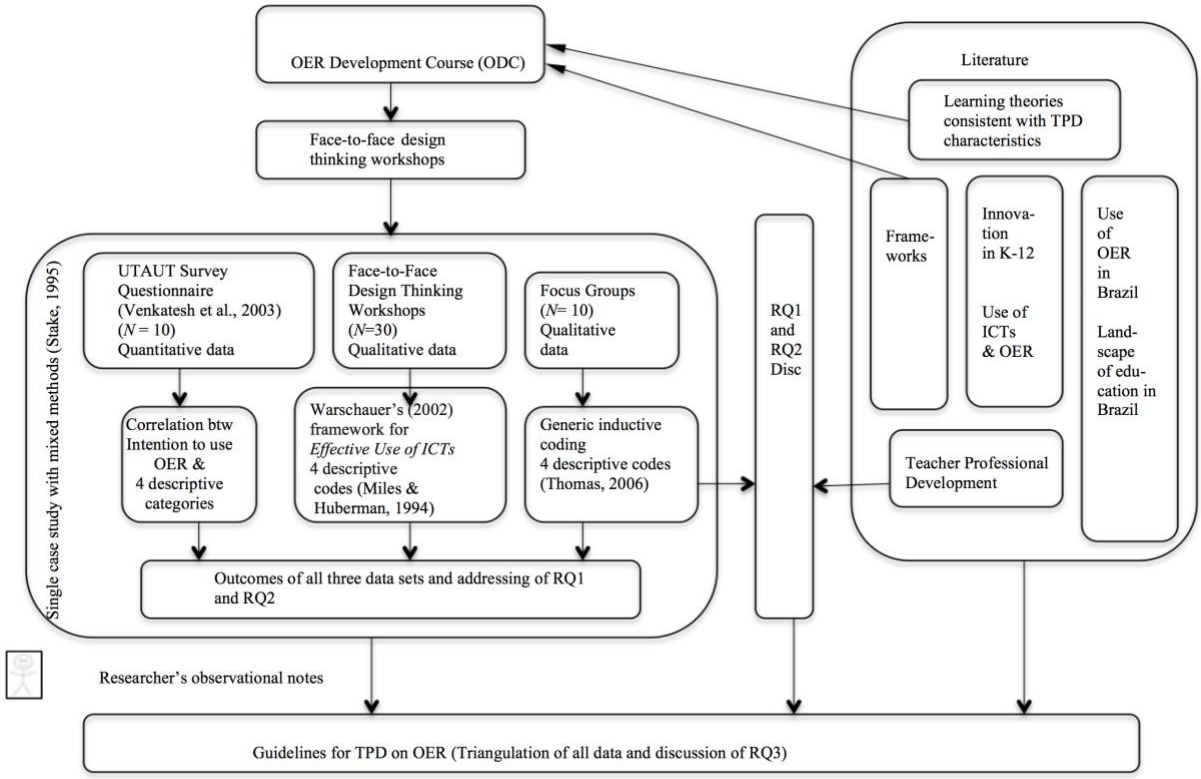


Figure 4 depicts the ODP, which makes up the single case study. The number of study participants during the different data-collection phases can be seen as well as the methods and data-collection strategies used to carry out the data analysis. The figure provides a summary of the process followed to address the research questions and to reach the study's final outcome.

In addition to the three design thinking workshops, the researcher delivered one initial workshop, which was aimed at explaining to the participants of the study the goal of the ODP, and at providing an overview on OER, addressing the 5Rs required for their use and highlighting their potential advantages and uses. This workshop was also geared toward informing participants about the different phases of the study, what was expected

from them if they chose to participate in the study and the knowledge and skills they would acquire therein. This workshop also helped the researcher establish initial rapport with the participants of the study. The first workshop was delivered in August 2016. The following section presents the population and sampling techniques used in this study.

Population and Sampling

This case study used purposive sampling. This form of sampling is termed purposive sampling because the group of participants was selected because they were neither using OER in their professional practices nor had they received any training to do so (Cohen et al., 2001). Since the goal of this study is not to generalize to a population but to obtain insights into specific individuals' learning, reactions and opinions, the researcher purposefully selected a group of individuals who would likely be most affected by such an intervention (Cohen et al., 2011; Onwuegbuzie & Collins, 2007). This sampling technique also appeared to be suitable because it allowed for elaborating on the various manifestations of the phenomena in question; it is also appropriate for small sample sizes (Teddlie & Yu, 2007). All 46 teachers at the school, including the Director, Vice-Director and Coordinator were invited to participate in this study (N=46). As the number of participants varied throughout the different stages of data collection, these figures are again reported in the corresponding chapter findings and discussion. The next section briefly explores other types of research, comparing them to the methodology used in this study in order to further justify its appropriateness.

Case Study versus Experimental and Historical Research

The case study methodology is particularly useful for providing an in-depth understanding of a bounded system as it enables the researcher to see how the system functions as a whole (Creswell, 2007). Furthermore, although the case study design does not afford the researcher an opportunity to influence or change the attitudes of the participants or the setting, it enables the researcher to explore participants' behavioral patterns (Yin, 2009). The case study approach also provides an opportunity for participants to voice their concerns, issues, challenges and perspectives in the field of study (Yin, 2009). In contrast, an experimental design "tests the impact of a treatment (or an intervention) on an outcome, controlling for all the factors that might influence that outcome" (Creswell, 2009, p. 146), and in such studies, the researcher deliberately controls and manipulates the conditions or variables that determine the events (Cohen et al., 2007). This study did not involve determining the effect of manipulating conditions or variables, and therefore an experimental study would not have been appropriate.

Another design, historical research, "enables scholars within a discipline, as well as society at large, to gain an understanding of its origins and its patterns of change" (Savitt, 1980, p. 52). A historical study makes use of data such as original documents, oral histories and secondary sources (Savitt, 1980). The use of a historical approach would not be a good fit with for this study since the use of OER in Brazil is still in its infancy. It was possible to collect data through direct observation during the workshops and through quantitative and qualitative methods, so the use of a historical approach would not have helped inform data adequately. The next section addresses the limitations of case study methodology.

Case Study Limitations

Flyvbjerg (2006) identifies several commonly stated limitations of case studies, which he considers to be myths or misunderstandings:

- the findings of a single case cannot be generalized and therefore a single case study cannot contribute to scientific development;
- the case study contains a bias toward verification in that it may be selective, biased, personal and subjective and is not easily open to cross-checking; and
- the case study is most useful for generating hypotheses, while other methods are more suitable for hypotheses testing and theory building. (Abstract)

Regarding the first assertion, that the findings of a single case cannot be generalized, Flyvbjerg (2006) contends that more discoveries have arisen from observation and carefully chosen experiments or exploratory studies than from statistics applied to large sample groups. "Formal generalization, be it on the basis of large samples or single cases, is considerably overrated as the main source of scientific progress" (Flyvbjerg, 2006, p. 10). Flyvbjerg (2006) adds, "that knowledge cannot be formally generalized does not mean that it cannot enter into the collective process of knowledge accumulation in a given field or in a society" (p. 10). The underlying assumption of this is that a case study can certainly be of value to this process even when it makes no attempt to generalize. Regarding the bias toward verification, Flyvbjerg (2006) defends the notion that:

> The case study contains no greater bias toward verification of the researcher's preconceived notions than other methods of inquiry. On the contrary, experience indicates that the case study contains a greater bias toward falsification of preconceived notions than toward verification. (p. 21)

Falsification in this sense refers to the proximity between researchers and research participants that the case study design entails (Flyvbjerg, 2006). Understanding the case is akin to a learning process, and as in any learning process, "the researcher who conducts a case study often ends up by casting off preconceived notions and theories" (Flyvbjerg, 2006, p. 21). Finally, with regards to the third limitation, Flyvbjerg (2006) contends, "the case study is useful for both generating and testing of hypotheses but is not limited to these research activities alone" (p. 13). This third myth derives from the first one, that it is not possible to generalize from a single case study.

The case study methodology also aligns well with the overarching goal of this research, which is to support change and innovation in one particular context. Case studies are moreover common approaches within Educational Studies. According to Brown (1992), "an effective intervention should be able to migrate from our experimental classroom to average classrooms operated by and for average students and teachers, supported by realistic technological and personal support" (p.143). There was little expectation that this intervention would effect significant change and innovation in the short-term; rather, it was understood to have the potential to achieve what Brown (1992) considers to be an *effective* intervention for future application. The collection and analysis of multiple sources of data built understanding about what kind of TPD in OER

is more *effective* in this particular setting, generating new theory or insights throughout this process (Eisenhardt, 1989).

Indeed, one of the several strengths of case study methodology is its ability to generate novel theory (Darke, Shanks & Broadbent, 1998; Eisenhardt, 1989; Flyvbjerg, 2006; Yin, 2009). "Case study research is also well suited to understanding the interactions between OER-related innovations and organizational contexts" (Darke et al., 1998, Abstract). Building theory from case studies centers directly on the juxtaposition of contradictory or paradoxical evidence (Eisenhardt, 1989). Eisenhardt (1989) further espouses that:

> Although a myth surrounding theory building from case studies is that the process is limited by investigators' preconceptions, in fact, just the opposite is true. This constant juxtaposition of conflicting realities tends to "unfreeze" thinking, and so the process has the potential to generate theory with less researcher bias than theory built from incremental studies or arm-chair, axiomatic deduction. (p. 547)

Eisenhardt (1989) notes that there are also potential weaknesses presented by building theory around case studies. The case study may produce an overly complex theory as a result of the intensive use of empirical evidence; it may also produce a narrow and idiosyncratic theory (Eisenhardt, 1989). With these potential limitations in mind, this research was focused on producing a "parsimonious, testable, and logically coherent theory" (Eisenhardt, 1989, p. 548) or set of insights for TPD in OER, derived from data and on-site observation. "The theory-building approach is particularly well-suited to new research areas" (Eisenhardt, 1989, p. 548), which is the case in this study, as discussed in both previous chapters. Yin (2009) concurs that case studies can help generalize to a

broader theory since the theory can be tested in one or more empirical cases. Ultimately, case studies are more concerned with analytic generalization than with statistical generalization (Yin, 2009). "This concern is not so much for a representative sample as for its ability to contribute to the expansion and generalization of theory" (Yin, 2009, p. 15).

Having presented the methodology used in this study, the following section briefly summarizes the two conceptual frameworks that guided this study, which were previously addressed in *Chapter 1: Introduction*.

Conceptual Frameworks used in this Study

To answer RQ1, this study used two conceptual frameworks: The UTAUT Framework and The Design Thinking Framework. The main objective was to gather data that represented the participants' perspectives on the adoption and use of OER in this setting, thereby decreasing the researcher's preconceived notions and theories. Justifications for the use of these two frameworks have been provided in *Chapter 1: Introduction*.

The UTAUT framework. The UTAUT framework was used to explore the intention of the participants of the study to use and adopt OER at the beginning of the intervention, and to collect demographic data. The UTAUT survey questionnaire is described in more detail in the *Quantitative Data Collection* section of this chapter.

The design thinking approach. The design thinking approach was used for delivering three workshops during teachers' *HTP* activity time during the ODP program, as previously addressed in *Chapter 1: Introduction*. The procedures and activities for conducting the design thinking workshops are presented in the *Qualitative Data*

Collection section of this chapter. The following section reports how quantitative data were collected.

Quantitative Data Collection

The quantitative portion of this study made use of one quantitative instrument: the UTAUT Survey Questionnaire. This quantitative instrument was used as a means to inform, triangulate and correlate responses with the qualitative portion of this study. The questionnaire was made available via Lime Survey, an online tool that facilitates easy dissemination to respondents and permits easy data exports into the Statistical Package for Social Sciences (SPSS) for comprehensive data analysis. The instrument used in this study has been adapted and developed by the researcher, as described below.

UTAUT survey questionnaire. Venkatesh et al. (2003) developed a research instrument that measures the framework and uses a 5–point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The real strength of a Likert scale is its simplicity and ease of use. Furthermore, "when several items are combined, more comprehensive multiple indicator measurement is possible" (Neuman, 2006, p. 210). Sauro (2012) pointed out that "7-point scales are slightly better than 5-point scales but not by much" (para. 2). He claimed that for "multiple item questionnaires it matters less how many scales you have" (para. 9). However, "the general effects of usable or unusable applications tend to outweigh the much smaller effects of scale points, labels, scale directions and poorly written questions" (Sauro, 2012, para. 12). In addition, 7-point scales are generally recommended for very large sample sizes, which is not what this study examines. He concluded, "it is more important to focus on finding good

benchmarks to compare results to and on what you will do with those ratings once the questionnaires are submitted for analysis" (para. 12). It should be noted, however, that a potential weakness of the UTAUT survey questionnaire is that it does not enable the researcher to observe or measure actual OER use. Due to this limitation, focus groups were held after the completion of the ODP to verify if the participants acquired new knowledge.

To suit the context of OER adoption in this research study, items in the framework were adapted and subsequently translated into Portuguese to ensure that all participants understood the terms being used. Before being administered to the participants, the original English-language version was translated into Portuguese by the researcher and was pre-tested for content and face validity by volunteers who speak Portuguese. All participants were invited to respond to the online UTAUT questionnaire during the beginning of the study. Online surveys are more cost-effective, save time for both researchers and respondents, can be programmed to provide increased accuracy of responses, afford design flexibility and can produce higher rates of return than paper-based surveys, among other advantages (Anderson & Kanuka, 2003). The adapted UTAUT research instrument (see Appendix A–UTAUT Survey Questionnaire) was used to collect demographic data and to assess stakeholders' intentions to adopt and use OER before delivery of the three design thinking workshops. Having presented and described the UTAUT survey instrument, the next section introduces the quantitative data collection procedures for the UTAUT survey questionnaire.

Quantitative data collection procedures. All teachers, and the director, vice-director and pedagogical coordinator (N=46) at the *Fundamental Education Municipal*

School were invited to participate in this study. An initial contact e-mail stating the purpose of the research was sent via e-mail to the school director (see Appendix B - Faculty Letter of Invitation and Consent Form). The school director was also sent the Informed Consent Package (see Appendix C–Informed Consent Package). The Informed Consent Package contained: contact information, responsibilities and time commitments of participants, purpose of the research, risks and benefits associated with participating in the study, privacy issues, storage of data and availability of results. The electronic notice also requested that the school director contact the researcher if she had any concerns with her teachers being invited to participate in this study. The school director replied indicating support for the study and the involvement of the teachers in it. Subsequently, the school director provided a list of e-mail addresses of all teachers, and sent them an electronic information letter and the Informed Consent package with instructions on how to participate in the study. Follow-up electronic letters were sent a few weeks later to those teachers who had not responded to the first invitation. All teachers who agreed to participate in the study received an invitation from Athabasca University's Lime Survey software to respond the UTAUT survey questionnaire. Information from the survey collected using Lime Survey software assigned token id numbers to participants, ensuring their anonymity. Informed and deemed consent was obtained for the online survey, design thinking workshops and focus groups prior to the commencement of the study. The following section addresses the qualitative data collection portion of the study.

Qualitative Data Collection

This section describes the procedures for qualitative data collection in this study.

Design thinking workshops. Collaboration and ongoing dialog with stakeholders is imperative to facilitate reform (Brown, 1992). Due to this, the researcher used a design thinking approach to deliver three workshops, all of which were conducted during the teachers' *HTP* activity time and lasted one hour. Thirty (N = 30) teachers total participated in the workshops. The teachers were divided into four groups, each with about seven or eight total participants. Teachers were provided with materials such as flipcharts, post-it notes, colored pens, glue, scissors and magazines for the workshop activities. As per recommendations of the *Design Thinking for Educators Toolkit* (2013), the workshops were conducted following the four phases of the design process: discovery of a challenge and how to best approach it; how to interpret something that is learned from the discovery phase; ideation in which ideas are generated and refined; and experimentation by making prototypes and getting feedback on the ideas that were created in the third phase. The fifth phase, in which stakeholders focus on tracking what was learned during the previous phases and on evolving their prototypes was not possible to conduct due to time and other constraints imposed by the school director, which impeded the researcher from delivering another workshop. The school director claimed that there were other important activities that needed to be conducted during teachers' *HTP* activity time, which resulted in limited time and engagement with teachers. The design thinking workshops were delivered during the months of September, October and November 2016.

The objective of the first design thinking workshop was to investigate teachers' perceptions and challenges regarding the question proposed by the researcher: How can we use digital resources to improve our pedagogical practices? During this workshop

teachers were divided into four groups, each containing five participants, and were asked to list their certainties and doubts regarding the problem. During the second workshop, the teachers were divided into the same four groups and asked to list strategies and solutions to the certainties and doubts they had raised in view of the problem posed during the first workshop. During the third workshop teachers were asked to build a prototype of how they would overcome the challenges raised during workshops one and two. To maintain continuity between the workshops, teachers were divided into the same groups that they had previously been working with before. There were some new teachers, who were randomly assigned to join one of the groups. At the end of each workshop, each group was asked to present their work to the rest of the participants. Data for the workshops were collected through field observation notes and digital audio and video recordings. Data analysis for the design thinking workshops is discussed in the *Qualitative Data Analysis* section of this chapter. The section that follows describes the focus group interviews, which were conducted in August 2017.

Focus groups. A focus group is a qualitative research technique in which people are informally interviewed in a group discussion setting (Neuman, 2006). After the ODP, focus groups were conducted with the teachers in order to gain insights into and inspire solutions through group effort (Anderson & Kanuka, 2003; Patton, 1990) so as to improve or build on future interventions (Morgan, 1997). The information gathered at this level helped shed light on the overall effectiveness of the intervention (Guskey, 2002). Focus groups were also aimed at addressing RQ2: What role, if any, can TPD play in teachers' OER adoption decisions? Focus groups were conducted upon completion of the TPD program, which lasted one year. Ten (N =10) teachers participated in the focus

groups. Teachers were divided into two groups, each with five participants. Focus group conversations consisted of semi-structured, open-ended questions (see Appendix D - Focus Group Conversations with Participants of the Study: Post-ODP), and data were collected through use of researcher observational notes and digital audio and video recordings. The two groups were allotted forty minutes to discuss the focus groups questions and a spokesperson appointed by the group presented the focus group discussions. Data analysis for the focus groups is presented after the *Quantitative Data Analysis* section of this study. The next section discusses how data analysis for data derived from the UTAUT survey instrument was carried out.

Quantitative Data Analysis

This section addresses how data collected from the 5–point Likert scale UTAUT survey questionnaire were analyzed.

UTAUT survey questionnaire. Spearman's rank correlation coefficient (Spearman's rho), a non-parametric measure of statistical dependence, was calculated to measure the strengths of association between the ordinal variables: performance expectancy, effort expectancy, social influence, facilitating conditions and stakeholders' intention to adopt and use OER. To establish a clear criterion for data analysis, the three sub-items of Intention to use OER were correlated with the sub-items of each of the variables: performance expectancy, effort expectancy, social influence and facilitating conditions. In other words, the three statements or questions of the variable Intention to use OER were cross-referenced with the statements or questions of the variables: performance expectancy, effort expectancy and social influence, facilitating conditions to investigate whether there was any correlation between them.

> Correlation is a bivariate analysis that measures the strengths of association between two variables. In statistics, the value of the correlation coefficient varies between +1 and -1. When the value of the correlation coefficient lies around ± 1, then it is said to be a perfect degree of association between the two variables. As the correlation coefficient value goes toward 0, the relationship between the two variables will be weaker. (Statistics Solution, 2017, para. 1)

It is also important to note that the Spearman rank correlation test makes no assumptions about distribution. The formula for calculating the Spearman rank correlation is as follows: $r_s = 1 - \frac{6\sum d_i^2}{n(n^2-1)}$, where *r*s denotes Spearman's coefficient of rank correlation and *di* is the difference between the ranks given to the two variable values for each item of data. This is an equivalent formula when there are no tied ranks, but if there are only a few tied ranks, it provides a sufficiently good approximation (Laerd Statistics, 2013). It is worth stressing that the correlation coefficient *(r)* is not a percentage, and that it varies between -1 and +1 ($-1 \leq r \leq 1$) (Laerd Statistics, 2013; Statistics Solutions, 2017). According to Laerd Statistics (2013), the criteria used to evaluate the correlation coefficient are as follows:

> $0 \leq r < 0.25$ - weak or inexistent correlation
>
> $0.25 \leq r < 0.50$ - weak correlation
>
> $0.50 \leq r < 0.75$ - moderate to good correlation
>
> $r \geq 0.75$ - strong correlation. (para. 4)

The SPSS software was used for the quantitative data analysis and provided a comprehensive and thorough process to assess the data to ensure it was considered valid

and reliable. Gathering the different types of data (nominal, ordinal, interval and ratio) broadens the ability to parse out relationships and structures, thereby enabling a stronger assessment of the data on the topic of OER adoption and use. SPSS is an established instrument of data analysis that ensures that reliability, validity and generalizability are accounted for in the data. Graphs and descriptive statistics were used to report the findings of the UTAUT survey questionnaire, which are discussed in *Chapter 6: The UTAUT Survey Questionnaire: Findings and Discussion*. These findings were subsequently correlated, integrated and triangulated with qualitative data analysis findings so as to provide a single coherent data set at the end of the study.

Qualitative Data Analysis

This section addresses how data from the three design thinking workshops, observational notes and focus groups were analyzed. Qualitative data were analyzed using a deductive approach as well as a generic inductive one. The deductive approach is usually classified as tight and pre-structured, whereas the inductive approach is more loose and emergent (Miles & Huberman, 1994). Put differently, "deductive approaches are concerned with developing propositions from current theory and testing them in the real world" (Dubois & Gadde, 2002, p. 559). The deductive approach was specifically used during the analysis of the design thinking workshops in which the coding categories were derived from the categories of Warschauer's (2002) framework for *Effective Use of ICTs*. The objective of using this approach was to test whether these categories were indeed a good fit in this particular setting.

Miles and Huberman (1994) caution that "too much structuring of the study might blind the researcher to important features in the case or cause misreading of local

informants' perceptions" (p. 16). Bearing this in mind, the researcher took measures not to be blinded to important information provided by the teachers during the design thinking workshops. These measures included detailed participant observation (Kolb, 2012); the use of written material produced by the teachers during the design thinking workshops to validate all digital audio and video recordings; and maintaining a reflexive relationship with the participants so as to minimize the possibility of researcher bias (Conrad, Neumann, Haworth & Scott, 1993). In contrast, the looser inductive data collection and analysis approach may lead to "indiscriminate data collection and data overload" (p. 17) and "researchers paying insufficient attention to the substantive findings of the complex social reality being researched" (Liu, 2016, p. 129). Moreover, "inductive analysis refers to approaches that primarily use detailed readings of raw data to derive concepts, themes or models" (Thomas, 2006, p. 238). With these limitations in mind, a generic inductive approach was used to analyze data collected during the focus groups. One of the strengths of the generic inductive approach is that it is methodologically flexible and does not overemphasize or defend any established methodologies, enabling the researcher to focus on findings that emerge from the data (Creswell, 2009; Liu, 2016; Thomas, 2006) without being restrained by more traditional qualitative data approaches (Thomas, 2006). This approach "is aimed at building up clear and straightforward connections between research objectives and research findings" (Liu, 2016, p. 130). It is also very useful "to describe the actual program effects, not just planned effects and to develop a model or theory about the underlying structure of experiences or processes that are evident in the data" (Thomas, 2006, p. 238). Although the general inductive approach is most similar to grounded theory, it does not separate

the coding process into open and axial coding (Thomas, 2006). Instead, theory building is focused on presenting and describing the most important categories that arise from the data (Thomas, 2006). To equalize the qualitative data analysis process and obtain creative insights so as to develop theory related to TPD in OER, the researcher systematically combined these two approaches "matching theory and reality, going back and forth between data sources and analysis" (Dubois & Gadde, 2002, p. 556). The section herein also describes the corresponding categories and coding schemes employed for the different qualitative data sets.

Design thinking workshops. Data from the three design thinking workshops were collected through in-field observational notes and digital audio and video recordings. Field observational notes and digital audio and video recordings of the presentations of each group upon completion of the workshop were loaded into the NVivo version 10.0 software package for analysis. Overall, four approximately ten-minute digital audio and video recordings were collected from each workshop, for twelve total recordings. The recordings were first transcribed into Portuguese and then translated into English.

Coding methodology for design thinking workshops. "Codes or categories are tags or labels for allocating units of meaning to the descriptive or inferential information compiled during a study" (Basit, 2003, p. 144). Codes are usually attached to chunks of words, phrases, sentences or whole paragraphs extracted from a specific setting and can take the form of a straightforward category label (Miles & Huberman, 1994). In order to code the qualitative data extracted from the design thinking workshops, this study used Miles and Huberman's (1994) more deductive method, which involves creating a "start list" of codes prior to fieldwork based on a conceptual framework. "In this deductive

approach, the initial step defines a structure of initial codes before line-by-line review of the data. Preliminary codes can help researchers integrate concepts already well known in the extant literature" (Bradley, Curry & Devers, 2007, para. 13). In line with this second method, a "start list" of coding category labels was created based on Warschauer's (2002) framework for *Effective Use of ICTs*, which consists of the following categories: (i) Physical Resources, (ii) Digital Resources, (iii) Human Resources and (iv) Social Resources. These categories are described in-depth in *Chapter 2: Review of Related Literature*. As these initial categories appeared to be a good fit with data collected from this research context, highlighting relevant phenomena focused on providing meaningful insights not only regarding the research content but also to a wider audience, these same coding category labels were used to code the twelve digital audio and video recordings extracted from the teachers' presentations and discussions of their assigned tasks during the three workshops. Using the four categories created by Warschauer (2002) as coding nodes is also in line with Ely et al. (1991), who maintain that the process of establishing categories as codes is strictly aligned with establishing an ongoing method, descriptive reporting and theory building. Consequently, the use of Warschauer's (2002) categories enabled the researcher to better understand and to determine which resources - physical, digital, human and social - impacted more or less the use of digital resources, and which resources, if in place, would more likely promote their use.

The resource category indicators–physical resources, digital resources, human resources and social resources - were loaded individually into the NVivo 10.0 analytic tool as free nodes to determine if there was any reference to them in the group tasks and

presentations during the three design thinking workshops. The unit of analysis was each of the twelve digital audio and video recordings containing group discussions after completing each workshop activity in the form of utterances, sentences or images provided by the respondents. Responses were coded according to the definitions of each resource category indicator. It is also important to stress that some of the teachers' responses were double coded. For example, some responses were coded as being both human resources and social resources. Frequency results may have been different if the resource category indicators had been single coded; however, there were instances when instructor responses appeared to fit in more than one category. Matrix coding queries that combined the resource category indicators with participants' responses or discussions were run to cross-reference data. The intent of this process was to determine frequencies and patterns in the impact of the four resource categories on teachers' decisions to use digital resources. Matrix coding queries and interpretations of findings are presented in *Chapter 4: The Design Thinking Workshops: Findings and Discussion.*

Focus groups. Analysis and coding of qualitative data involves searching through data for regularities and patterns as well as for topics the data cover, and consequently developing coding categories derived from words and phrases that represent and arise from topics and patterns (Bogdan & Bilken, 2006). Focus group data were interpreted and analyzed using a generic inductive approach. The primary objective of using this approach was to identify themes in the data that were related to the evaluation of the ODP. In line with this approach, coding category labels loosely derived from the 5Rs of Guskey's (2002) Multilevel Evaluation Framework were used to investigate RQ2, about what role, if any, TPD played in teachers' OER adoption decisions (Basit, 2003).

Coding methodology for the focus groups. To develop a final coding scheme for the analysis of the focus groups, the researcher followed the coding procedures for inductive analysis recommended by Creswell (2002). These include: "initial reading of data; identifying specific data segments related to objectives; labeling the segments of data to create categories; reducing redundancy and overlap among categories; and creating a model incorporating most important categories" (Creswell, 2002, p. 266). First, the researcher prepared the two digital and audio files to be analyzed, transcribed them and added observational notes and/or memos to the codes. Next, the researcher undertook a close reading of all data to analyze participants' responses during the focus groups, in order to identify specific data related to participants' responses to focus group questions and on the researcher's observational notes regarding teachers' participation and engagement in ODP. The researcher then labeled segments of the data to create codes, producing seven different codes, which were labeled accordingly. Concepts associated with the overall effectiveness of the ODP were used as references. Evidence within and underpinning the discussions about teachers' perspectives, motivations, challenges and experiences during the ODP was sought to evaluate what role the program played in teachers' decisions to adopt and use OER. That is, the extent to which teachers referred to concepts of effectiveness, interest and motivation, challenges experienced, support obtained to participate in the TPD program, and needs and preferences regarding TPD in their discussion of the ODP was evaluated. Finally, the researcher eliminated data that were redundant or did not add further to the data analysis. When data saturation was achieved, the researcher was able to create a model that incorporated the most relevant coding categories. The final model consisted of four

major categories that highlighted teachers' experiences and learning outcomes related to the ODP. Coding categories were devised to be relatively straightforward and explicit in meaning, which is in line with Garrison, Cleveland-Innes, Koole and Kappelman (2006), who espouse that categories must be meaningful and indicators must be relatively discernible (i.e., explicit) if coding is to have reliability. Focus group digital audio and video recordings were loaded into NVivo and free nodes were created. The unit of analysis was responses to semi-structured, open-ended focus group questions in the form of utterances submitted by the respondents. Table 2 provides an overview of the final coding scheme or code family. The description of indicators was extracted from the open-ended focus group questions and was loosely based on Guskey's (2002) Levels of Professional Development Evaluation.

Table 2. Code Family for Focus Groups

Core Coding Categories	Guskey's (2002) Levels of Professional Development Evaluation	Description of Indicators
Interest and Motivation	Level 1- Teachers' reactions	Did they like the experience? Did they show interest and motivation to use what they learned? How many teachers participated in all the design thinking workshops?
Knowledge Gained	Level 2- Teachers'learning	Did teachers acquire the intended knowledge? If so, what new knowledge was acquired during the design thinking workshops?
Support Obtained	Level 3 - Organizational support	Did the school administration and/or the researcher provide proper support during the TPD program? In what ways was support provided by the school administration? How can support for this TPD program be improved? Which incentives, policies or other actions would provide further support for a TPD program in OER?

Effective Type of TPD in OER for Teachers	What kind of professional development on OER would work best in this setting? How can this TPD program be improved to inform future change efforts?

The data reduction process in the qualitative part of the study is ongoing until the conclusion of the study, and involves selection, simplification, abstraction and transformation of the raw data (Miles & Huberman, 1994). Data reduction was obtained by "combining pieces of information into categories" (Kolb, 2012, p. 84), as the above code family table illustrates. Data saturation for all qualitative data occurred when no new information was obtained from the amassed data and the researcher began to gain insight into which directions to pursue in the analysis (Bogdan & Biklen, 2006).

The following section addresses the strategies adopted to assess the validity of findings for both the quantitative and qualitative phases of the study (Tashakkori & Teddlie, 2003; Creswell, 2009).

Validity

Most scholars have advocated the use of validity procedures for the analysis of quantitative and qualitative data (Creswell, 2009; Tashakkori & Teddlie, 1998). Creswell and Plano Clark (2007) contend that "validity, within a mixed methods context, is the ability of the researcher to draw meaningful and accurate conclusions from all the data in the study" (p. 146). Thus, validity will be herein addressed within the context of both the qualitative and quantitative research approaches used in this case study.

The concepts of credibility, dependability and transferability have been used to describe various aspects of trustworthiness in qualitative research (e.g., Guba, 1981; Lincoln & Guba, 1985; Patton, 1987). These concepts are often used to expand upon the traditional notions of reliability and validity employed in quantitative research. Whereas reliability plays a limited role in qualitative research and relates primarily to inter-coder agreement in qualitative data analysis, qualitative data validity also "comes from the analysis of the researcher and from information gleaned while visiting with participants and from external reviewers" (Creswell & Plano Clark, 2007, p. 134). Further, Creswell and Plano Clark (2007) recommend that the term *validity* be used in studies that use mixed methods for data collection and analysis.

Baxter and Jack (2008) recommend using four criteria to achieve case study validity and subsequent trustworthiness. These criteria are described below.

- The case study research questions should be clearly written and substantiated.
- The case study design should be appropriate for the research questions.
- Purposeful sampling strategies appropriate for case study should be applied.
- Data should be collected and managed systematically. (p. 556)

Baxter and Jack (2008) also contend that "triangulation of data sources is a primary strategy that can be used and would support the principle in case research that the phenomena be viewed and explored from multiple perspectives" (p. 556). The collection and comparison of different data sources enhances the quality of data and promotes idea convergence and confirmation of findings (Knafl & Breitmayer, 1989). Although the findings of each data source were reported separately in the different chapters in this study for the sake of clarity, all data were converged into one coherent dataset in *Chapter*

7: Guidelines for TPD in OER, so as to provide the reader with an integrated and comprehensive understanding of the overall case and/or the contributing factors that influenced the final outcomes (Baxter & Jack, 2008).

The case study methodology used in this study promotes triangulation validity (of data source, data type, method and theory), which is obtained when the researcher can draw evidence from multiple datasets. Doing so is advantageous because multiple datasets provide better results than single datasets do. Methodological triangulation is very frequently used and has the most to offer "when using different methods on the same subject" (Cohen et al., 2011, 196). Accordingly, this study employed methodological triangulation for data analysis. Specific strategies were adopted to assess the validity of qualitative findings such as rich, thick description and member checking (Baxter & Jack, 2008), where participants "had the opportunity to discuss and clarify the interpretation, in addition to contribute additional perspectives on the issue under study" (Baxter & Jack, 2008, p. 556). Rich, thick description "can be an important provision for promoting credibility as it helps to convey the actual situations that have been investigated and, to an extent, the contexts that surround them" (Shenton, 2004, p. 69). Checks related to the accuracy of the data obtained during each design thinking workshop and focus groups were made "on the spot" at the end of each workshop and at the conclusion of the focus groups (Shenton, 2004). The researcher opted for conducting these checks "on the spot" since there was little expectation that the teachers would actually read the digital audio and video transcripts *post hoc*. These measures were geared toward minimizing potential threats to validity during the data collection and data analysis process. "Although no qualitative studies are generalizable in the statistical

sense, their findings may be transferable" (Marshall & Rossman, 1999, p. 43). Generalizability of findings was not an important issue in this study as its aim was to provide "a rich picture of a particular context that will never repeat again, but from which important lessons may be drawn, compared with practices and contexts elsewhere, and used to help guide practice" (J. Dron, personal communication, February 18, 2016). Finally, following Lincoln and Guba (1985), the qualitative portion of the research was made rigorous through prolonged engagement and observation in the field, triangulation of data, member checking, reflexivity (carried out through use of a researcher journal containing observational notes taken after the design thinking workshops and focus groups) and rich, thick descriptions. Additional strategies were also used to establish the credibility of findings such as the use of observational field notes and peer examination of the findings post intervention (Baxter & Jack, 2008). Observational field notes were used to record the researcher's impressions of each data-collection session, to detect emerging patterns from the data collected and to generate theory (Shenton, 2004). Lastly, peer examination of the findings post intervention ensured "the consistency of the findings or the 'dependability' of the data" (Baxter & Jack, 2008, p. 556). Opportunities for examination of findings by peers and academics upon completion of the project enabled them to challenge assumptions made by the researcher, "whose closeness to the project frequently inhibits his or her ability to view it with real detachment" (Shenton, 2004, p. 67). Constructive criticism and questions provided by peers afforded the researcher opportunities to rethink findings and strengthen her arguments.

Regarding the quantitative data analysis, two potential threats need to be taken into consideration: internal and external validity threats. The first is related to

instrumentation, because the UTAUT instrument utilized for measuring the intention of stakeholders to adopt and use OER was adapted and translated into Portuguese. It is advisable to use the same instrument in other Portuguese speaking *fundamental education* schools and other K-12 public schools to validate the instrument (Creswell, 2009). However, threats to validity were minimized because it was part of a suite of data-collection methods. External validity is also a potential problem because this study relied on a small nonrandom population of instructors (Neumann, 2006). Using a small number of participants is, however, common and heavily precedented in exploratory research and pilot interventions (Onwuegbuzie & Collins, 2007).

Ethical Considerations

There was minimal ethical risk involved in this study. To ensure that participation was voluntary, participants were asked to sign a Faculty Letter of Invitation and Consent Form via e-mail, and to do so again during the first face-to-face workshop. In addition, the researcher was available on site, several times during the study, and via e-mail and by phone to answer any questions or doubts participants may have had.

All participant responses and other information were kept confidential. To preserve participants' privacy, data collected included no identifying information, and the names of all participants were replaced with pseudonyms. A database was created that included participant pseudonyms and corresponding feedback so that names of the participants were not associated with their responses. Findings from quantitative and qualitative data analysis did not identify any names or personal information. Information from the survey collected using Lime Survey software assigned token id numbers to participants, ensuring anonymity. Upon completion of the survey, all online data were removed.

Data in the form of word files, surveys, digital audio and video recordings and any other information about participants was electronically downloaded to the researcher's computer. Two backup copies were committed to removable data storage devices, both of which were kept in the researcher's office under lock. Hard copies of the data (questionnaires and data from focus group interviews) were printed and stored under lock at the researcher's office as well. These will be saved for five years and then destroyed. Overall, there were no potential risks involved in the study beyond those normally encountered in any K-12 public school environment. The researcher received approval from the Research Ethics Board at Athabasca University (see Appendix E - Certification of Ethical Approval and Appendix F - Certification of Ethical Approval–Renewal) and from the school director to undertake this study.

Role of Researcher

Stake (1995) calls attention to the fact that both the role and perspective of the researcher must be clearly outlined when using case study methodology. Qualitative research usually entails collecting data via study participants, and the relationship between the researcher and participants may influence the data (McGinn, 2008). This is particularly relevant in this study, where an intervention was undertaken in which a loosely action-research methodology was explicitly designed to bring about change, and in which there was direct contact between the researcher and participants. As the goal of the intervention was to raise awareness and build participants' knowledge on OER use, the role of the researcher was that of a change agent and facilitator. Information obtained from the vice-director of the school pre-intervention helped the researcher shape the intervention, and the researcher opted to use the design thinking approach so as not to

pressure participants toward OER adoption or use. The goal was to enable participants to reflect on how they could incorporate OER in their professional practices, provided that they were willing to do so. This approach also enabled the researcher to build a closer relationship with the participants and proved useful for understanding and addressing teachers' concerns, as well as in facilitating discussions and data gathering. Despite these protective measures, upon the conclusion of each workshop, the researcher became increasingly aware that there were several challenges to be overcome in order to effect real change in teachers' practices. It is also worth noting that although the researcher is an OER advocate and believes that the adoption of OER would be highly beneficial in this context, the researcher did not at any time impose her personal beliefs and values; she was more interested in capturing the voices and perspectives of the participants so as to generate richer data collection.

The researcher's profile and roles in this study are as follows. The researcher is a middle-aged female and has had previous teaching experience. As most teachers who participated in the study were also middle-aged females, it was easier for the researcher to empathize with participants. During the intervention, the researcher worked as a distance education consultant and instructional designer in a wide variety of projects. Although the researcher has completed a Masters program in Canada and an additional Postgraduate qualification in Instructional Technologies and has published work in the area of online cross-cultural research, she had not had any previous experience using the design thinking approach or undertaking a field intervention. Moreover, most of the researcher's work has focused on designing instruction for adults in corporate or higher education environments. Therefore, it was the researcher's first time undertaking an

intervention in a K-12 environment, planning and designing this intervention using the design thinking approach. This presented additional challenges, at least initially. To overcome these challenges, the researcher consulted experts in design thinking so as to ensure that the problem proposed was in line with the objective of the ODP. Additionally, while the researcher had prior experience using mixed methods in her Masters thesis, this was the first time she used case study methodology to create evidence-based OER guidelines, the final output of the case study.

Due to these multiple roles, the researcher decided to capture a specific instance that occurred while undertaking the intervention and share here how she used it to distill insights regarding participants' thinking. During the fourth workshop, some of the teachers became very active in sharing their critical reflections on government-related decisions and actions. Coincidentally, this was the only workshop the pedagogical coordinator participated in. The researcher became concerned about this as these comments could potentially divert teachers' attention away from the task at hand. The objective of this workshop was for teachers to build a prototype that showed how teachers would overcome the challenges raised in the second and third workshops. However, the researcher decided not to intervene, as this was perceived as a reflection on issues that impact teachers' practice, which is encouraged for participants but often not practiced by facilitators. As these were real-life examples of some of the challenges faced by these teachers and added to findings of the study, they were seen as valuable and appropriate to bring up.

It is important to acknowledge that, in addition to being the intervention planner, designer and facilitator and the focus group facilitator, the researcher's role also served

some of the functions of an authority figure. Did the participants tell the researcher what they wanted the researcher to hear because of this? The researcher feels that this what not the case. As the intervention and focus group facilitator, the researcher was approachable, did not try to influence the participants in any way, and encouraged a climate of openness, transparency and collaboration. This, the researcher hopes, will have had an impact on participants and encouraged them to freely share their thoughts.

As the only face-to-face interaction between the researcher and participants was during the workshops and focus groups, the researcher did not get to know the participants well. This may have made it easier for the researcher to refrain from offering personal perspectives and to listen more actively to what the participants were saying. This also contributed toward decreasing researcher bias. Other impediments or constraints on the part of the school administration regarding the intervention as a whole have been duly noted whenever applicable. Yet, as this case study is unique and bounded by its context, these reflections and observations may not be helpful or applicable to other settings or contexts.

The most important lesson the researcher learned was that, due to the several variables and challenges that impact OER adoption and use in this group, a long-term intervention may have effected better results than this short-term one. Thus, the aim of having the intervention serve as an effective agent of change was unfortunately not fully achieved due to time constraints. Attentive listening to participants' narratives and discussion of challenges and benefits related to the use of OER in their teaching practices; researcher reflections throughout the intervention; and analysis and triangulation of multiple data sets helped the researcher achieve the findings of this

study. As Carl Rogers (1969) noted, we cannot teach another person directly; we can only facilitate their learning. Bearing this in mind, while it was the role of the researcher to facilitate the learning of the participants during this study, the researcher was also aware that there would be substantial gains in her own learning process in terms of how to best teach and implement OER.

Limitations of the Study

There are a number of limitations to this study in addition to those previously discussed in the *Case Study Limitations* section. First, as a large amount of qualitative data needed to be collected and analyzed, systematic documentation of data collection was carried out. Another limitation of this study was the small sample size, particularly in regards to the quantitative strength of the findings. Constraints related to sample size curtailed the types of statistical procedures that might be used, particularly the more rigorous parametric measures of association, such as t-tests and analyses of variances (Driscoll, Appiah-Yeboah, Salib & Rupert, 2007). Consequently, there are no statistics for generalizing from small purposive samples. However, despite the small sample size, findings were adequately triangulated "by using multiple sources of evidence to provide multiple instances from different sources" (Miles & Huberman, 1984, p. 234), measures that could counteract biases in the researcher's collection and analysis of case data. As Yin (1994) asserts, "the case study findings are strengthened by the convergence of information from a variety of sources, providing multiple measures of the same phenomenon" (p. 92). Third, a case study in which the researcher plays a participant role requires comradeship and enthusiasm to support the intervention, yet "a certain wisdom is needed to walk this narrow line between objectivity and bias. The personal skill to hold

all of these attitudes simultaneously is a challenge and a defining feature of the quality of the research" (Anderson & Shattuck, 2012, p. 18). The researcher was mindful of this and did her best to actively support the intervention in addition to being aware of potential researcher bias. Fourth, coder inter-rater reliability was not obtained, as the researcher carried out this study without any external assistance, which may have adversely affected the ability to validate the coding schemes and qualitative data analysis. To make up for this shortcoming in the coding process, findings were shared with other researchers to obtain feedback, which helped add validity to the final results. A final limitation is that the findings of this study are transferable only to the extent that the participants are representative of Brazilian *fundamental education* public school teachers or other teachers in K-12 contexts undergoing TPD in OER or in some form of an OER development course. However, as discussed previously, the findings of this "study can be universalizable, even if they do not lead to generalizable theory" (J. Dron, personal communication, June 20, 2017).

Conclusion

This chapter explained the research methodology and methods. A case study methodology was used in order to enable the researcher to explore a "real-life, contemporary bounded system" (Creswell, 2007, p. 73) and its corresponding values, beliefs and challenges with regards to innovation during a period of twelve months. A case study that made use of mixed methods to gather information in this bounded setting was deemed to feature a suitable methodology. This methodology afforded the researcher an opportunity to effectively understand in what ways and to what extent TPD impacted

teachers' decisions to adopt and use OER. The use of the case study methodology held the potential not only to collect rich and detailed data on participants' perspectives and challenges with regards to OER use but also to generate new theory that informs what kind of TPD program in OER would best meet the needs and requirements of teachers in this specific context. Validity and trustworthiness of all data were ensured through triangulation of multiple sources of data, and strategies were adopted to assess the validity of qualitative findings by using rich, thick description, member checking and peer review. Although the "findings of this study may not apply more widely" (Seale, 2012, p. 121), the findings of this study allowed the researcher "to gain detailed descriptions and understanding of the prerequisites for effective TPD in OER in this particular setting" (Seale, 2012, p. 121). In the chapter that follows, findings and discussion from the qualitative data collected from the design thinking workshops are reported.

Chapter 4: The Design Thinking Workshops: Findings and Discussion

Introduction

This chapter describes the major data findings for the three design thinking workshops, which were focused on answering RQ1. Thirty total teachers (N=30) participated in the three one-hour design thinking workshops. The school director and vice-director did not participate in any of the design thinking workshops, even though the researcher invited them to do so, because, according to them, they were busy or engaged in other activities. The pedagogical coordinator only participated in the last design thinking workshop. As previously mentioned, the first workshop was focused on providing participants with an overall view of OER and on the ODP; the design thinking workshops are respectively numbered two, three and four. The remainder of this chapter comprises six sections. The first section outlines the qualitative data analysis and matrix coding query results for the design thinking workshops. The second section presents the findings for the coding category human resources and provides a discussion of the results. The third section focuses on the coding category digital resources, discussing its findings and presenting examples from within the data collected. The fourth section provides a complete analysis and discussion for the coding category social resources. The fifth section provides an analysis and discussion of the coding category physical resources. Direct quotes from participants are used to support and clarify emerging perspectives, challenges and actions as they relate to each of the resource categories. To avoid over-generalization and prevent losing focus of the participants' perspectives and experiences, a *thick description* of the participants' accounts is provided.

Qualitative Data Findings: Matrix Results

Matrix coding queries that combined the resource category indicators with participants' responses were run in order to cross-reference data and thereby determine frequencies and patterns in relationship to the impact of the four resource categories on teachers' decisions to use digital resources. The use of Warschauer's (2002) categories enabled the researcher to better identify which resources - physical, digital, human and social - impacted more or less the use of OER in this setting, and which resources, if in place, would be most likely to promote their use.

Table 3 shows the frequency counts for each resource category when cross-referenced with teachers' responses and presentations at the end of each workshop. Matrix cell shadings in a darker blue indicate higher frequencies.

Table 3. Matrix Coding Query Results for the Design Thinking Workshops

	Workshop 2				Workshop 3				Workshop 4				Total Frequency
Digital Resources	0	0	1	5	4	0	0	2	0	0	0	0	12
Human Resources	6	6	2	7	1	4	2	2	4	1	2	0	37
Physical Resources	6	0	1	3	1	5	2	1	0	0	0	0	20
Social Resources	2	0	0	0	2	1	2	4	5	2	3	2	23

Matrix coding query results show that all four resource indicators: digital resources, human resources, physical resources and social resources appear to be present in teachers' discussions on the use of digital resources to improve their pedagogical practices, some to a higher degree than others. These findings are not surprising, as several studies and reports that focus on the use and creation of OER have underscored

that for teachers to be able to effectively use OER they must have access to computers and the Internet, to online digital material or content that is appropriate to local culture, to TPD that provides them with knowledge and skills to use such resources and to support from their institution or from local governments (see Collins & Halverson, 2009; Ehlers, 2011; Haßler et al., 2011; Hew & Brush, 2006; OER Regional Consultation, 2017; Panke & Seufort, 2013; Petrides et al., 2010; Rossini, 2010; Warschauer, 2002). While access to computers and the Internet is still a major challenge for most Brazilian *fundamental education* public schools inasmuch as there is low availability of equipment and limited Internet connection (CIEB, 2016), there is a potential solution to this problem. For example, it is possible for teachers to use and create OER as offline resources (OER Regional Consultation, 2017). This means that OER can be downloaded for offline use, provided that teachers possess the knowledge and skills to find OER and to download them to home or school computers. Findings cover specific frequency counts presenting examples and quotes that illustrate each resource indicator when cross-referenced with specific group discussions and presentations during the three design thinking workshops. For the sake of clarity, findings for each resource indicator are discussed separately.

Human Resources: Findings and Discussion

Human resources refer to issues such as literacy and education that are necessary for proper computer use (Warschauer, 2002). In the context of this study, human resources also refer to possessing knowledge and skills with ICTs so as to be able to assemble and repurpose OER. This resource indicator is strictly tied to TPD. The total frequency count for human resources when crossed-referenced with all twelve digital

audio and video recordings of teachers' discussions and presentations on the use of digital resources was 37. Although the frequency was higher in Workshop 2, this same resource indicator appeared to span the other workshops.

Problems and challenges related to the lack of human resources in the form of proper TPD were mentioned frequently when the researcher asked groups to list their uncertainties and doubts regarding the use of digital resources during the second workshop. They were also present during the third workshop when the researcher requested that groups list strategies and solutions to these same uncertainties and doubts. TPD was thereby perceived as a solution to the use of digital resources in this group. In the fourth workshop, the teachers' task was to build a prototype that showed how they would overcome the challenges identified by teachers during the first and second workshops and again once the groups pointed out that they lacked TPD to effectively use digital resources. Lack of basic technology knowledge and skills was identified as a barrier to OER use. Some examples of participants' doubts regarding using digital resources can be found from direct quotes from group members.

> *What types of resources to use for lay people? Is there a course to take to master existing technologies?* (Group 1, reference 1).
>
> *Will there be materials needed to work with these digital resources? Will there be training for teachers?* (Group 3, reference 1).
>
> *Doubts regarding the technologies is whether there is a course available. What course could teach us to use digital resources?* (Group 2, reference 1).

Strategies and solutions for the incorporation of digital resources in their pedagogical practices as proposed by the teachers focused on the need for TPD as well, as the following statements demonstrate.

> *Problems with downloading and handling of digital resources can be solved through TPD and teachers should use their curiosity in a constructive way* (Group 1, reference 2).
>
> *Promote TPD, interdisciplinary projects, updating in digital information, continuous digital training* (Group 2, reference 2).
>
> *Have more TPD in ICTs and OER* (Group 3, reference 2).
>
> *And the solution would be that this TPD would not be a course like we usually have that lasts only 3 hours and then we have to put into practice what we learned during the entire year. It should be a course with a beginning, middle and end. So this TPD should have a strong theoretical component so that we will be well prepared and not running to solve problems in the day to day, go there and do a course that lasts 3 hours and then come back and we have to solve and try to do a miracle during the year* (Group 2, reference 3).
>
> *And it should not be just a basic course, erase, paint etc. It would be good to really learn something deeper about the computer. Something that gives us a good foundation and that spares our colleague's time* (Group 3, reference 3).

Although the design thinking approach is focused on enabling teachers "to build a prototype of pedagogical possibilities that take into account the cultural transformations that have been brought on by the digital world, it is not intended to be a short-term or linear process" (P. Gonsales, personal communication, April 17, 2017). Potential

solutions may only surface after existing problems have been thoroughly discussed and worked out. It would have been desirable to have more time with the participants in order to better implement technological innovation. However, this was not possible due to the fact that the principal of the school informed the researcher that there were other pressing matters on the *HTP* activity agenda, which imposed time limits and limited the availability of the teachers. Hence, the researcher was only able to conduct four workshops as the school principal made it clear that more workshops would disrupt the agenda of other *HTP* activities. Nevertheless, Workshop 4 enabled the researcher to glean more insight into participants' barriers and needs specifically regarding TPD when using digital resources, as the statements below illustrate.

> *No matter how much he or she (the teacher) wishes, the training that the city hall gives us is of no use* (Group 1, reference 3).
>
> *Because if we have the resources, we will work as long as there is TPD* (Group 2, reference 4).
>
> *The training would be to enable us to use different sites and acquire more skills* (Group 3, reference 4).

These findings corroborate the literature review on TPD in Brazilian *fundamental education* public schools, highlighting the deficiencies of those TPD programs that are currently offered since they neither focus on enhancing teachers' abilities to work with 21st century learning practices (Brzezinski, 2008; Freitas, 2002; Gatti, 2008; Saviani, 2009) nor do they focus on teaching basic computer skills for ICT uptake (Brzezinski, 2008; Freitas, 2002; Gatti, 2008; Saviani, 2009), both of which are important drivers for OER adoption and use. Provision of digital literacy and digital skills are imperative to

ensure that teachers can make informed decisions about adopting and using OER. Further, the current hierarchal organizational structure of professional education in the Brazilian *fundamental education* public school system may need a change in mindset, toward one that is open to implementing innovative practices such as OER use (de los Arcos et al., 2016; Huitt & Monetti, 2017). Ideally, education on basic computer and ICT knowledge and skills should be more focused on building collaborative knowledge, enabling teachers to engage in teaching opportunities that are more aligned with 21st century learning (Gonsales, 2015).

The findings of this study, that teachers perceive formal, long-term TPD as being valuable in improving their ability to use OER, are contrary to those from a recent study conducted by TIC Educação (2015) in public schools, regarding how teachers learn to use ICTs. According to TIC Educação (2015):

> Teachers point out that the main way they learn how to use ICTs pedagogically is not the training courses offered by education departments, but the so-called "informal exchanges" among educators, cited by 70% of public school teachers. What are these informal exchanges? Moments between classes? Planned meetings? The research does not clarify this information, but, in any case, it is evident that teachers want and like to know the work of their colleagues, with whom they share similar challenges. It is an important signal to public policymakers to take advantage in a more efficient way of the moments of exchange and cooperation already established between teachers. (p. 14)

In fact, there is support for these data in findings that were cross-referenced with the resource indicator social resources, which are addressed later on in this chapter.

The groups also identified certain advantages to using digital resources during the workshops. The statements below highlight these advantages.

> *The cool thing also about digital resources as teachers and even me being a specialist is that it is cool for updates. We update through the digital part. We can be up to date in our areas* (Group 1, reference 4).
>
> *What is clear is that technology also broadens the knowledge of both teachers and the students and the students have much greater ease with it than we do since they are from a different generation and it also streamlines our work* (Group 2, reference 5).
>
> *Technology opens up new possibilities for student learning. Children are motivated by this type of resource. And the resources are visual and facilitate the learning capacity of the students* (Group 3, reference 5).
>
> *Variety. The great variety that we have from materials that are accessible and that we are able to use them in our classes* (Group 4, reference 1).
>
> *The certainties are in relation to the research where the children can solve their doubts. What the computer teacher said will complement what they are seeing in the classroom* (Group 4, reference 2).
>
> *Digital resources that are well used only contribute to teaching and learning. They broaden the teacher's knowledge. The students have more ease with digital technologies and resources. Digital resources help speed up the teacher's work* (Group 2, reference 6).

It is worth noting that there is a computer teacher in the school examined in this study. Although the computer teacher appears to be savvier with technology and computer use,

she has never used or created OER. However, she plays a fundamental role in helping teachers with technology whenever they have doubts, a role which is supported by the findings of the TIC Educação (2015) study and also by the findings of this study. Some other advantages that were mentioned regarding the use of digital resources during this workshop were the ability to use music for teaching purposes, the ability to use videos to teach a particular subject and the ability to use games to complement and/or supplement subjects such as Math, Portuguese, Science, Physical Education and Arts. It is interesting to note that the teachers perceive the use of digital resources as a means to update and renovate their professional practice. The statement that follows captures this notion.

> *We are always updating because what we learned at the university has not helped us to adapt to the changing times and every day that passes, for example in my case, there is something that is being updated and innovated* (Group 1, reference 5).

It is also curious to note that teachers who participated in this study seem to believe that their students possess more knowledge and skills with technology than they do. This may be an inaccurate perception (Beetham et al., 2009), but students' knowledge of and skills with technology was beyond the scope of this study, so it was not possible to validate the assumption. Ultimately, findings with regards to the category indicator human resources are also in harmony with a large-scale study on pedagogy and ICT in schools around the world conducted by IEA SITES in 2006. First, the teachers in this study appear to perceive that the use of digital resources can be a more effective lever for pedagogical change, both for them and their students (Law & Yuen, 2008). Second, lifelong learning and connectedness afforded by the use of digital resources enables

teachers to remain current in their pedagogical practices (Law & Yuen, 2008), as teachers' affirmations corroborate. Lastly, teachers believe that the use of digital resources will engage students more in their learning process (Law & Yuen, 2008).

Notwithstanding all the advantages to using digital resources brought up by the teachers, Law and Yuen (2008) underline the need for professional development to promote teacher adoption of digital resources. This is because "teachers' self-perceived pedagogical ICT-competence correlates significantly with ICT use in teaching, which can help increase OER use" (Law & Yuen, 2008, p. 213). There is evidence that without planned and systematic literacy and education or some other kind of "informal exchange," teachers' ability to effectively use digital resources decreases.

Digital Resources: Findings and Discussion

According to Warschauer (2002), "digital resources refer to digital material that is made available online" (para. 10). Digital resources also encompass factors such as ease of access to these resources, taking into consideration other issues and/or barriers such as the quality of the resources and language-related issues. This indicator is therefore related to how accessible resources such as OER are to teachers. The total frequency count for digital resources when crossed-referenced with all twelve digital audio and video recordings of teachers' discussions and presentations on the use of digital resources was 12. Despite a low frequency count for this resource indicator, teachers mentioned that they regularly used the Internet to search for materials such as images, videos and music. According to the teachers, these materials are used to supplement instructional content or to conduct assessments. These findings are supported by the TIC Educação (2015) study, which found that:

> Using the Internet to prepare lessons or student activities is a common activity among public school teachers: 96% of them reported that they had used some type of content obtained on the internet for this purpose (i.e., images, test questions, texts, videos, programs/software, games, thematic presentations, to name a few); among these resources, the data indicate a greater emphasis on instructional materials, for presenting content or completing assessments. (p. 13)

Findings from the TIC Educação (2015) study also reveal that 86% of the public school teachers reported having created new materials from a combination of various resources obtained on the Internet. While during the workshops the researcher did not specifically ask the teachers if they made modifications or alterations or created new

materials from content obtained online, it appears that some of them may have already engaged in such practices. The fact that these teachers regularly search for, download and create using materials retrieved on the Internet is not to say that they are doing so in a way that complies with the 5Rs using open licenses or Creative Common licenses. On the contrary, it merely implies that these teachers are aware that the Internet is a good place to search for educational content. This notion is corroborated by data that indicates that the publishing and sharing of these resources on the Internet is still a relatively rare activity, practiced by only 30% of public school teachers (TIC Educação, 2015). However, there are no statistics that may be used to determine how many of these resources are indeed OER, and copyright infringement is still a major concern (TIC Educação, 2015).

Accessibility and language-related barriers regarding the use of digital resources and their impact on the indicators of digital resources are described in the teachers' affirmations below.

> *The translation. Many sites are not translated into Portuguese and we do not know if what we're reading is correct. So, we have that doubt* (Group 4, reference 3).
>
> *How to find material. How do we find material? Will I always use Google to do a search? Will I always use YouTube to search for a song or a video? What are some alternate means?* (Group 4, reference 4).
>
> *If the website that we are accessing is reliable, is the information there (on the site) reliable?* (Group 4, reference 5).
>
> *Translation. Because we often only find things in English. Use Google translator; that is a more trusted tool* (Group 1, reference 6).

> *And the sites. There are lots of good things to use and unfortunately we do not have access to them* (Group 4, reference 6).
>
> *Accessibility. Trustworthiness and reliability of the sites and materials that are being used. How to effectively download material. Problems with translation since most of the digital resources available are in English. Different ways of using available material. How to correctly handle such materials. How to carry out tasks using digital resources.* (Group 4, reference 7).

Regarding language barriers, there is a consensus among scholars that "the dominance of the English-language content is a real problem" (Amiel, 2013; Cobo, 2013; OER Regional Consultation, 2017, p. 19) and may be perceived as a barrier inasmuch as there are more OER available in English than in other languages. As teachers themselves pointed out, one solution could be to use Google Translator, which is an acceptable tool for translations. The OER Regional Consultation (2017) report is very much in line with this solution, and has stated "since OERs are mostly digital resources, then we can use many technologies that overcome the language barrier, such as online translation systems, for text documents, sounds and videos" (p. 20). Irrespective of the benefits afforded by the use of online translation systems to access and obtain OER, "there is need to foment the production of local knowledge and indigenous ways of knowing in order to foster adequate learning opportunities" (Amiel, 2013, p. 136). Bearing this in mind and considering that Brazil is still in the early stages of mainstreaming OER, it has in recent years placed great emphasis on launching initiatives and repositories that foster the production of local OER, as addressed in the Brazilian K-12 OER Initiatives section of *Chapter 2: Review of Related Literature*.

These findings also suggest that, since teachers do not know how to locate openly licensed digital resources, when they do find them they have doubts as to whether these materials are reliable, and encounter problems using them. These findings are consistent with the assertion that "most educational sites and repositories are focused on the distribution and dissemination of resources and provide little guidance or tools for those who wish to make revisions or remix existing resources" (Amiel, 2013, p. 128). When access to digital resources is limited, the knowledge and ability to distinguish a high quality digital resource from a low quality one is curbed, and/or language barriers are at play; it is easy therefore to understand why teachers may download and use whatever resources are at hand without considering their legal implications. There is a need to promote practices that provide access to local digital resources and local repositories. Mechanisms for incentivizing knowledge sharing should be embedded in these practices.

Social Resources: Findings and Discussion

"Social resources refer to the community, institutional, and societal structures that support access and use to digital resources" (Warschauer, 2002, para. 10). Support is most effective when there is an institution-wide policy that ensures that teachers receive proper resources such as time, salary, technical support, school planning, leadership and school time-tabling to integrate innovative teaching practices (Hew & Brush, 2006). The total frequency count for social resources when crossed-referenced with all twelve digital audio and video recordings of participants' discussions and presentations on the use of digital resources was 23.

Lack of time, personnel and low salaries were identified as barriers to the use of digital resources, as the following statements demonstrate.

> *We do have access but there is only one person at school who works with computers and it's a bit of a problem. We need more people, more environments, right?* (Group 4, reference 8).
>
> *And we have to factor in how much employees earn - about R $ 1,700.00 (US $ 567,00 per month) right?* (Group 1, reference 7).
>
> *Usually it's the women in Osasco that support the household, not the men. How will you pay for broadband? How will you be able to afford state-of-the-art equipment? These are real issues here.* (Group 1, reference 8).
>
> *Usually the vast majority of the faculty is female. They work both in the morning and in the afternoon. And their workload triples where? At home. What time is [a teacher] going to do this?* (Group 1, reference 9).
>
> *We do not have enough professionals. Will more professionals be hired to undertake this endeavor?* (Group 3, reference 6).
>
> *Before anything is initiated we need planning. We partner with the students for research; when we do not have the resources to research we ask them to research and bring things because they attend the computer classes and there they can conduct research* (Group 3, reference 7).

Lack of time was cited as one of the major barriers to the use and creation of digital content by 13% of the teachers in the study conducted by TIC Educação (2015). Teachers need time to preview web sites or repositories in order to locate images, texts and audio or video files. Lack of time coupled with low salaries is also a concern because teachers may be inclined to put less effort into their teaching or to embrace new pedagogical practices. Conversely, teachers who are willing to put in longer hours of

work may end up suffering from *burn out* and feel they are not compensated for their additional efforts (Lai, Trewen & Pratt, 2002; P. L. Rogers, 2000). According to the vice-director of the school, the teachers do not use the seven hours allotted weekly for studying, preparing lessons, correcting activities and/or exams to study. In his own words, "they are supposed to but they do not do so" (R. Aton, personal communication, June 20, 2017). The contradictory assertions between the vice-director and teachers make it difficult to precisely assess whether lack of time does indeed hamper teachers' efforts in incorporating digital resources and/or new pedagogical practices.

As previously mentioned, it appears that teachers rely heavily on the computer teacher or on informal exchanges with colleagues. In order not to overburden the computer teacher, the teachers proposed that the school hire an agent of inclusion, a full-time member of the academic staff whose duty would be to provide training and ongoing support for using digital resources. The affirmations that follow illustrate other solutions and strategies proposed by the teachers.

> *Take advantage of the students' experience with digital technologies* (Group 1, reference 10).
>
> *Take advantage of the students' experience with digital resources. Establish partnerships with technology and computer teachers through use of the computer in special projects* (Group 2, reference 7).
>
> *…exchange ideas with other colleagues. Use some of the resources we already have. Exchange ideas with experts in the area* (Group 3, reference 7).

> *So I think that this is what we only have access to here (The Computer Teacher) unfortunately* (Group 2, reference 9).
>
> *We even do have access but there is only one person at school who works with computers and it's a bit of a problem. We need more people, more resources* (Group 4, reference 10).
>
> *Help from an agent of inclusion in the computer classes aimed at the best use of computers for the group, request school administration authorize use of diverse sites and YouTube by means of a password only for teachers so that they can search for videos to use in their classes* (Group 4, reference 14).

Such statements show that teachers are requesting more personnel to support them in their endeavors with digital resources use. These findings are somewhat consistent with the results from the CIEB (2016) report[10], which found that in four out of ten Brazilian public schools it is the teachers who usually take the initiative to request for capacity-building on ICTs. The state or municipal secretaries offer regular training to approximately one fourth of schools, but the teachers frequently evaluate this training as being poor or insufficient (CIEB, 2016). Additionally, only 3.4% of teachers chose to participate in programs for developing the ability to use digital resources (CIEB, 2016). The majority, 36.4%, chose to participate in TPD programs that provide basic knowledge and skills in how to use the Internet and how to work with basic software (CIEB, 2016).

This study also found that external web sites such as YouTube are often blocked by school administrations. Apparently, this measure is taken so that the students do not spend time surfing on YouTube or on other social media sites, which may disrupt class

activities. The CIEB (Center of Innovation for Brazilian Education)[11] (2016) study[12] nevertheless claims that the majority of Brazil's public schools (65%) have regular access to a variety of search engines such as Google and other sites such as the *Portal do Professor* and *Escola Digital*. The two latter sites are geared toward providing teachers with a wide variety of OER, but are not really open. The solutions proposed by the teachers in this study, such as providing a password for teachers to access YouTube, are coherent but may not be feasible due to server and other bureaucracy-related constraints. However, provided there is effective pedagogical and technical support that can respond swiftly or adequately to teacher requests or doubts (Cuban, Kirkpatrick & Peck, 2001), teachers could learn how to embed YouTube videos and other video and audio material that is openly licensed in PowerPoint-like presentations using their home computers if they do not have access to YouTube on school premises to teach their classes. These practices must be aligned with the school curriculum and learning objectives previously defined by the school leadership (CIEB, 2016).

With regards to school leadership, the CIEB (2016) report highlights that only 36% of the Brazilian public school principals stated that they have strategies and plans to use technology for educational purposes. Moreover, less than 10% of the cases feature actual establishment of clear goals and objectives to put these strategies and goals into action (CIEB, 2016). Consequently, the impact of OER use on teachers' practices in the classroom are limited and contingent on the principal's willingness and capacity to incorporate such goals into the school curriculum. It is worth stressing that the principal of the *Fundamental Education* Municipal School did not participate in any of the design

[11] CIEB – Centro de Inovação para a Educação Brasileira
[12] The CIEB report is not at the same level of methodological rigor as the TIC Educação study.

thinking workshops, which suggests that she initially agreed with the idea of free TPD but apparently saw little value in actually implementing OER use in the school. The teachers who participated in the study strongly criticized the current government administration for their lack of vision regarding uptake on digital resources. Teachers also stated they feel professionally undervalued by state and municipal authorities. Two examples of this were captured in teachers' discussions during the fourth workshop.

> *The authorities that were previously in power during 12 years, specifically the mayor, did not value any of the teachers. They (the teachers) were ranked in the second or third position in terms of importance. So maybe now they will rethink this because when it matters to them they do it fast* (Group 2, reference 9).
>
> *Once we have a newly elected mayor, a different political party in power, a new secretary of education, it's all about having a closer look at the technological advances and investing in them* (Group 2, reference 10).

Teachers' capacities to use digital resources are strictly tied to a shared vision for their effective use (CIEB, 2016; Hew & Brush, 2006; TIC Educação, 2015). Any plan to improve their ability to use digital resources should focus on teaching and learning, and not merely on technology-related issues (P. L. Rogers, 2000); it should also prioritize aligning the current curriculum with the goals of the PNE. While it may be feasible to hire agents of inclusion or OER/ICT experts to provide pedagogical and technical support (Cuban et al., 2001), teachers must also understand "how OER can enhance their practice in addition to understanding the underlying benefits of technology for educational purposes" (OER Regional Consultation, 2017, p. 19). The use of OER needs to be a collective decision based on a shared vision and may entail changing cultural

norms and modifying practices and behaviors of leadership and teachers (de los Arcos et al., 2016). In a study conducted by Venturini (2014) aimed at assessing the views and perspectives on OER use of different stakeholders, such as non-profit organizations, academia and public authorities, Venturini concluded that the absence of a culture of collaboration is one of the main challenges to OER uptake in Brazil. To overcome this barrier, there should be more collaboration with policymakers and school administrators, so that teachers feel more valued as professionals and authors of educational content (Venturini, 2014). Further, government authorities and school administrators should be engaged in providing "a continuous review of the purposes and outcomes of the national curriculum" (Beetham et al., 2009, p. 7) so as to ensure that this curriculum "supports flexibility, stakeholder-responsiveness, and innovation in curriculum design" (Beetham et al., 2009, p. 7).

Physical Resources: Findings and Discussion

"Physical resources encompass access to computers and telecommunication connections" (Warschauer, 2002, para. 10). The total frequency count for physical resources when crossed-referenced with all twelve digital audio and video recordings of teachers' discussions and presentations on the use of digital resources was 20. All teachers reported they had access to computers at home, although some of them reported that they sometimes needed help from their family members to perform basic computer operations. Most of the teachers who participated in this study listed three complaints about things that are strictly related to physical resources: obsolete equipment in the teachers' rooms, computers and other multimedia equipment being available only in the computer lab and unreliable and unstable high-speed broadband Internet. In fact, there

was Wi-Fi connectivity only one time when the researcher was on site.

These findings are consistent with those of the CIEB (2016) report and the TIC Educação (2015) study. Access to computers in public schools is mostly restricted to the schools' computer labs. 21% of the teachers reported that there are computers available only for administrative purposes (CIEB, 2016). 75% of the schools reported that there are computers in the computer lab, among which almost half reported sporadic use of these computers (CIEB, 2016). There are computers available in classrooms in less than 4% of the schools (CIEB, 2016). The CIEB (2016) report also highlights that there is great variability in the amount of equipment available. In almost every school there are printers, televisions, stereos, microphones, projectors, scanners, and DVD players. Equipment maintenance fails frequently and is rarely prevented, which causes problems in the actual availability of the machines. In almost all the cases, technical support from the state or municipal secretariats of education is ineffective. In 28% of the cases, students and family undertake maintenance and in 13% of the cases the equipment remains broken (CIEB, 2016). Poor or limited Wi-Fi connectivity and obsolete equipment were also cited as major obstacles toward teachers' efforts to use digital resources (TIC Educação, 2015).

In most states, there are an average of 25 students per computer. This number is calculated according to the division of the sum of all equipment available (i.e., computers, notebooks, tablets) by the quantity of students during the morning, afternoon, and night periods. However, this average hides disparities between states. Among respondents, there are public schools in which there are 64 students per computer, for which access is virtually nonexistent; meanwhile there are other public schools that have

an average of ten students per computer (CIEB, 2016). For the sake of comparison, the Kennisnet Four Report Balance Monitor reports that, in The Netherlands, in 2015 the average number of students per computer was five (CIEB, 2016).

Conclusion

"Public school teachers are well protected by the law, which practically prevents them from ever being fired" (Farias, 2016, p. 149). This means that there are few official compulsion structures that may motivate them to move out of their comfort zones and change their attitudes, beliefs or behaviors. Data from the human resources indicator suggest that teachers perceive several potential benefits regarding the adoption and use of digital resources in their pedagogical practices, which is a positive factor, indicating that at least some teachers would be willing to move out of their comfort zones, provided that they received the required training and resources. Nonetheless, data also suggests that teachers are somewhat resistant to adopting new practices due to the fact that they feel undervalued, do not want to add more or unnecessary work to their already heavy workload, and are used to taking action that is either top-down or that comes in the form of an official policy. Upon completion of the workshops, it became easier to detect who the champion teachers in the school may be. Lack of engagement on the part of the school administration during the design thinking workshops suggests they are not interested or do not have time to push for real reform in this avenue. Having additional design thinking workshops may have engendered more readiness for change and innovation among the administrators. Having presented the main findings of the design

thinking workshops, the next chapter addresses the findings from the focus groups conducted post intervention.

Chapter 5: Focus Group Interviews: Findings and Discussion

Introduction

This chapter presents and discusses the results obtained from the data analysis of the focus groups conducted post-ODP. Focus groups were aimed at assessing the overall effectiveness of the TPD program. In addition, they were geared towards answering research question two (RQ2) of this dissertation: What role, if any, can TPD play in teachers' OER adoption decisions? Ten (N =10) teachers participated in the focus groups during teachers' one-hour *HTP* activity time. The content of this chapter is divided into four sections. Each section presents the four main categories and/or factors highlighted by the teachers as being important to be considered in a TPD program on OER based on the data analysis. Each of the categories and/or factors, which derive from the final code family, are presented and discussed separately, with a clear definition for each one and with the respective examples of participants' responses acquired during data collection. This chapter concludes with important implications for TPD on OER in this setting with basis on data collected during the focus groups.

Interest and Motivation

These categories sought to assess teachers' reactions to the ODP. They focused primarily on evaluating if teachers showed interest and motivation in the TPD program and/or to use what they learned in the program. Findings revealed that all of the teachers (N =10) who participated in the focus groups also participated in all of the design thinking workshops. The groups were asked what factors, if any, piqued teachers' interest and motivation regarding their opportunity to participate in the ODP. Six

teachers stated they were interested in the TPD program due to its direct relationship with ICT skills, an area that they feel they are deficient in, and in which they want to develop professionally. Seven teachers felt motivated by the opportunity provided to learn and reflect on new practices. As an example of motivation to learn new things, one participant stated:

> *This professional development program has been an eye-opener for me. We often hear about the private schools using technology to deliver courses but when you think of public schools it's a different reality. And this course got me thinking - if they can do it then why can't we? Of course, we don't have the technology but we could start doing things on our own. Now OER were something I had never heard about. If they are free resources then why aren't the public schools using them? This is why I decided to take this course, to learn more about these resources* (Group 1, reference 1).

From this teacher's assertion, there seems to be a misconception with regards to OER not only being free resources but also open resources that comply with the 5Rs, a topic that was addressed by the researcher during the first workshop. This rather common misconception is demonstrated in the results of a study carried out by Richter and Ehlers (2010) aimed at exploring the motivators for and barriers to using OER in informal discussions with a small group of German schoolteachers. Findings from their study indicated that teachers do not generally differentiate between things being open and free; instead, they worry about finding resources of suitable quality and relevance to their local context. This is one of the reasons why TPD on OER is so fundamental, especially if its use is to be scaled up. Overall, it appears that the ODP was effective in filling a common

TPD gap in this setting by introducing the potential of digital resources for teaching purposes (Brzezinski, 2008; Freitas, 2002; Gatti, 2008; Saviani, 2009), as per *Chapter 2: Review of Related Literature*.

The teachers who participated in the focus groups also appear to be more extrinsically motivated than intrinsically motivated for educational reform or to adopt innovative practices. Other studies carried out in developing countries have shown that lack of personal interest or motivation is also a barrier to OER adoption (Cox, 2016; Gunness, 2012). Although monetary incentives and career promotions seem to play an important role in motivating teachers to participate in TPD programs, all teachers agreed that the factors that would most motivate them to engage in such practices would be having proper resources and being recognized for their efforts. One teacher reflected this thinking by noting:

> *I am usually motivated by my own practice but it is very complicated because we always have to do things on our own for us and our students. And there comes a time when you get tired of doing things on your own and the authorities don't recognize your efforts. We don't work expecting that the town hall will do anything for us. Because it is often the case that when any teacher needs materials they improvise using paper boxes or something similar* (Group 1, reference 2).

These findings are in harmony with a study conducted by Jhangiani, Pitt, Hendricks, Key and Lalonde (2016), which explored the motivations and perceptions of higher education faculty to adapt and use OER. Results of their study demonstrate that lack of institutional support and lack of resources are significant barriers to OER adoption and use (Jhangiani et al., 2016). Lastly, it is this researcher's viewpoint that if the school's pedagogical

coordinator, or other administration, had participated in all the design thinking workshops these could have also raised their awareness and possibly resulted in their providing more motivation and support for teachers during the ODP.

Knowledge Gained

This category is focused on assessing whether there were any gains in teachers' knowledge and/or skills during the design thinking workshops. More specifically, the researcher aimed at assessing whether there was any evidence in the findings of changing attitudes and conceptions to OER use as a result of the workshops. All participants agreed that they gained new knowledge from the ODP. Findings appear to reveal that there was indeed a change in teachers' attitudes and conceptions with regards to OER use upon completion of the workshops. Evidence of this can be found in the following statements:

> *…the workshops were useful because they presented new learning opportunities and new practices* (Group 1, reference 3).
>
> *The workshops made me think about new teaching possibilities. I had never before even thought about using computers or OER. It would be interesting to learn more* (Group 1, reference 4).
>
> *… so these workshops opened doors to new knowledge and perhaps later on we may try to use them* [OER] (Group 2, reference 1).
>
> *It was interesting to discover that OER can be used offline because that makes it easier for us since we have all these problems with technology* (Group 2, reference 2).

Findings also suggest that teachers' initial ideas and concepts on OER evolved as a result of the TPD process. For example, the statements above highlight the fact that teachers see value in learning new pedagogical practices. Additionally, the fact that some teachers understood that OER can be used as offline resources indicates there is a better understanding of what OER really are; this becomes more evident when teachers move away from technology-related issues. Nevertheless, it is worth stressing that there is no evidence from the findings that teachers improved their awareness of how the 5Rs are reflected in their pedagogical decisions; teachers' discussions were more focused on the use of digital resources in general. More time and practical actions with the teachers would be necessary in order to assess this. These findings support the extant literature review that has underscored the importance of awareness-raising strategies (Aguilar, Montoya, & de Monterrey, 2013; dos Santos, 2011; Torres, 2013) and capacity-building (Haßler et al., 2011; Petrides et al., 2010) to overcome some of teachers' barriers when using of OER. Thus, the ODP, which made use of a design thinking approach, appeared to be effective in spurring awareness and building some knowledge regarding the use of digital resources to supplement teaching and learning activities. Finally, as the participants had never had conversations about OER use before taking the TPD program, it appears that the ODP positively impacted teachers to rethink their current practices in light of contemporary educational transformations and innovations.

Support Obtained

The category support is aimed at assessing the organizational and technological support for the ODP. The researcher investigated in what ways support was provided by the school administration, how support for this TPD program could be improved, and

which incentives, policies or other actions would provide further support for a TPD program in OER.

While all ten participants felt supported to participate in the TPD program by the school administration, this support was limited to their participation in the workshops, as the school administration did not encourage them or provide them with resources to pursue their studies on OER after each workshop or upon completion of the ODP. "Lack of resources could also include time as a resource (i.e., the time set aside to properly use OER)" (C. Blomgren, personal communication, January 10, 2018). Interestingly, the participants do not blame the school administration for the lack of proper resources and infrastructure. On the contrary, they think it is the responsibility of the town hall of the municipality of Osasco to provide them with better equipment and access to Wi-Fi connectivity. As one participant mentioned, "we think the town hall of the municipality of Osasco should be more concerned about the lack of resources. Quality in education equals work quality for the teacher" (Group 1, reference 5). Support for the TPD program could be further improved by providing teachers with the proper resources so that they could study during their own free time on school premises. These findings are also consistent with those of a study carried out by Allen and Seaman (2016) who found that the most cited barriers to OER adoption for teachers in higher education in the US are a lack of resources. These results are also corroborated by the findings of studies conducted by Petrides et al. (2010) and Haßler et al. (2011) on OER uptake in different countries and settings, which have underscored the importance of access to resources and ongoing administration support for *effective* TPD.

When asked about which incentives, policies or other actions would provide further support for a TPD program in OER, one participant responded that "an increase in salary would motivate us to try out new things because then we wouldn't have to work in two schools to pay our bills" (Group 2, reference 4). Another participant stated that the use of mobile phones by the teachers during their *HTP* activity time could solve some of the issues related to deficient infrastructure. In her own words:

> *The city hall could invest in a router that today costs less than US $ 23.00. You place the router in the school and distribute the signal to all teachers. If the teachers have access to this signal, provided it is high quality, would we be able to access the Internet and other sites from our mobile phones, which today is easier for all of us since we don't want to bring our own laptop to schools as we might get mugged* (Group 2, reference 5).

According to a recent survey conducted by the Fundação Getúlio Vargas de São Paulo (Getúlio Vargas Foundation of São Paulo–FGV–SP), "by the end of 2017, it is estimated that Brazil will have one smartphone per inhabitant" (Capelas, 2017, para. 1). Sales of smartphones are also expected to grow due to their popularity and due to the price of computers, which cost on average US $400.00 (Capelas, 2017). Indeed, all the participants in the study possess a smartphone or a mobile phone. Nevertheless, there is no guarantee that if participants could use their mobile phones for TPD purposes during their *HTP* activity time that this would bear any impact on their decision to learn about or use OER. Moreover, there is no data to support that the use of mobile phones would have improved the learning outcomes of the ODP. In line with this, Amiel (2011) posits that there are two distinct categories related to educational technology. The first category,

which he has termed "simple technology," comprises computers, mobile phones, calculators and other equipment used by people in their daily lives (Amiel, 2011). Complex technology, on the other hand, consists of the system of people and resources who meet over time so that devices are able to reach their users, coupled by the relationships and conditions that provide support for their use (Amiel, 2011). As Amiel (2011) cautions, "the use of technology should focus on the development of fluency with the technological system itself" (p. 3). Any device can be used for educational technology as long as there are clear goals and purposes established for its use (Amiel, 2011), and yet there is need for a pedagogical plan that objectively and systematically lays out the training requirements for use of a specific device, how devices will be used for educational purposes and what provisions are necessary for its deployment.

It is clear that it is not the technology employed that drives the motivation to learn, but rather the support system in place for a particular technology that enables teachers to achieve positive learning outcomes from a TPD program. Moreover, as Amiel (2011) asserts, "when technology reaches the school, the technological resources tend to be used to complement or supplement already existing practices" (p. 2). Amiel's arguments on align with Unwin's (2005) and Davis et al.'s (2009) recommendations for teacher education when implementing OER initiatives, as the scholars argue that the focus of such initiatives should be on the pedagogy rather than on the technology.

All things considered, as Avalos (2011) upholds, "the way in which teachers engage in professional development depends largely on policy environments and school conditions" (p. 17). The development and implementation of a school policy that considers the use of OER in teachers' practice aligned with better school conditions in

the form of infrastructure or equipment may effect better support for the provision of TPD in OER (Jhangiani et al., 2016; OER Regional Consultation, 2017).

Effective Type of TPD in OER for Teachers

This category is geared toward evaluating two main issues extracted from the focus group data. First, it evaluates what kind of professional development on OER works best in this setting. Second, it considers how this TPD program could be improved to inform future change efforts, especially in regards to OER uptake. Data collected from this category focuses on what kind of TPD would have more potential to help teachers make informed decisions on adopting and using OER to complement or supplement their pedagogical practices.

There was a consensus between the two groups that the kind of TPD in OER that would work best in this setting is a practical, hands-on TPD that teaches teachers step by step how to differentiate between open and closed resources and how to assemble and repurpose OER. The participants of this study appear to need more facilitator support toward this end. Statements and utterances provided by the participants corroborate this assertion:

> *…we think TPD should be practical, hands-on and less theoretical. The kind of TPD that provides concrete examples of existing OER so that we could see what they look like. It would be helpful for us if we could see what these OER look like, the images, etc.* (Group 1, reference 6).
>
> *If you did something online together with us, showed us the step by step. Showed us how to get started and then had us learn on our own* (Group 1, reference 7).

> *If we are provided with this hands-on training, with more support in the beginning, then we can gain experience. But it is better if this is done face-to-face at the beginning* (Group 2, reference 6).
>
> *Then we could create an activity in a Wiki and disseminate it though the public school network* (Group 2, reference 7).

Participants' requests for hands-on, practical, step-by-step learning with OER match with findings from research on the characteristics of some *effective* development programs, as discussed in *Chapter 2*. Several scholars have advocated for strategies that foster active learning activities for effective OER use in the face-to-face classroom environment (Garet et al., 2001; Grubb & Tredway, 2010; Haßler et al., 2011; Ingvarson et al., 2005; Unwin, 2005; Villegas-Reimers, 2003). Participants' suggestions to create activities through use of a Wiki suggest that these teachers are somewhat attuned and amenable to collaborative knowledge sharing and learning practices, which is quite positive for OER use and reuse. These findings are consistent with other studies that have identified teacher knowledge sharing and collaborative learning as key components of a professional development program that focuses on building capacity on OER (Haßler et al., 2011; Petrides et al., 2010). Yet, caution needs to be exercised when using a MediaWiki page because "even if the page is licensed under CC rights, the 'retain' right may be compromised simply because it is a dynamically generated page that relies on a working server to be accessed" (J. Dron, personal communication, April 10, 2018). Avalos (2011) has also noted that using different tools for learning and incentivizing reflective learning experiences may be more conducive to good learning outcomes in a TPD programs. These different tools for learning are addressed in *Chapter 7*.

Lastly, data suggest that participants require facilitator support to successfully engage in new practices that require the use of OER. In fact, there is compelling empirical evidence that facilitator support plays a key role in promoting instruction, scaffolding engagement and learning in online, blended and face-to-face learning environments (Garrisson, Anderson & Archer, 2000; Jones, Aoki, Rusman & Schlusmans, 2009; Laurillard, 2002). For example, Garisson et al. (2000) has underscored the importance of facilitators' presence in helping students in a learning community to achieve "personally meaningful and educationally worthwhile learning outcomes" (Anderson, Rourke, Garrison & Archer, 2001, p. 5; Garrison, 2011, p. 24). Laurillard (2002) emphasizes the value of collaborative learning among students and how this needs to be supported by a facilitator who plays a substantial role in helping learners create a sense of belonging and community. Jones et al. (2009) has also acknowledged the vital role of the facilitator in fostering a collaborative inquiry learning community.

Conclusion

Although the focus groups helped teachers form clearer conceptions on OER use and by doing so played a pedagogic role, they also raised further issues. Factors directly linked to teachers' practice when using digital resources were at the top of respondents' concerns, such as deficient organizational and technological support and insufficient skills and/or autonomy or confidence to learn on their own. Findings from the focus groups also suggest there are still misconceptions with regards to OER not only being free resources but also open resources that comply with the 5Rs. At this time teachers

appear to require more TPD to comprehend how the 5Rs are reflected in their pedagogical decisions. As a result, teachers' narratives regarding the type of TPD in OER that would be effective focused on the delivery of practical, hands-on TPD that teaches them step by step how to assemble and repurpose OER. Such a practice has the potential to provide teachers with the necessary support for scaffolding engagement and learning in order to progressively lead them to empowerment and provide them with the autonomy and confidence required to learn about OER. As one of the main factors for teacher engagement with OER is professional development (Commonwealth of Learning, 2015; Kanwar et al., 2011; McGreal et al., 2015), TPD does indeed appear to play a fundamental role in teachers' OER adoption decisions.

This chapter presented the qualitative findings from the focus groups. The next chapter presents and discusses quantitative data collected from the UTAUT survey questionnaire.

Chapter 6: The UTAUT Survey Questionnaire: Findings and Discussion

Introduction

This chapter describes the major data findings for the UTAUT survey questionnaire, which was used to assess the intention of stakeholders to adopt and use OER pre-ODP. It begins by presenting the demographic information of the participants who responded to the online UTAUT survey questionnaire. It will then turn to reporting the findings of the UTAUT survey questionnaire, highlighting how these findings contributed to answering RQ1, thereby supporting some of the qualitative data gathered from the design thinking workshops.

Participants' Demographic Information

Although all the participants of the study (*N*=46) were invited to complete this questionnaire, only ten participants (*N* =10) responded to it. Figures 5, 6, 7, 8 and 9 provide a synopsis of participants' demographic information plus other relevant data.

Figure 5: Gender / Age group

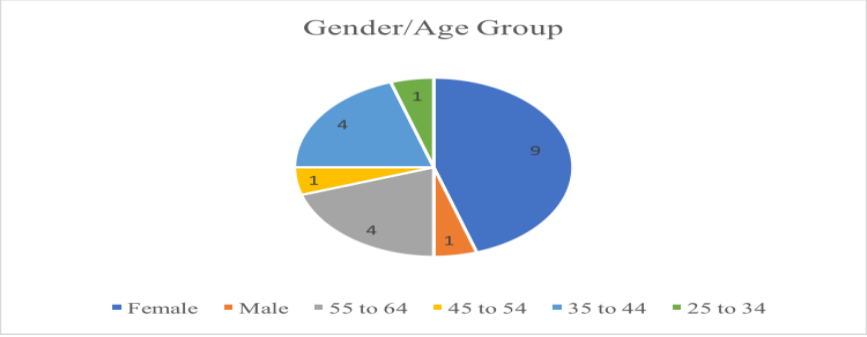


Figure 6: Highest academic qualification / Current role in school

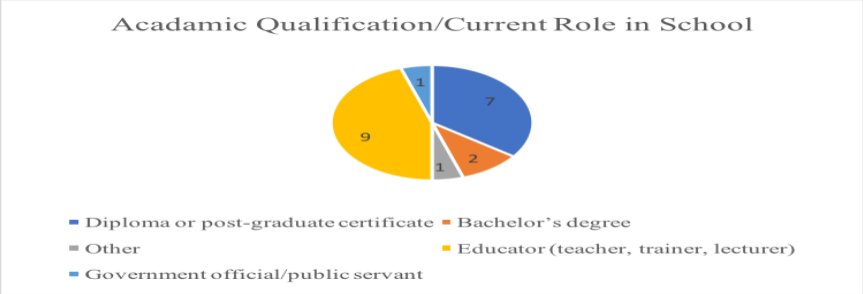


Figure 7: Years worked in the school / Grades taught at the school

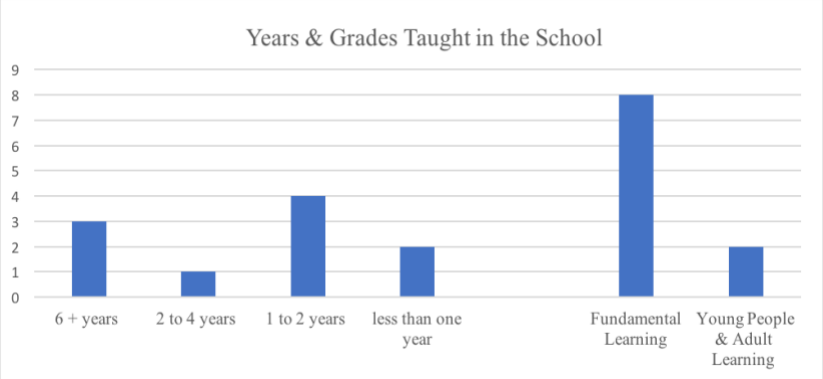


Figure 8: Hours of teaching per week

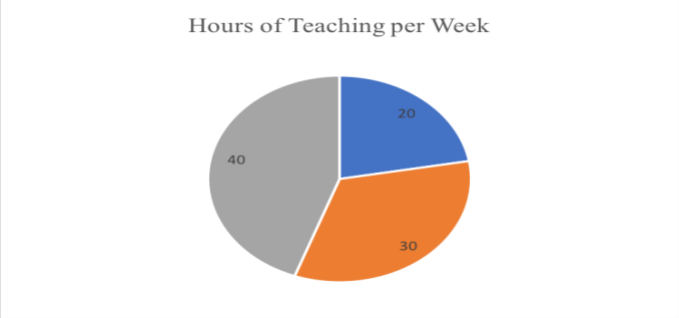
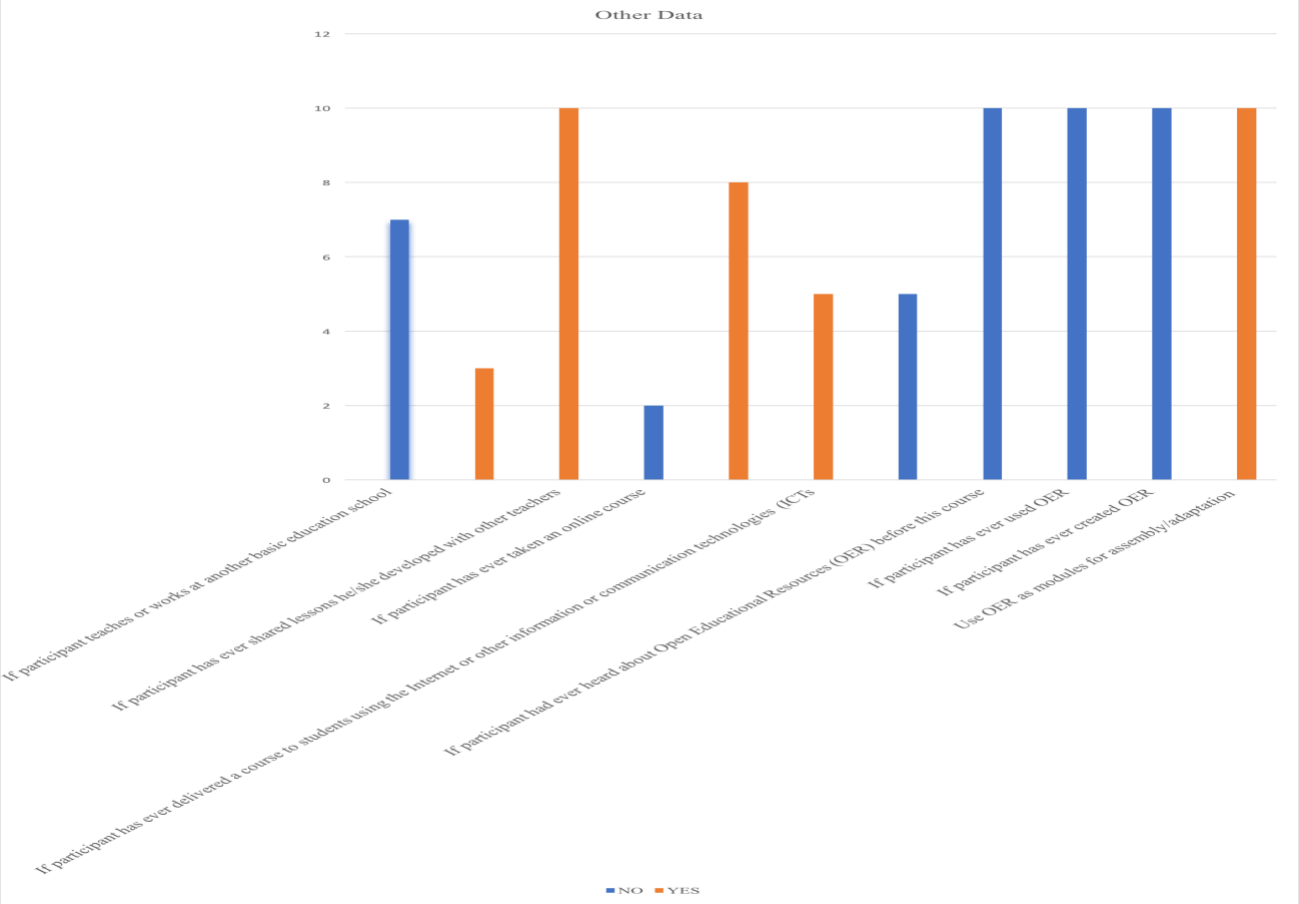


Figure 9: Other data related to online learning, ICT use and OER use and creation



None of the respondents were under 25 or over 65. Seven of the respondents stated that they possessed a diploma or postgraduate degree, while only two stated they possessed a bachelor's degree. It is important to note that in Brazil it is possible to obtain a postgraduate degree without possessing a bachelor's degree. This type of postgraduate degree is similar to a specialization or technical/vocational program, which does not require a bachelor's degree. There are also postgraduate degrees that require students to possess a bachelor's degree; these are usually one-year courses, in which students are required to present a final paper or a monograph on their subject of study. Only one respondent possessed a Master's degree. Therefore, it is difficult to infer from these data

if those respondents who stated they possessed a diploma or postgraduate degree did or did not actually possess a bachelor's degree in some field of study.

Most of the respondents identified themselves as being educators. 80% of the respondents reported they taught the *fundamental education* cycle. In contrast, only 20% of the respondents reported teaching young people and adults (EJA)[13]. The EJA program is offered by all state and municipal public schools in Brazil to young people and adults who were not able to conclude their K-12 studies at the expected age. It is also worth mentioning that 70% of the teachers work only in this school, although the number of hours they teach per week appears to vary. All of the respondents stated that they shared lessons developed with other teachers. This is not a surprising finding, since sharing lessons developed with other teachers is a common and collegial practice in secondary and higher education (Hiebert, Gallimore & Stigler, 2002). Sharing lessons developed with other teachers is also viewed as an effective process inasmuch as it helps to generate knowledge linked with practice, affording teachers multiple learning opportunities (Hiebert et al., 2002). Fifty percent of the respondents stated they had already used ICTs to deliver a course to students, although the questionnaire did not ask specifically what type of ICTs were used to deliver courses. Finally, with regards to OER, all of the respondents reported they had never heard about OER, never used OER and never created OER. The respondents were also asked whether they preferred to use OER as modules for assembly/adoption or OER that contain the full course package with no changes required. Although all respondents answered that they would prefer to use OER as modules for assembly/adoption, these findings suggest that the respondents randomly

[13] EJA - Ensino de Jovens e Adultos

checked one answer, as it would be difficult to opt for something they reported they had never heard about.

Findings of the UTAUT Survey Questionnaire

The UTAUT survey questionnaire was analyzed using Spearman's rho to measure the strengths of association between the ordinal variables: performance expectancy, effort expectancy, social influence, facilitating conditions and stakeholders' intentions to adopt and use OER. Tables 4, 5, 6 and 7 present the data results for the Spearman rank correlation test. The section that follows provides a full discussion and analysis of all data findings of Spearman's rank correlation coefficient tests.

Table 4. Data results for Spearman's rank correlation coefficient between the variables Intention to use OER and Performance Expectancy

Total count (N = 10) / Spearman's rank correlation coefficient	Performance Expectancy 1[I would find OER useful in my courses]	Performance Expectancy 2 [Using OER will enable me to accomplish course development activities more quickly]	Performance Expectancy 3[Using OER will increase learning outcome of my students]	Performance Expectancy 4 [The use of OER will allow me to have access to more information about the subjects I teach]
Intention to use OER1 [I intend to use and integrate OER into my courses in the future]	0.60	0.63	0.60	0.60
Intention to use OER2 [I predict I would use and integrate OER into my courses in the future]	0.48	0.45	0.67	0.48
Intention to use OER3 [I plan to	0.48	0.45	0.67	0.48

use and integrate OER into my courses in the future]	

Table 5. Data results for Spearman's rank correlation coefficient between the variables Intention to use OER and Effort Expectancy

Total count (N = 10) / Spearman's rank correlation coefficient	Effort Expectancy 1[It would be easy for me to navigate and interact with content available on OER websites]	Effort Expectancy 2 [It would be easy for me to become skillful at using and integrating OER into my courses]	Effort Expectancy 3 [I would find OER easy to use]	Effort Expectancy 4 [Learning to use OER websites will be easy for me]
Intention to use OER1 [I intend to use and integrate OER into my courses in the future]	0.37	0.63	0.54	0.46
Intention to use OER2 [I predict I would use and integrate OER into my courses in the future]	0.45	0.45	0.59	0.48
Intention to use OER3 [I plan to use and integrate OER into my courses in the future]	0.45	0.45	0.59	0.48

Table 6. Data results for Spearman's rank correlation coefficient between the variables Intention to use OER and Social Influence

Total count (N = 10)	Social Influence 1 [People who influence my behavior think that I should use and integrate OER into my	Social Influence 2 [People who are important to me will think that I should use and integrate OER into my	Social Influence 3 [The directors and other staff at my school will be helpful in the use and integration of OER into my courses]	Social Influence 4[In general, my school will support the use of OER in teaching and learning]

Spearman's rank correlation coefficient	courses]	courses]		
Intention to use OER1 [I intend to use and integrate OER into my courses in the future]	0.62	0.62	0.60	0.85
Intention to use OER2 [I predict I would use and integrate OER into my courses in the future]	0.67	0.67	0.48	0.74
Intention to use OER3 [I plan to use and integrate OER into my courses in the future]	0.67	0.67	0.48	0.74

Table 7. Data results for Spearman's rank correlation coefficient between the variables Intention to use OER and Facilitating Conditions

Total count (N = 10) / Spearman's rank correlation coefficient	Facilitating Conditions 1 [I have the resources necessary to access OER]	Facilitating Conditions 2 [I have the knowledge necessary to use and integrate OER into my courses]	Facilitating Conditions 3 [OER is similar to other course content I use for teaching]	Facilitating Conditions 4 [Help will be available when I have problems using and integrating OER into my lessons or courses]
Intention to use OER1 [I intend to use and integrate OER into my courses in the future]	-0.12	0.22	0.38	0.76
Intention to use OER2 [I predict I would use and integrate OER into my courses in the future]	-0.04	0.18	0.30	0.87
Intention to use	-0.04	0.18	0.30	0.87

OER3 [I plan to use and integrate OER into my courses in the future]

Discussion of Findings of the UTAUT Survey Questionnaire

This section provides an analysis and discussion of all data findings for Spearman's rank correlation coefficient tests as per Tables 4, 5, 6 and 7.

Performance expectancy. Results for Spearman's rank correlation coefficient between the variables Intention to use OER and Performance expectancy showed a weak ($r_s = 0.45$) to moderate and good ($r_s = 0.67$) degree of correlation. A high r_s (close to 1) indicates that two or more variables are strongly correlated. It is worth highlighting that the teachers responded identically to sub-items Intention to use OER 2 and Intention to use OER 3, which may have adversely impacted the final correlation scores. There are two possible reasons for this: either the inclusion of these sub-items was unnecessary inasmuch as they were redundant or repetitive, or the teachers did not understand the subtle differences between them. Performance expectancy was used to determine how much the teachers who responded to this questionnaire believed that OER would assist them in performing their jobs. It appears that lack of knowledge or awareness on OER resulted in weaker correlations. The current findings are consistent with those reported by other scholars who have all stressed the need to raise awareness on OER so that teachers can decide whether their use will in fact help them preform their jobs better (Aguilar et al., 2013; de los Arcos et al., 2016; dos Santos, 2011; Torres, 2013). These findings also suggest that OER adoption may be enhanced by educating teachers on the potential benefits of the use and creation of OER, thereby improving the accessibility and dissemination of OER (Dulle & Minishi-Majanja, 2011).

Effort expectancy. Results for Spearman's rank correlation coefficient between the variables intention to use OER and effort expectancy also varied between a weak (r_s =0.37) to moderate and good (r_s =0.63) degree of correlation. The questions on effort expectancy are focused on the amount of work teachers are expected to do to find and use OER (Percy & Van Belle, 2012). Effort expectancy is also strictly tied to teachers' abilities to incorporate 21st century teaching strategies and approaches in their lessons (Beetham et al., 2009; CIEB, 2016; Ochsner, 2010). The findings suggest that lack of knowledge and skills in ICTs influenced the participants' responses, resulting in relatively weak degrees of correlation. These findings are consistent with those of a recent study carried out by the CIEB, which explored how ICTs, digital resources and content were being adopted in K-12 public schools throughout Brazil. Although the results of the study are not strictly related to the use of OER, the CIEB (2016) report brings to the forefront the innumerable challenges that are associated with ICT use, negatively impacting OER adoption and use in this context. Namely, lack of clear implementation actions for ICT use in schools even though the political-pedagogical policies of public schools address the use of ICTs in schools and lack of teacher competency with ICTs due to lack of systematic capacity-building or TPD programs (CIEB, 2016). Further, the use of digital resources and content is more present in the administration of the school than in the classroom activities (CIEB, 2016). The school administration frequently uses tools and ICTs provided by state secretaries and the Ministry of Education (MEC)[14]; however, it has failed to establish an action plan for effective ICT use by schoolteachers (CIEB, 2016). Therefore, the use of ICTs in the school largely depends on individual teachers' willingness, autonomy, competency and

[14] MEC – Ministério da Educação

capacity to employ digital resources and content for educational purposes (CIEB, 2016). These findings are contrary to those reported by Mtebe and Raisamo (2014), which suggest that "OER will be easy to use and free of efforts" (Mtebe & Raisamo, 2014, p. 261). The widespread use of OER in this context may happen only when a clear and effective policy and action plan for use of ICTs is in place. These findings underscore not only the need for capacity-building in ICT to facilitate and enhance OER uptake but also the need to integrate ICTs into the curriculum "in a more qualitative way" (Gonsales, 2015, p. 8). Such qualitative means include: "incorporating trends that are already part of life in networked society, such as collaborative practices in digital networks, gamification, active methodologies of learning, use of cell phones and other mobile devices, and adoption of OSS and open content" (Gonsales, 2015, p. 9).

Social influence. As shown in Table 6, results obtained for Spearman's rank correlation coefficient between the variables Intention to use OER and Social influence ranged from moderate and good ($r_s = 0.67$) to strong ($r_s = 0.85$). Social influence represents "the extent to which teachers are influenced or affected by their colleagues or school administrators" (Percy & Van Belle, 2012, p. 119) to adopt and use OER. These results appear to indicate that the greater the social influence, the greater the intention to use OER. In other words, social influence may "have a positive effect on teachers' intention to adopt and use OER" (Mtebe & Raisamo, 2014, p. 259). The findings of this study are in line with the findings reported by Dulle & Minishi-Majanja (2011) who explored the acceptance and use of open access within public universities in Tanzania. Dulle and Minishi-Majanja's (2011) study concluded, "social influence was found to be a determinant of open access usage" (p. 40). The findings of this study are contrary to

those of other studies that also investigated the impact of social influence on intention to adopt and use OER (Mtebe & Raisamo, 2014; Percy & Van Belle, 2012). These findings can be attributed to the key role the pedagogical coordinator plays in determining which TPD programs will be delivered, and to the fact that TPD programs in this system typically prioritize government-mandated programs (André, 2015; Davis et al., 2011). If TPD in OER is not perceived as a priority then it is unlikely that the pedagogical coordinator will push this agenda. Overall, TPD in this particular context is frequently a top-down process, as corroborated by the literature review. These findings also suggest that the beliefs and attitudes of the pedagogical coordinator and other peers toward OER can also substantially influence teachers' adoption decisions. According to Simpson, Koballa, Oliver and Crawley (1994), attitudes can be defined as specific feelings that indicate whether a person likes or dislikes something. In the context of OER integration, the attitudes of the pedagogical coordinator and teachers may be conceptualized as one or more parties liking or disliking the use of OER. Beliefs can be defined as premises or suppositions about something that are felt to be true (Calderhead, 1996; Richardson, 1996). In this context, teachers' beliefs may include their pedagogical beliefs, how teaching and learning should be carried out and their own personal beliefs on OER. Some scholars have advocated that beliefs determine a person's attitude (Bodur, Brinberg & Coupey, 2000); this line of thinking proposes that if there is little or no belief that the use of OER may be beneficial, then it is more likely that teachers' attitudes toward OER use will also be negative. Moreover, if teachers perceive that other *fundamental education* public schools are currently not adopting or using OER, they may be more resistant to doing so themselves.

Facilitating conditions. Results for Spearman's rank correlation coefficient between the variables intention to use OER and facilitating conditions showed a strong degree of correlation ($r_s = 0.87$) for the variables Intention to use OER 3 [I plan to use and integrate OER into my courses in the future] and Facilitating Conditions 4 [Help will be available when I have problems using and integrating OER into my lessons or courses]. All other correlations between the sub-items intention to use OER and the sub-items for facilitating conditions were weak or inexistent.

In this particular context, facilitating conditions can be perceived as the extent to which teachers believe that there are adequate resources, such as technical infrastructure, administrative or peer support to support the use of OER (Percy & Van Belle, 2012). Facilitating conditions influence both the actual use of OER and individuals' intentions to use OER (Percy & Belle, 2012). In similar studies, Mtebe and Raisamo (2014) and Percy and Van Belle (2012) found that the presence of facilitating conditions had no significant effect on teachers' intentions to adopt and use OER, which is consistent with findings except for the sub-item Facilitating Conditions 4. In a similar study carried out by Dulle and Minishi-Majanja (2011), researchers found that age is an important factor in determining how much assistance will be needed for an individual to adopt and use OER. Older teachers may need more assistance to use and integrate OER into their lessons, which is relevant in this study given that 80% of the participants identified as being in the following age groups: 35 to 44 and 55 to 64, and 40% of the teachers in this study were raised at a time when the Internet and/or ICTs did not exist. The results of this study are also consistent with the findings reported by Venkatesh et al. (2003), that older teachers expect to receive more assistance with respect to the usage of new technology or new

pedagogical practices than younger teachers do.

Conclusion

The validity of the collected quantitative data cannot be assured due to the small size of the self-selected sample, and the results can only be suggestive to the extent that they correlate with the qualitative data. These data supplement some of the qualitative data collected with little validity, but highly support qualitative data from the design thinking workshops that appeared to indicate the need for the improvement of social influence and facilitating conditions in Brazilian *fundamental education* public schools. Having presented and discussed the main findings of the UTAUT survey questionnaire, Chapter 7, which follows, draws on the research findings from RQ1 and RQ2 to propose guidelines for TPD in OER in response to RQ3.

Chapter 7: Guidelines for TPD in OER

Introduction

This chapter presents a specific set of evidence-based guidelines for TPD in OER. It is divided into two sections. The first section provides a discussion of insights obtained on emerging themes based on the qualitative and quantitative data analysis presented in Chapters 4, 5 and 6. This first section is divided into three topics: Teachers' use of digital resources, the design thinking approach for raising awareness among the school administration and TPD in OER. The second section builds on these insights, providing a set of evidence-based OER guidelines in the context of TPD for Brazilian *fundamental education* public school teachers, which are divided into four main factors: policy support, organizational support, infrastructure support and TPD support. These factors are based on analysis of participant responses with regards to the different coding schemes and categories used throughout the study and an interpretation of participants' narratives, which are used to identify the most important factors to be considered when offering a TPD program on OER.

Discussion of Emerging Themes

The mixed-methods approach used in this case study enabled the researcher to draw important conclusions based on the triangulation of different data sets. Findings provided a number of insights, which are discussed in the sections below.

Teachers' use of digital resources. Findings from the section on Digital Resources in *Chapter 4* revealed that teachers regularly use the Internet to search for

supplementary resources in their own time and using their own devices, despite the fact that the school system does not currently support the use of OER (see findings in paragraph 1 in the section on Digital Resources). Thus, regardless of the organizational and technological systems that seem to be against them, as previously discussed in the sections on Human, Social and Physical Resources in *Chapter 4* and in the sections on Motivation and Support Obtained in *Chapter 5*, some teachers appear to be determined to engage in activities beyond those dictated by the school administration or government, because they feel that they can make a difference. This supports the notion that teachers do actually engage with digital resources to supplement learning activities. Although the study participants are not specifically looking for OER to complement lessons, as they do not possess the knowledge or skills necessary to do so, these practices share similarities with Weller's (2010) concept of "little" OER, as previously addressed in *Chapter 2: Review of Related Literature*. Weller (2010) defines "little" OER as "individually produced, low cost resources" (p. 105). Such resources are not necessarily produced for educational purposes, although they can be, and "usually have low production quality" (Weller, 2010, p. 105). Another distinguishing feature of "little" OER is their ability "to be shared through a range of third party sites and services" (Weller, 2010, p. 105). An analogy can be drawn between "little" OER and participants' narratives on how they search for lesson material on the Internet. This analogy has three major dimensions. First, some of the participants in this study are individually producing resources that they download from the Internet, adapt to fit a particular context or lesson objective and then distribute in print to students. Second, the participants usually share these resources with other teachers. Third, these resources can be characterized as low cost and low

production since they do not incur costs to the school. As the participants of the study do not know how to share the resources produced using the Internet or other services, these resources are restricted to the individual or to the school's use of them. The way in which participants make use of the Internet and the Web 2.0 to "individually produce resources" (Weller, 2010, p. 105) to complement or supplement textbooks can thus be said to follow Weller's characterization of "little" OER. This can be characterized as a "do it yourself approach" (Matzat & Sadowski, 2012) as it is neither supported by the school administration nor does it involve teamwork or a collective school system. This informal approach was also found in the TIC Educação (2015) study. The potential impact these informal practices can have on teachers' development of digital skills, particularly for those teachers who use the Internet more frequently to search for resources (Matzat & Sadowski, 2012), is quite significant since this is dynamic and a "bottom up" practitioner driven practice (Rennie & Reynold, 2014). The fact that some teachers are already using the Internet to search for supplementary resources, regardless of whether these resources are OER, suggests they may be amenable to adopting and using OER, as the findings in the section Knowledge Obtained in *Chapter 5* have shown (see Group 1, reference 3; Group 1, reference 4; Group 2, reference 1; and Group 2, reference 2). Yet, as the results obtained from findings of Chapters 4, 5 and 6 have revealed, without institutional support and training, teachers' use of OER may fail to achieve significant results. For example, in the sections on Human and Social Resources in *Chapter 4*, there is data indicating that the participants require not only training and personnel, but also leadership support in order to progress with learning (see Group 2, reference 4; Group 3, reference 4; Group 4, reference 14). These findings are further corroborated by the results in the category

Support Obtained in *Chapter 5* (see the findings and discussion in paragraphs 2 and 3). These findings are in harmony with Rennie and Reynold (2014) who claim that teachers also need to have "top down" institutional driven support (Rennie & Reynold, 2014) if they are to be successful in their endeavors with the OER.

It is also worth highlighting that, although the focus of this study was on OER uptake, there were no significant findings indicating that teachers use OER that comply with the 5Rs. On the contrary, the findings suggest that, overall, teachers have difficulties distinguishing between OER that are licensed under open or Creative Commons licenses, and ICT-related issues. Participants' somewhat conflated narratives with regards to their use of digital resources are clearly illustrated in findings in *Chapter 4* and *Chapter 5*. This could be attributed to three main factors. First, although the researcher provided a presentation and a clear explanation of the 5Rs of OER and Creative Commons licenses during the first workshop, and attempted to clarify their doubts over the course of the three face-to-face design thinking workshops, the participants of the study had little time to assimilate this new knowledge. A more practical, hands-on TPD may have afforded teachers a better opportunity to distinguish between OER and ICT issues in addition to teaching them how to assemble, repurpose and license OER. However, this was not possible due to time constraints that were beyond the researcher's control and, as previously stated, the researcher did not want to impose OER adoption and use. A practical hands-on TPD or "learning by doing" approach would be a natural follow-up to the design thinking workshops, provided that the time is available. Second, the researcher did not limit teachers' discussions strictly to OER-related issues during the design thinking workshops; teachers were free to address policy, organizational and technology-

related issues. This is very much in harmony with the design thinking approach, which holds that participants should be able to resolve outstanding challenges and problems before implementing and prototyping innovative practices. Finally, also due to time constraints that were beyond the researcher's control, the participants were not able to actually build a prototype showing how they could incorporate OER into their professional practices. A longer-term intervention coupled with practice may have allowed participants to better understand what OER use entails, and may have led participants to focus their discussion more on OER-specific issues. Overall, the findings of this study corroborate the need to provide teachers with the pedagogical readiness that focuses on the fit between ICTs and OER.

Design thinking approach for awareness-raising of school administrations.

The design thinking approach proved to be effective for raising teachers' awareness and knowledge regarding the use of digital resources, as indicated by the findings of the section Knowledge Obtained in *Chapter 5* (see Group 1, reference 3; Group 1, reference 4; Group 2, reference 1; and Group 2, reference 2). The design thinking process provided teachers with opportunities to learn about the use of digital resources and reflect on their use and implementation in their pedagogical practices. It also afforded teachers opportunities to participate actively in the decision-making process regarding how innovation may be best implemented in this setting, which is consistent with a bottom-up approach toward obtaining teacher support for OER adoption. However, as innovation in this setting is usually top-down and teachers appear to be resistant to adopting new practices due to lack of policies or incentives that encourage them to leave their comfort zones (Choppin, 2004; Goodson & Mangan, 1995; Hennessy, Ruthven & Brindley, 2005;

Selwyn, 1999), they need to feel that the school administration is supportive in order to effect change. The school administration ought to be able to understand the implications of this change and make informed decisions so as to provide teachers with a solid framework for new practices. It is also quite often the case that innovations in this environment are unsuccessful due to school administrations' misconceptions or lack of vision regarding change, exacerbated by a lack of specific objectives and policies or initiatives to promote such innovation (Avalos, 2011; Beetham et al., 2009; CIEB, 2016; Farias, 2016; Hew & Brush, 2006; Jhangiani et al., 2016; P.L. Rogers, 2000; TIC Educação, 2015). The design thinking approach is one out of several that could be used to provide school administrators with the awareness and knowledge of OER needed for implementation of "top down" institutional driven support (Rennie & Reynold, 2014). It could give them an opportunity to prototype how OER could be incorporated in teachers' pedagogical practices based on the school's needs and constraints, and on teachers' skills and needs.

TPD in OER. The findings presented in the Human Resources section in *Chapter 4* (see findings and discussion in paragraphs 1, 2 and 3) and Effective Type of TPD in OER for Teachers in *Chapter 5* (see findings and discussion in paragraphs 2 and 4) suggest that formal TPD plays a fundamental role in Brazilian teachers' OER adoption decisions and that therefore there is need for ongoing, long-term TPD on OER in the form of mini-courses that last between six and twelve months. This type of TPD should be applicable to teachers' pedagogical practices (Avalos, 2011; Venturini, 2014). Short-term TPD that focuses on filling an immediate knowledge and skills gaps is detrimental to teachers' pedagogical practices, as the findings in the Human Resources section of

Chapter 4 have shown (see Group 2, reference 3). Longer professional development programs build community and have a bigger impact (Avalos, 2011; Venturini, 2014; Villegas-Reimers, 2003). Lastly, as most of these teachers have little or no skills with ICT, there is a need to train them in ICT use so that they can feel more confident with OER use. As the findings in the Effective Type of TPD in OER for Teachers section in *Chapter 6* have revealed, this TPD should be focused not only on providing teachers with the necessary knowledge and skills on OER but also on providing them with the necessary facilitator support for scaffolding engagement and learning, so that teachers feel more empowered (see findings and discussions in paragraphs 2 and 4). The following section presents professional development guidelines for OER, which are based on the findings of this study.

TPD Guidelines for OER

The guidelines for TPD in OER in Brazilian *fundamental education* public schools result from several key points that have been discussed thus far, and emerge from the outcomes of the ODP, participants' perspectives and narratives and the researcher's observational notes and insights during the intervention. These guidelines are not intended to be prescriptive; however, they can provide some direction for policymakers, teacher educators or school administrators who wish to promote the adoption and use of OER in the Brazilian public *fundamental education* system. The guidelines can also be adapted to local needs and contexts. The factors that compose the TPD guidelines have been grouped into four categories: policy support factors, organizational support factors, infrastructure support factors and TPD support factors. As noted in the introduction of

this chapter, these four categories derive from the analysis of participant responses with regards to the different coding schemes and categories used throughout the study and the interpretation of participants' narratives that have resulted in the identification of the most important factors to be considered when offering a TPD program on OER so as to ensure there is proper support. Each category contains a description of the actors involved, what actions are recommended and how such actions can be achieved. The categories are summative and interrelated, so that they may potentially increase OER uptake in steps, like building blocks.

However, in order to achieve effective outcomes through use of the guidelines, school administrators and teachers need to embrace the idea of using OER. The TPD guidelines for OER presented in this context are based on the findings of this study and on critical engagement with the literature. The guidelines begin with policy support factors. The policy provides directives and rules the organizational, infrastructure and TPD factors. Teachers' engagement with OER depends on clear policies that provide directives and rules for their adoption and use. Ease of use with available infrastructure and tools and effective pedagogical support may enhance teachers' engagement with these resources in addition to stimulating their use. The four categories that constitute the guidelines are classified as follows.

- **Policy support factors:** those associated with providing guidelines that increase school administration awareness on OER uptake and other school policy support related issues that may facilitate the implementation of innovation in this context.
- **Organizational support factors:** those associated with providing the necessary personnel or staff for TPD in OER in addition to having a clear plan and core

curriculum with specific objectives to incorporate OER. These factors are strongly associated with the support required by teachers to adopt new practices.

- **Infrastructure support factors:** those associated with equipment such as multimedia, computers and Wi-Fi connectivity, which enable successful delivery of TPD programs on OER. As the data has shown, equipment availability and access to Wi-Fi connectivity in this setting is deficient. Therefore, "it is important to consider the possibility of using offline solutions and local networks (i.e., hard media, mesh etc.)" (OER Regional Consultation, 2017, p. 22).

- **TPD support factors:** those associated with the provision of TPD that best caters to the needs of the participants of the study, taking into consideration their pedagogical needs and organizational and infrastructural constraints. The TPD support factors are focused on providing pedagogical support for a TPD program on OER.

Table 8 presents the guidelines.

Table 8. Guidelines for TPD in OER

Factors	Who	What	How
Policy Factors	Policymakers, school administrators, teacher educators, OER experts	1) Raise awareness on OER so as to enable stakeholders to make informed decisions regarding how OER could be best implemented. 2) Provide stakeholders with the pedagogical	1) Use bottom-up TPD approaches whenever possible (e.g., design thinking) to raise awareness on OER (see findings and discussion in paragraphs 1, 2 and 3 in the Knowledge Gained section in *Chapter 5)*. 2) Promote and hold dialogue with policy

		readiness that focuses on the fit between ICTs, OER and current teaching and learning practices to plan and support new practices.	makers, teacher educators and school administration in order to build knowledge on and capacity for OER. This dialogue should spell out the benefits afforded by OER use and the training and provisions necessary for OER adoption and implementation (see findings and discussion in paragraphs 4, 5 and 6 in section Digital Resources and findings in paragraphs 4 and 5 in the Social Resources section in *Chapter 4;* findings in paragraph 2 in the Interest and Motivation section in *Chapter 5;* and, in *Chapter 6*, the findings and discussion in paragraph 1 in the Social Influence section, and the findings and discussion in paragraph 1 in the Facilitating Conditions section).
	Policymakers, school administrators	3) Provide incentives or initiatives that stimulate the use of OER for learning and teaching and that help teachers to feel more professionally valued so that they are willing to embrace innovative practices.	3) Provide unexpected rewards such as open badges to boost engagement and motivation or a TPD stipend to teachers who participate in the TPD program, if possible (see findings and discussion in paragraphs 2, 3, 9 and 10 in the Social Resources section in *Chapter 4;* the findings and discussion in paragraphs 3, 5 and 6 in

			the Interest and Motivation section in *Chapter 5;* and the findings in paragraph 3 in the Support Obtained section in *Chapter 5*).
Organizational Support Factors	Policymakers, school administrators, teacher educators, OER experts	1) Provide interested teachers with alternative options and locations for the TPD program besides the school. Providing alternative locations for TPD can mitigate lack of personnel issues.	1) TPD in OER could be provided in teacher education centers located in the municipality in the event that there are not enough facilitators or personnel to deliver TPD on school premises. This affords not only proximity of training but also enables interested teachers from different schools to disseminate and multiply these practices in their own schools (see findings in paragraphs 2 and 3 in the Social Resources section in *Chapter 4*). This recommendation is also based on the fact that there is a teacher education center located in the municipality and that some teachers mentioned during the workshops that they had already attended some TPD programs there.
	School administrators	2) Provide teachers with access to external web sites such as YouTube, CC search, or OER repositories for TPD purposes on school premises.	2) "Schools that have a separate contract for Internet access which bypasses the official channels could request for this" (T. Amiel, personal communication, April 8, 2018) (see findings and discussion in paragraph 6 in section Social Resources in

			Chapter 4).
	Policymakers, OER experts	3) The TPD curriculum for pre-service and in-service teachers could include a detailed specification with clear objectives and learning outcomes for how OER can be integrated into and across disciplines.	3) Show an example of this, how OER can be integrated in a Math or Science class, for instance, using existing repositories and OSS (see findings and discussion in paragraphs 7 and 8 in the Social Resources section in *Chapter 4*).
Infrastructure Support Factors	Policymakers	1) Mitigate problems with Wi-Fi connectivity.	1) "Policymakers could think of mechanisms and support for schools in purchasing equipment, providing technical support and help them in defining and creating local access policies" (T. Amiel, personal communication, April 8, 2018) (see findings and discussion in paragraphs 2 and 3 in the Support Obtained section in *Chapter 5)*.
	School administrators, teacher educators, OER experts	2) In the event that Wi-Fi access and connectivity is limited or unreliable, use other equipment, tools or materials to deliver the TPD program.	2a) Use multimedia equipment or classroom teaching equipment available on school premises such as data projector, overhead projector and easels (see findings and discussion in paragraphs 1 and 2 in the Physical Resources section in *Chapter 4*). 2b) Use hard media containing tutorials on OER use and other offline resources (see findings and discussion in paragraphs 1 and 2 in

			the Physical Resources section in *Chapter 4*). 2c) Use Handouts, booklets, newspaper articles, academic articles and LibreOffice Impress Presentation slides (see findings and discussion in paragraphs 1 and 2 in the Physical Resources section in *Chapter 4*).
TPD Support Factors	OER experts, teacher educators *Ideally, one facilitator per school. In the event there are not enough facilitators, the TPD program can be delivered face-to-face in state or municipal teacher education centers, or online.	1) Delivery mode of TPD program.	1) Provide teachers with face-to-face, practical, hands-on TPD by giving clear examples of existing OER and by providing step-by-step instructions on how to locate, use, adapt, remix and license locally contextualized OER using open licenses or Creative Commons license (see findings and discussion in paragraphs 2 and 3 in the Type of Effective TPD on OER for Teachers section in *Chapter 5*).
	OER experts, teacher educators *One facilitator per school	2) Pedagogical aspects	2) Model effective practices for OER use and progressively incorporate into the TPD program tasks that are associated with teachers' professional practices and corresponding discipline or subject area taught. For example, begin by assigning teachers a task that involves searching for an image, text, audio or video OER that can be used to complement or

			supplement an activity or lesson in their discipline. It is necessary for the facilitator to show teachers who are less proficient with technology how to locate and download existing OER as offline resources. The facilitator can then assign tasks that enable teachers to use and adapt offline resources according to the discipline they teach (see findings and discussion in paragraphs 2 and 3 in section Human Resources and findings and discussion in paragraph 4 in section Digital Resources in *Chapter 4*).
	OER experts, teacher educators *One facilitator per school	3) Pedagogical aspects and tools	3) Use tools present in the school system (i.e., multimedia equipment, classroom teaching equipment, hard media and printed material) in combination with mobile devices or online material whenever possible to engage teachers in the learning process (see findings and discussion in paragraph 1 in the Physical Resources section in *Chapter 4* and findings in paragraph 3 in the Support Obtained section in *Chapter 5*).
	OER experts, teacher educators *One facilitator per school	4) Pedagogical aspects	4) Develop teachers' digital capability and skills with the technology being used

			by demonstrating how this technology can be employed to improve instructional strategies and practices (see findings and discussion in paragraph 1in the Human Resources section in *Chapter 4* and the findings and discussion in paragraph 1 in the Interest and Motivation section in *Chapter 5*).
	OER experts, teacher educators *One facilitator per school	5) Pedagogical aspects	5) Help teachers set up a Wiki to disseminate OER activities they have created to other public schools (see findings and discussion in paragraph 2 in the Effective Type of TPD in OER for Teachers section in *Chapter 5*).
	OER experts, teacher educators *One facilitator per school	6) Pedagogical aspects	6) Provide ongoing facilitator support (e.g., instruction for a significant duration of time, support teachers during the implementation phase and provide active and collaborative learning opportunities for teachers) for scaffolding engagement and learning in order to progressively empower teachers to gain the autonomy and confidence required for learning about OER (see findings and discussion in paragraphs in 1, 2 and 3 in the Effective Type of TPD in OER section in *Chapter 5*).

	Buddy or expert teachers (computer teacher at the school or an agent of inclusion)	7) Provide ongoing help and support during and after the TPD program.	7) Have teachers who did not take the TPD program observe participants in action (see findings and discussion in paragraph 4 and 5 in the Social Resources section in *Chapter 4* and the findings and discussion in paragraph 1 in the Facilitating Conditions section in *Chapter 6*).

Conclusion

According to Farias (2016), Brazilian K-12 public schools can be broadly classified into two types. The first type is characterized by poor infrastructure, and lack of Internet availability and basic equipment (i.e., projectors, televisions and data projectors) (Farias, 2016). The second type of school possesses good infrastructure but is faced with different challenges, "such as non-supportive principals, lack of pedagogical planning and support, and absence of policy for the use of the devices, and the related technology, such as Internet connection, projectors, and television" (Farias, 2016, p. 146). Both types of K-12 public schools pose a series of challenges for those educators who wish to implement innovative practices. This study was conducted in the first type of school, and its findings are most applicable to similar contexts. The findings may also be applicable to the second type; it is necessary to raise school administrations' awareness about the potential for OER so that they can provide their teachers with the necessary support for OER

uptake. The final chapter presents the overall conclusions of this study, a discussion of the limitations of the research and recommendations for future research.

Chapter 8: Conclusions, Limitations, and Recommendations for Future Research

Introduction

This last chapter presents the final conclusions and suggestions for the advancement of TPD in OER in the Brazilian *fundamental education* public school system. It begins by focusing on the research outcomes and presents some concluding remarks. Next, it discusses the limitations of this study. Finally, it provides recommendations for future research.

Research Outcomes

The purpose of this case study was to explore a set of evidence-based OER guidelines in the context of TPD for Brazilian *fundamental education* public school teachers. A TPD intervention on OER was undertaken *in situ* in one Brazilian *fundamental education* public school over the course of one year, in response to a call for practical actions to disseminate and build capacity on OER (dos Santos, 2011).

RQ1 investigated what factors influence Brazilian *fundamental education* public school teachers in their adoption and use of OER in their professional practices. Evidence from qualitative and quantitative data analysis and interpretation of findings indicated that there are several factors that hinder OER uptake in this environment. These include: lack of infrastructure (i.e., reliable high-speed broadband and Wi-Fi connectivity, computers or multimedia equipment); lack of support from the school administration; lack of support from the policymakers and authorities to use educational technology; work overload; low salaries; lack of personnel and TPD to train teachers how to use OER; lack of knowledge and skills with ICTs; linguistic barriers; and limited access to

external web sites such as YouTube and Google due to firewalls. Data also revealed that the teachers do not use OER in their pedagogical practices and have limited knowledge and/or skills in using ICTs for educational purposes. Brazilian *fundamental education* public school teachers need TPD that is aligned with their particular needs and constraints, so as to gradually, with support and incentives from school administrations, provide pedagogically rich and technologically enhanced supplementary or complementary learning experiences through the use of OER to their students.

RQ2 explored what role, if any, TPD could play in teachers' OER adoption decisions. Data findings from the focus groups suggested that some teachers are interested in learning more about available digital resources, as the sections on Human Resources in *Chapter 4* and Knowledge Obtained in *Chapter 5* showed. Despite this interest, teachers also have low levels of digital skills; this calls for training to master the use of ICTs, which can lead to better learning outcomes when using OER. TPD programs should thus offer professional development opportunities that specifically target the development of skills and proficiencies required for OER learning (Collins & Halverson, 2009; Farmer, 2014; Ehlers, 2011; Haßler et al., 2011; Harrington & Rhine, 2015; Hew & Brush, 2006; OER Regional Consultation, 2017; Panke & Seufort, 2013; Petrides et al., 2010; Rossini, 2010; Warschauer, 2002). TPD should also be focused on increasing teachers' understandings of how the 5Rs of OER are reflected in their pedagogical decisions.

This study provides TPD-specific guidelines derived from the reality and constraints of one *fundamental education* public school. There are other Brazilian *fundamental education* public schools that face similar policy, organizational,

infrastructural and training challenges, as corroborated by the literature review. The guidelines derived herein can thus be used in Brazilian schools other than *fundamental education* ones, including public high schools and some private basic education schools.

Limitations of the Study

This study has several limitations. First, only ten (N =10) self-selected participants responded to the focus group interviews. Thus, the different number of participants during the different phases of data collection may have adversely affected both quantitative and qualitative data results. Second, there is a gap in Brazilian K-12 literature on the use of OER, but this gap also presented limitations to this study. Although this further underscores the relevance and contribution of this study to TPD for OER use in Brazil, and to the related body of knowledge, it also provided restricted bases for comparisons and analysis. The same could be said regarding the lack of evaluation of any kind of OER initiative and its implications for TPD in Brazil. Third, restricted time with the participants of this study may have limited the value of these data. However, care was taken to establish additional trustworthiness measures to findings and interpretations did not go beyond data. Lastly, most of the participants who participated in the design thinking workshops did not respond to the UTAUT survey questionnaire. Therefore, it was not a valid sample and so the findings can only be suggestive rather than significant.

Recommendations for Future Research

The areas for future research are vast, given that this is a new area of research in Brazil. The impressions the researcher had about the teachers and school administrators that participated in this study in terms of engagement can be subject to further studies.

Further research is required to assess and validate the effectiveness of the design thinking approach in raising school administrators' and teachers' awareness of OER in addition to its potential in helping stakeholders' prototype models for TPD in OER. Further studies are needed to validate the guidelines proposed in this study and the overall effectiveness of the ODP. Future research could use the same methodology and similar methods in multiple case studies to confirm the validity of or expand on the TPD guidelines on OER provided here. There is also a need to assess Brazilian *fundamental education* school administrators' perspectives and challenges in adopting and using OER. To this end, an online survey or focus groups could be used. Research is also required into the impact of TPD in OER for those institutions that choose to offer them and on the improvement of student learning when teachers use OER. More large-scale OER initiatives and practical implementation actions could further inform TPD development for OER use in Brazil.

Conclusion

While TPD in OER along with training for ICT use may result in increased teacher engagement enabling the development of a culture of OER use to complement or supplement lessons, there should also be an institutional policy that incentivizes the production and distribution of OER, as well as provides incentives for teachers to openly share their creations (Pretto, 2012; Venturini, 2014). Policymakers and school administrators could consider implementing the latter in light of existing constraints in this environment before pushing the agenda toward OER adoption. For teachers, OER training and adoption could represent another activity added to their already heavy workloads. Teachers' bottom-up buy-in and adoption of OER is always more effective than any top-down government or institutional OER policy mandate (Cox & Trotter,

2016). However, it is known that changes in the Brazilian K-12 public school system tend to be top-down, occur at a very slow pace and attract many skeptics. Unfortunately, the improvement of the quality of K-12 public education in Brazil is rarely at the top of the government's list of priorities (Cara, 2013). Redefining the instructional practices of Brazilian *fundamental education* public school teachers to incorporate OER "to develop effective interventions to improve conditions for learning" (Farmer, 2014, p. 58–59) is a time-consuming, gradual process. The integration and adoption of OER impact teaching requiring "an emphasis on improving instructional strategies" (Shambaugh, 2014, p. 125). However, despite these obstacles, the introduction of OER in K-12 public education in Brazil can "provide an incentive for resource-constrained institutions" (Cox & Trotter, 2016, p. 151) by saving costs, and can be an important avenue for the much-needed innovation and change in teachers' cultural mindsets.

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Appendix A

UTAUT Survey Questionnaire

English Version

Demographic Information:

TO THE RESPONDER: The demographic information requested is necessary for the research process. Please rest assured that this information and all your responses on this questionnaire will be kept **strictly confidential**. Data will be reported in such a way that identification of individuals will be impossible.

Token ID #: _____

1. Gender (Check one): _____Male _____Female

2. Age (Check one group): _____under 25
_____25 to 34
_____35 to 44
_____45 to 54
_____55 to 64
_____65+

3. What is your highest academic qualification?

_____Diploma or postgraduate certificate

_____ Bachelors degree
_____ Masters degree
_____ Doctorate
_____ Other

4. Which best describes your current role(s)? Select all the option (s) that apply

____ Educator (Teacher, trainer, lecturer)

_____ Manager or administrator
_____ Professional staff developer
_____ Technologist (e.g., web developer, software developer
_____ Government official/public servant

5. How long have you worked at the at this *Fundamental Education* Municipal School?

_____ 1–2 years

_____ 2–4 years
_____ 4–6 years
_____ 6+ years
_____ less than one year

6. What grade (s) do you teach in this *Fundamental Education* Municipal School?

_____ ensino fundamental (fundamental learning)

_____ ensino médio (final phase of basic education)

7. Do you teach or work at another basic education school?

_____ Yes

_____ No

8. How many hours do you teach per week?

_____ 20

_____ 30
_____40
_____ other

9. Have you ever shared lessons you developed with other teachers?

____ Yes

____ No

10. Have you ever taken an online course?

_____ Yes

_____ No

11. Have you ever delivered a course to your students using the Internet or other information or communication technologies (ICTs)?

_____ Yes

_____ No

12. Have you ever heard about Open Educational Resources (OER) before this course? _____ Yes

_____ No

13. Have you ever used and created OER? ____Yes

_____ No

14. Would you prefer to use OER as modules for assembly/adaptation **OR** OER that contain the full course package with no changes required? **Please choose only one option.**

OER as modules for assembly/adaptation _____

OER that contain the full course package with no changes required _____

Definition of Terms:

a) The term ICT is defined "as ways of working with computers, Internet or software for teaching and learning purposes" (Jakobsdóttir, McKeown, Hoven, 2010, p. 105).

b) OER are defined as "teaching, learning or research materials that are in the public domain or that can be used under an intellectual property license that allows re-use or adaptation (i.e. Creative Commons)" (UNESCO, 2017a, para. 1).

Questionnaire:

Please choose the option that corresponds to your opinion or knowledge on the topics contained in this questionnaire by ticking (✓) on the appropriate box.

Performance Expectancy (Please choose by ticking (✓) on the appropriate box)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
15. I would find OER useful in my courses					
16. Using OER will enable me to accomplish course development activities more quickly					

17. Using OER will improve my students' learning outcomes					
18. The use of OER will allow me to have access to more information about the subjects I teach					

Effort expectancy (Please choose by ticking (✓) on the appropriate box)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
19. It would be easy for me to navigate and interact with content available on OER websites					
20. It would be easy for me to become skillful at using and integrating OER into my courses					
21. I would find OER easy to use					
22. Learning to use OER websites will be easy for me					

Social influence (Please choose by ticking (✓) on the appropriate box)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
23. People who influence my behavior think that I should use and integrate OER into my courses					
24. People who are important to me think that I should use and integrate OER into my courses					
25. The directors and other staff at my school will be helpful in the use and integration of OER into my courses					

26. In general, my school will support the use of OER in teaching and learning					

Facilitating conditions (Please choose by ticking (✓) on the appropriate box)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
27. I have the resources necessary to access OER					
28. I have the knowledge necessary to use and integrate OER into my courses					
29. OER is similar to other course content I use for teaching					
30. Help will be available when I have problems using and integrating OER into my lessons or courses					

Intention to use OER (Please choose by ticking (✓) on the appropriate box)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
31. I intend to use and integrate OER into my courses in the future					
32. I predict that I would use and integrate OER into my courses in the future					
33. I plan to use and integrate OER into my courses in the future					

Note. Adapted with permission from Mtebe, J. S., & Raisamo, R. (2014). Challenges and instructors' intention to adopt and use open educational resources in higher education in Tanzania. *The International Review of Research in Open and Distributed Learning*, *15*(1). © Joel Mtebe and Roope Raisamo.

Portuguese Version

Questionário de Pesquisa do Modelo da Teoria Unificada de Aceitação e Uso de Tecnologia

Informações demográficas:

AO RESPONDEDOR: As informações demográficas solicitadas são necessárias ao processo de pesquisa. Por favor, sinta-se seguro quanto à **estrita confidencialidade** em que serão mantidas estas informações e todas as suas respostas a este questionário. Os dados serão manejados de maneira que a identificação individual será impossível.

Número identificador do token id: _____

1. Gênero (Assinale um): _____Masculino _____Feminino

2. Idade (Marque um grupo):
_____ Abaixo de 25
_____ 25 a 34
_____ 35 a 44
_____ 45 a 54
_____ 55 a 64
_____ Acima de 65

3. Qual a sua qualificação acadêmica mais alta?
_____Diploma ou certificado de pós-graduação
_____ Bacharelado
_____ Mestrado
_____ Doutorado
_____ Outra

4. Qual item melhor descreve suas atuais funções? Selecione todas as opções que se aplicarem:
_____ Educador (professor, instrutor, palestrante)
_____ Gerente ou administrador
_____ Desenvolvedor de equipe profissional
_____ Tecnólogo (p. ex., desenvolvedor de web ou de software)
_____ Representante do governo ou funcionário público

5. Há quanto tempo trabalha nessa Escola Municipal de Ensino Fundamental?	_____ 1 a 2 anos _____ 2 a 4 anos _____ 4 a 6 anos _____ há mais de 6 anos _____ há menos de 1 ano
6. Em que série(s) você leciona na escola?	_____ Ensino fundamental _____ Ensino médio
7. Você ensina ou trabalha em outra escola de ensino fundamental?	_____ Sim _____ Não
8. Quantas horas você leciona por semana?	_____ 20 _____ 30 _____ 40 _____ Outro
9. Você alguma vez compartilhou lições que desenvolveu com outros professores?	____ Sim ____ Não
10. Você alguma vez fez um curso online?	_____ Sim _____ Não
11. Você alguma vez deu um curso a seus alunos usando a Internet ou outras tecnologias de informação e comunicação (TICs)?	_____ Sim _____ Não
12. Você já tinha ouvido falar em Recursos Educacionais Abertos (REA) antes deste curso?	_____ Sim _____ Não
13. Você alguma vez usou REA?	____ Sim

____ Não

14. Você alguma vez criou REA? ____ Sim
____ Não

15. Você preferiria usar REA em módulos, para integrar/adaptar **OU** REA que contivessem o pacote completo do curso, sem necessidade de mudança? **Por favor, assinale apenas uma opção.**

_____ REA em módulos, para integrar/ adaptar
_____ REA que contivessem o pacote completo do curso, sem necessidade de mudança _____

Definição dos termos:

a) O termo TIC é definido como "modos de trabalhar com computadores, Internet ou programas com o propósito de ensinar e aprender" (Jakobsdóttir, McKeown, Hoven, 2010, p. 105).

b) REA são definidos como "materiais para ensinar, aprender e pesquisar, que estão em domínio público ou são publicados com licença de propriedade intelectual que permita sua livre utilização, adaptação e distribuição (i.e. licenças Creative Commons)" (UNESCO, 2017a, para. 1).

Questionário:

Por favor, escolha a opção que corresponde à sua opinião ou ao seu conhecimento dos tópicos contidos neste questionário ticando (✓) no espaço adequado.

Expectativa de desempenho

	Discordo fortemente	Discordo	Neutro	Concordo	Concordo fortemente
16. Eu consideraria REA úteis em meus cursos					
17. Usar REA permitirá que eu execute atividades de desenvolvimento do curso mais depressa					
18. Usar REA aumentará os resultados de aprendizado dos meus alunos					
19. O uso de REA permitirá que					

eu tenha acesso a mais informações sobre os assuntos que leciono					

Expectativa de esforço

	Discordo fortemente	Discordo	Neutro	Concordo	Concordo fortemente
20. Para mim, seria fácil navegar e interagir com o conteúdo disponível em websites de REA					
21. Para mim, seria fácil tornar-me hábil no uso e na integração de REA em meus cursos					
22. Eu acharia REA fácil de usar					
23. Aprender a usar websites de REA será fácil para mim					

Influência social

	Discordo fortemente	Discordo	Neutro	Concordo	Concordo fortemente
24. As pessoas que influenciam meu comportamento acham que eu deveria usar e integrar REA em meus cursos					
25. As pessoas que são importantes para mim acham que eu deveria usar e integrar REA em meus cursos					
26. A direção e outras pessoas da equipe na minha escola vão ajudar no uso e na integração de REA nos meus cursos					
27. De forma geral, minha escola vai apoiar o uso de REA no ensino e na aprendizagem					

Condições facilitadoras

	Discordo fortemente	Discordo	Neutro	Concordo	Concordo fortemente
28. Eu possuo os recursos necessários para acessar REA					
29. Eu tenho o conhecimento					

necessário para usar e integrar REA em meus cursos					
30. REA são semelhantes a outros conteúdos do curso que uso para ensinar					
31. Haverá ajuda disponível se eu tiver problemas ao usar e integrar REA em minhas aulas ou cursos					

Intenção de usar REA

	Discordo fortemente	Discordo	Neutro	Concordo	Concordo fortemente
32. Eu pretendo usar e integrar REA em meus cursos no futuro					
33. Eu prevejo que vá usar e integrar REA em meus cursos no futuro					
34. Eu planejo usar e integrar REA em meus cursos no futuro					

"Ao apertar o botão SUBMETER, seus dados serão incluídos no estudo. Se você decidir retirá-los após a submissão, simplesmente contate Viviane Vladimirschi (vladimirschi@uol.com.br) e informe seu identificador de participação. Seus dados serão destruídos e não serão incluídos no estudo."

Nota. Adaptado com permissão de Mtebe, J. S., & Raisamo, R. (2014). Challenges and instructors' intention to adopt and use open educational resources in higher education in Tanzania. *The International Review of Research in Open and Distributed Learning*, *15*(1). © Joel Mtebe e Roope Raisamo.

Appendix B

Faculty Letter of Invitation and Consent Form

English Version

August 1, 2016

Dear Director, Vice-Director, Coordinator and Professor,

This letter is to invite you to participate in a study that I'm conducting at this *Fundamental Education* Municipal School aimed at exploring what are a set of evidence-based OER guidelines in the context of TPD for Brazilian *fundamental education* public school teachers by means of the design, development and implementation of a ODP (OER Development Program), teacher professional development (TPD) program. OER (Open Educational Resources) are "teaching, learning or research materials that are in the public domain or that can be used under an intellectual property license that allows re-use or adaptation (i.e. Creative Commons)" (UNESCO, 2017a, para. 1). Recent studies have underscored that there is need to provide effective, collaborative, hands-on TPD to support the development of OER. In addition, the city of São Paulo in Brazil has decreed that all educational resources paid for by the city must be OER licensed using a Creative Commons license (Sao Paulo, 2011). Therefore, there is need for practical implementation actions in order to train teachers and staff how to assemble and repurpose courses from available OER.

The study will take place over one year, Spring/August, 2016 to Spring/September, 2017. I anticipate that six to ten hours of your time will be required over the course of one year during the term Spring/August, 2016 to Spring/September, 2017. For this study you will be asked to respond to one online survey, you will be invited to participate in four one-hour workshops that will be delivered at the school during your *HTP* activity time and you will be invited to participate in focus group interviews. You will need access to the Internet for the online survey and an e-mail address. For in-depth information on this study, please read the Informed Consent Package.

Please be assured that your involvement in this research is completely voluntary and there are no known or anticipated risks to participation in this study. You have the right to refuse to participate and to withdraw at any time during this research, without prejudice. All questions in the surveys must be completed, but you can choose not to complete the survey if you do not know how to respond to the questions. You can also choose not to participate in any workshop or in the focus groups. *All information will be held confidential.* If you decide to participate in the four workshops and in the focus groups where participants know who is participating and where participants meet face-to-face complete anonymity cannot be guaranteed. You are therefore requested to respect the privacy and confidentiality of the other participants.

If you have any questions about this study or would like additional information to assist you in reaching a decision about participation, please feel free to contact Viviane Vladimirschi at 55-11-99651-2006 or vladimirschi@uol.com.br or Dr. Rory McGreal at 1-780-231-0596, or rory@athabascau.ca. This study has been reviewed by and received ethical clearance from the Athabasca Research Ethics Board.

Thank you in advance for your interest in this project. To participate in this research, please reply to this e-mail by [date], and add the following statement in the body of your e-mail, along with your name and an e-mail address:

"Yes, I have read the information on the study and accept to participate in the research study on Professional Development Guidelines for OER use to be conducted from September, 2016 to September, 2017 at this *Fundamental Education* Municipal School."

This statement will indicate your consent to participate in the study. Volunteers will be contacted by email, at which time they will be notified of the survey link.

Yours sincerely,
Viviane Vladimirschi
Principal Researcher
EDDE Student
Athabasca University

Portuguese Version

Carta Convite aos Docentes e Formulário de Consenso Informado

1 de agosto de 2016

À Direção, Vice-direção, Coordenação e Docentes,

Sirvo-me desta carta para convidar sua participação em um estudo que estou conduzindo nessa Escola Municipal de Ensino Fundamental, cujo objetivo é explorar diretrizes de desenvolvimento profissional para professores (DPP) em REA para serem adotadas por escolas de ensino fundamental da rede pública por meio do planejamento, desenvolvimento e da implantação de um programa semipresencial piloto: o CDREA (Curso de Desenvolvimento em REA). REA (Recursos Educacionais Abertos) são "materiais para ensinar, aprender e pesquisar, que estão em domínio público ou são publicados com licença de propriedade intelectual que permita sua livre utilização, adaptação e distribuição (i.e. licenças Creative Commons)" (UNESCO, 2017a, para. 1). Estudos recentes realçam a necessidade de se oferecer um DPP eficaz, colaborativo e prático, para embasar o desenvolvimento de REA. Além disso, o município de São Paulo, no Brasil, decretou que todos os recursos educacionais financiados pelo município devem ser REA licenciados pelo Creative Commons (São Paulo, 2011). Portanto, existe uma demanda por ações práticas de implantação, para que professores e gestores escolares sejam treinados para usar e criar material didático a partir de REA já disponíveis.

O estudo ocorrerá de agosto de 2016 à agosto de 2017. Estimo que entre seis a dez horas de seu tempo venham a ser solicitadas ao longo deste período, que vai de agosto de 2016 a agosto de 2017. Para o estudo, você será solicitado a responder a um questionário online; convidado a participar em quatro workshops presenciais, de uma hora de duração cada, a ocorrerem na escola durante seu Horário de Trabalho Pedagógico; e será convidado a participar em grupos de foco. Você precisará ter acesso à Internet para responder ao questionário online e de um endereço de e-mail. Para informações mais detalhadas sobre o estudo, por favor, leia o pacote de Consenso Informado.

Por favor, esteja ciente de que sua participação nesta pesquisa é completamente voluntária, e de que não há nenhum risco conhecido ou previsto envolvendo sua participação no estudo. Você tem o direito de se recusar a participar e o direito de se retirar a qualquer momento durante esta pesquisa, sem nenhum tipo de prejuízo. Todas as questões do questionário precisam ser completadas, mas você pode optar por não completar o questionário se não souber como responder às perguntas. Pode também optar por não participar de nenhum dos workshops. *Todas as informações serão mantidas em sigilo.* Se você decidir participar dos workshops presenciais e dos grupos de foco (nos quais os participantes sabem quem está participando, pois se encontram

presencialmente), o anonimato total não pode ser garantido. Portanto, solicito que respeite a privacidade e a confidencialidade dos demais participantes.
Caso tenha perguntas a respeito deste estudo ou gostaria de obter informações adicionais que o ajudem a decidir sobre sua participação, por favor, sinta-se à vontade para contatar Viviane Vladimirschi no 55-11-99651-2006 ou pelo vladimirschi@uol.com.br ou Dr. Rory McGreal no 1-780-231-0596, ou pelo rory@athabascau.ca. Este estudo foi avaliado e autorizado pelo Comitê de Ética em Pesquisa da Universidade de Athabasca.

Agradeço antecipadamente por seu interesse neste projeto. Para participar desta pesquisa, por favor, responda a este e-mail até [data] acrescentando no final, no corpo da mensagem, a declaração a seguir, bem como seu nome e endereço de e-mail:

"Sim, eu li as informações sobre o estudo e aceito participar da pesquisa sobre Diretrizes de Desenvolvimento Profissional em REA para Professores de Ensino Fundamental, a ser realizada de agosto de 2016 a agosto de 2017 nessa Escola Municipal de Ensino Fundamental."

Esta declaração indicará seu consentimento em participar do estudo. Os voluntários serão contatados por e-mail, ocasião em que serão informados sobre o link para a pesquisa.

Atenciosamente,
Viviane Vladimirschi
Pesquisadora Principal
Doutoranda em Educação com especialização em Educação a Distância
Universidade de Athabasca

Appendix C

Informed Consent Package

English Version

1. **Title of Dissertation:** Professional Development Guidelines for OER use: A case study of Brazilian *Fundamental Education* Public School Teachers

2. **Contact Information:**

Principal researcher: Viviane Vladimirschi

Tel: 55-11-96512006 (Brazil time)
E-mail: vladimirschi@uol.com.br

Thesis Supervisor: Dr. Rory McGreal
Tel: 1- 780-2310596
E-mail: rory@athabascau.ca

Athabasca Research Ethics Board
Tel: 1-800-788-9041, ext 6718
E-mail: rebsec@athabascau.ca

3. **Responsibilities and time commitment of participants:** Forty-six teachers as well as the Director, Vice-Director, and Coordinator of this *Fundamental Education* Municipal School have been invited to participate in this study.

The study will take place over one year, Winter/August, 2016 to Winter/September, 2017. I anticipate that six to ten hours of your time will be required over the course of one year during the Winter/September, 2016 to Winter/August, 2017 term. At the beginning of the study, you will be asked to respond to one online survey, as described below. To respond to this survey, you will need access to the Internet and an e-mail address. You will also be invited to participate in 4 one-hour workshops that will be delivered at the school during your teacher professional activity time (*HTP- Horário Trabalho Pedagógico*). The time commitment of participants and the corresponding activities that will be undertaken during each phase of the study such as the online survey, workshops, and focus groups are described in more detail below.

Online Survey 1: August, 2016 – September, 2016

The online survey employs a 5 point Likert-type scale UTAUT (Unified Theory of Acceptance and Use of Technology) instrument aimed at collecting your demographic data and assessing your intention to adopt and use OER in order to design an effective intervention for the participants of the study. This survey is comprised of 31 survey questions. It is anticipated that approximately thirty to forty minutes of your time will be required to answer the survey.

Design Thinking Workshops – September, 2016 – December, 2016

The researcher will deliver four design thinking workshops during your *HTP* activity time to raise awareness on open education, OER and the use of digital resources in your professional practices. It is estimated that approximately 4 hours of your time will be required for these workshops.

Focus Groups: August, 2017

Focus groups will be conducted with all participants of the study regardless of whether you completed the ODP. Focus group interviews will consist of semi-structured, open-ended questions, aimed at assessing the overall effectiveness of the professional development program on OER use. For the focus groups, you will be divided into groups of six or seven participants. The focus group will be conducted during your *HTP* activity time at the school. It is estimated that approximately one hour of your time will be required for these focus group conversations.

You will need access to the Internet and an e-mail address in order to participate in the online survey.

4. **Purpose of the research:** This study is aimed at exploring what are a set of evidence-based OER guidelines in the context of TPD for Brazilian *fundamental education* public school teachers by means of the design, development and implementation of an ODP (OER Development Program), teacher professional development program (TPD). OER (open educational resources) are "teaching, learning or research materials that are in the public domain or that can be used under an intellectual property license that allows re-use or adaptation (i.e., Creative Commons)" (UNESCO, 2017a, para.1). Recent studies have underscored the need to provide effective, collaborative, hands-on TPD to support the development of OER. In addition, the city of São Paulo in Brazil has decreed that all educational resources paid for by the city must be OER licensed using a Creative Commons license (Sao Paulo, 2011). Therefore, there is need for practical implementation actions in order to train teachers and staff how to assemble and repurpose courses from available OER.

The purpose of this mixed-method, case study is threefold: (a) to gain new insights on TPD for OER implementation and uptake within K-12; (b) to develop capacity on OER

use; and (c) to provide a set of evidence-based OER guidelines in the context of TPD for Brazilian *fundamental education* public school teachers.

5. **Risks and benefits:** The risks associated with participating in this study are negligible and are certainly no greater than those encountered in any regular K-12 public school environment. Participation is voluntary. Your answers to Online Survey 1 will be identified with a token identifier number that has been generated for you; your name will not be presented on any documents. Data containing comments in regards to your participation in the design thinking workshops on digital resources; and focus group interview responses will include no identifying information and your names will be replaced with pseudonyms. If you change your mind about taking part in any of the activities of this study, you can withdraw at any time. To do this, simply contact Viviane Vladimirschi (vladimirschi@uol.com.br), and provide your token identifier number. Your data will then be destroyed and will not be included within the study. There will be no consequences from deciding to withdraw your participation and no need to explain your withdrawal. You have the right to refuse to participate and to withdraw at any time during this research, without prejudice.

Your participation will contribute to a better understanding of which activities of the ODP enable teachers to assemble and repurpose courses from available OER supporting the development of their professional practice. This study will help inform the development of a new model for TPD in OER, which is significant to the advancement of Brazilian *fundamental education* public school teaching practices and to the profession. The findings have potential application beyond the São Paulo municipality context and could be utilized in other *fundamental education* public school settings.

6. **Privacy:** All participant responses and other information will be kept confidential. To preserve participants' confidentiality, privacy, and anonymity, the data collected will include no identifying information and the names of all participants will be replaced with pseudonyms. A database will be created that will include participant pseudonyms and corresponding feedback so that the names of the participants are not associated with their responses. Findings from both quantitative and qualitative data analysis will not identify any names or personal information. Information from survey collected using Lime Survey software will assign token id numbers to participants, ensuring anonymity.

Data in the form of word files, surveys, digital audio and video recordings and any other information about participants will be electronically saved on the researcher's computer. Two backup copies will be committed to removable data storage devices. The two data storage devices will be kept in the researcher's office under lock. Hard copies of the data - questionnaires and data from focus group interviews- will be printed and stored under lock at the researcher's office. These will be saved for five years and then destroyed.

The personal information recorded on this form is being collected under the authority of the Post-Secondary Learning Act and Section 33(c) of the Freedom of Information and

Protection of Privacy Act. This information will be used to research Professional Development Guidelines for OER use, and is protected under the privacy provisions of the Freedom of Information and Protection of Privacy Act. If you require further information concerning the collection and use of this personal information, please contact Viviane Vladimirschi at 55-11-99651-2006 or vladimirschi@uol.com.br.

7. **Availability of Results:** The research will be listed in an abstract posted online at the Athabasca University Library's Digital Thesis and Project Room, and the final research paper will be publicly available. The whole or parts of the dissertation may be published and/or made available on the WWW.

This study has been reviewed by the Athabasca University Research Ethics Board. Should you have any comments or concerns regarding your treatment as a participant in this study, please contact the Office of Research Ethics at 780-675-6718, ext 6718 or by e-mail at rebsec@athabascau.ca

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Deemed consent:

PROCEED TO SURVEY

"Submission of the completed questionnaire will constitute consent to include the data in the study

Pacote de Consenso Informado

Portuguese Version

1. **Título da Tese:** Diretrizes de Desenvolvimento Profissional para Professores em REA: Um Estudo de Caso de Professores do Ensino Fundamental da Rede Pública

2. **Contatos:**

Pesquisadora principal: Viviane Vladimirschi
Tel: 55-11-96512006 (Horário brasileiro)
E-mail: vladimirschi@uol.com.br

Supervisor da tese: Dr. Rory McGreal
Tel: 1- 780-2310596
E-mail: rory@athabascau.ca

Comitê de Ética em Pesquisa da Universidade de Athabasca
Tel: 1-800-788-9041, ext 6718
E-mail: rebsec@athabascau.ca

3. **Responsabilidades e comprometimento dos participantes quanto ao tempo:** Quarenta e seis professores, bem como a Direção, a Vice-direção e a Coordenação Pedagógica dessa Escola Municipal de Ensino Fundamental foram convidados a participar deste estudo.

O estudo ocorrerá ao longo de um ano, do inverno de 2016 ao inverno de 2017. Eu estimo que entre seis e dez horas de seu tempo venham a ser solicitadas ao longo do curso durante o intervalo compreendido entre agosto de 2016 e agosto de 2017. No começo do estudo, você será convidado a responder à um questionário online, conforme descrito abaixo. Para responder ao questionário, será preciso ter acesso à Internet e um endereço de e-mail. Você também será convidado a participar de quatro workshops presenciais, de uma hora cada, a ocorrerem na escola, durante seu Horário de Trabalho Pedagógico.

O comprometimento dos participantes quanto ao tempo e as atividades a ocorrerem durante o estudo, tais como o questionário online, os workshop presenciais, e os grupos de foco estão descritos em detalhes abaixo.

Questionário Online: agosto – setembro de 2016

O questionário online consiste de uma escala de 5 pontos tipo Likert, e é denominado Teoria Unificada de Aceitação e Uso de Tecnologia, cujo foco é coletar seus dados demográficos e avaliar sua intenção de adotar e usar REA, tendo por objetivo esquematizar uma intervenção eficaz para os participantes do estudo. Este questionário é composto de 34 questões. Estimo que entre trinta e quarenta minutos de seu tempo serão necessários para o preenchimento do questionário.

Workshops Presenciais de *Design Thinking*: setembro, 2016 – dezembro, 2016

A pesquisadora realizará workshops presenciais de *Design Thinking* durante seu Horário de Trabalho Pedagógico para aumentar o seu conhecimento a respeito de REA e para investigar quais são as barreiras ou desafios para incorporar recursos digitais em sua práticas pedagógicas. Estimo que aproximadamente quatro horas de seu tempo serão necessárias para estes workshops.

Grupos de Foco – agosto, 2017

Os grupos de foco serão realizadas com todos os participantes do estudo, independentemente de terem ou não completado o CDREA. Os grupos de foco irão ser baseados em perguntas semiestruturadas e de resposta aberta, focadas na avaliação da eficácia da intervenção. Para esses grupos de foco, os participantes serão distribuídos em grupos de seis ou sete pessoas. Os grupos de foco serão realizados na escola, durante seu Horário de Trabalho Pedagógico. Estimo que uma hora de seu tempo será necessária para os grupos de foco.

Você precisará de acesso à Internet para responder ao questionário online e de um endereço de e-mail.

4. **Objetivo da pesquisa:** Este estudo está focado em investigar diretrizes para REA baseadas nos achados para o desenvolvimento professional de professores (DPP) para serem adotas por escolas de ensino fundamental da rede pública por meio do planejamento, desenvolvimento e da implantação de um programa CDREA (Curso de Desenvolvimento de REA). REA (Recursos Educacionais abertos) são "materiais para ensinar, aprender e pesquisar, que estão em domínio público ou são publicados com licença de propriedade intelectual que permita sua livre utilização, adaptação e distribuição (i.e., licenças Creative Commons)" (UNESCO, 2017a, para. 1).

Estudos recentes realçam a necessidade que existe de se oferecer um DPP eficaz, colaborativo e prático, para fomentar a adoção e o uso de REA. Além disso, o município de São Paulo, no Brasil, decretou que todos os recursos educacionais financiados pelo município devem ser REA licenciados pela Creative Commons (São Paulo, 2011). Portanto, há uma demanda por ações práticas de implantação, para que professores e

gestores escolares sejam treinados na integração e adaptação de REA já disponíveis em seus cursos ou aulas.

Este estudo de caso de metodologia mista tem por objetivo: 1) obter mais conhecimento sobre que tipo de DPP promoveria a adoção e uso de REA em escolas de ensino fundamental da rede pública; 2) treinar os professores para usarem REA; e 3) desenvolver um conjunto de diretrizes baseadas nos achados para DPP em REA no contexto de uma escola pública de ensino fundamental brasileira.

5. **Riscos e benefícios:** Os riscos associados à participação neste estudo são desprezíveis e certamente não maiores do que aqueles encontrados em qualquer ambiente normal de escola pública de Ensino Fundamental. A participação é voluntária. Suas respostas ao questionário online 1 serão identificadas por meio de um número de número de identificação (token) que terá sido previamente gerado e informado; seu nome não estará em nenhum documento. Dados contendo comentários relativos à sua participação nos workshops presenciais de *design thinking* e respostas dadas durante os grupos de foco não vão incluir informações capazes de identificar os participantes, e os nomes serão substituídos por pseudônimos. Se mudar de ideia sobre participar de qualquer uma das atividades deste estudo, você poderá se retirar a qualquer momento. Para fazer isso, basta contatar Viviane Vladimirschi (vladimirschi@uol.com.br) e fornecer o número identificador de seu token. Seus dados serão então destruídos e não serão incluídos no estudo. Não haverá consequências caso você resolva abandonar a pesquisa, e também não precisará justificar sua decisão. Você tem o direito de se recusar a participar e de se retirar a qualquer momento durante esta pesquisa, sem nenhum tipo de prejuízo.

Os benefícios são sua contribuição para uma melhor compreensão de quais atividades do CDREA capacitam os professores a integrar e adaptar cursos a partir de REA existentes, apoiando o desenvolvimento de sua prática profissional. Este estudo ajudará a informar o desenvolvimento de um novo modelo de DPP em REA, o que é significativo para o avanço das práticas docentes dos professores de Ensino Fundamental da rede pública no Brasil e para a profissão como um todo. Os achados da pesquisa têm aplicação potencial em outras escolas públicas de Ensino Fundamental do Brasil.

6. **Privacidade:** Todas as respostas dos participantes, e outras informações, serão mantidas em sigilo. Para preservar a confidencialidade, privacidade e o anonimato dos participantes, os dados coletados não incluirão informações capazes de identificá-los, e os nomes dos participantes serão substituídos por pseudônimos. Será criado um banco de dados contendo os pseudônimos dos participantes e as respectivas contribuições, de modo que os nomes dos participantes não sejam associados às suas respostas. Os achados derivados tanto dos dados quantitativos quanto dos qualitativos não identificarão nomes nem informações pessoais. Informações de pesquisa coletadas por meio do software Lime Survey receberão tokens com números de identificação atribuídos aos participantes, assegurando anonimato. Participantes que decidirem tomar parte dos quatro workshops presenciais de *design thinking* e dos grupos de foco (nos quais os participantes sabem quem está participando, pois irão se encontrar presencialmente),

devem estar cientes de que anonimato total não pode ser garantido. Portanto, solicito que respeite a privacidade e a confidencialidades dos demais participantes.

Dados em forma de arquivos de texto, pesquisas, gravações digitais de som e imagem e qualquer outra informação sobre os participantes serão salvos eletronicamente no computador da pesquisadora. Duas cópias de segurança serão armazenadas em dispositivos de armazenamento que permitem a remoção dos dados gravados. Os dois dispositivos de armazenamento de dados serão guardados à chave no escritório da pesquisadora. Cópias impressas dos dados – questionários e dados dos grupos de pesquisa qualitativa – serão guardadas à chave no escritório da pesquisadora e mantidas por cinco anos. Depois disso, serão destruídas.

A informação pessoal gravada neste formulário está sendo coletada sob a autoridade do Ato de Aprendizagem Pós-Secundário e da Seção 33(c) do Ato de Liberdade de Informação e Proteção à Privacidade. Esta informação será usada para pesquisar Diretrizes de Desenvolvimento Profissional para Professores em REA, e é protegida pelo Ato de Liberdade de Informação e Proteção à Privacidade. Se desejar mais informações a respeito da coleta e do uso de informações pessoais, por favor, entre em contato com Viviane Vladimirschi no 55-11-99651-2006 ou pelo vladimirschi@uol.com.br.

7. **Disponibilidade dos resultados:** Esse estudo será listado em um resumo publicado online na Biblioteca Digital de Teses e Sala de Projetos da Universidade de Athabasca, e o documento final relativo à pesquisa estará disponível publicamente. O todo ou partes da dissertação poderão ser publicados ou tornados disponíveis na internet.

Este estudo foi auditado pelo Comitê de Ética em Pesquisa da Universidade de Athabasca. Caso tenha algum comentário ou preocupação sobre seu tratamento enquanto participante deste estudo, por favor, entre em contato com o Escritório de Pesquisa Ética no 1-780-675-6718, ramal 6718, ou pelo e-mail rebsec@athabascau.ca

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Por favor, mantenha uma cópia desta informação de consentimento para seus registros.
Clicando o botão abaixo e submetendo este questionário constitui seu consentimento e implica sua concordância aos termos acima.

Appendix D

Focus Group Conversations with Participants of the Study: Post-ODP

English Version

Questions

1) Did you attend all four workshops? If not, how many did you attend?
2) During the workshops, you were asked to undertake activities aimed at responding to the following question: "How can we use digital resources to improve our pedagogical practices"? These digital resources referred specifically to the use of OER and their potential to complement your professional practice. Did you have conversations about these subjects with the school administration or with other teachers prior to these workshops? If so, how would you describe these conversations?
3) Were these workshops useful for you in any way? What new information and knowledge did you gain from these workshops?
4) What were your main takeaways or lessons learned from these workshops?
5) In what ways do you feel the school administration supported you during this professional development program?
6) If you do not feel that the school administration supported you, what things could they have done to support you better?
7) Has this professional development program influenced your decision to adopt and use OER and ICTs in your professional practice, and if so, how?
8) Do you have plans to put into action the new knowledge and skills you have acquired? If so, describe these plans and who would be able to help you achieve your goals.
9) Which incentives, actions, or policies, if any, would motivate you to adopt and use OER and ICTs in your professional practice?
10) In your opinion, in what ways could this professional development program have been more effective in terms of both its quantity and quality?
11) Do you have any other suggestions or comments that could help this professional development program to improve in the future?

Questões para o Grupos de Foco com os Participantes do Estudo: Pós Intervenção

Portuguese Version

1) Você participou dos quatro workshops presenciais? Caso contrário, quantos você participou?
2) Durante os workshops presenciais, você foi convidado a realizar atividades em relação ao problema proposto: "Como podemos usar recursos digitais para melhorar nossas práticas pedagógicas"? Estes recursos digitais se referiam especificamente ao uso de REA e TICs e seu potencial para complementar sua prática profissional. Você já tinha tido conversas com a administração da escola ou com outros professores antes desses workshops sobre esses assuntos? Como você descreveria essas conversas?
3) Estes workshops presenciais foram úteis para você de alguma maneira? Que novas informações e conhecimentos você ganhou nesses workshops?
4) Quais foram as principais lições aprendidas durante esses workshops presenciais?
5) De que forma você sente que a administração da escola o apoiou durante este programa de desenvolvimento profissional?
6) Caso negativo, de que forma você acha que a administração da escola poderia ter ajudado a apoiá-lo mais neste programa de desenvolvimento profissional?
7) Como esse programa de desenvolvimento profissional influenciou, ou não, até agora, sua decisão de adotar e usar REA e TICs em sua práticas profissionais?
8) Você tem planos para colocar em ação os novos conhecimentos e habilidades que você adquiriu? Descreva esses planos e quem poderá ajudá-lo a conseguir isso.
9) Quais incentivos, políticas, ou ações, se houverem algumas, te motivariam para adotar e usar REA e TICs em suas práticas profissionais?
10) Na sua opinião, de que forma esse programa de desenvolvimento profissional poderia ter sido mais eficaz em termos de quantidade e qualidade?
11) Alguma outra sugestão ou comentário que poderia ajudar esse curso de desenvolvimento profissional no futuro?

Appendix E

Athabasca University
RESEARCH CENTRE

The future of learning

CERTIFICATION OF ETHICAL APPROVAL

The Athabasca University Research Ethics Board (AUREB) has reviewed and approved the research project noted below. The AUREB is constituted and operates in accordance with the current version of the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS) and Athabasca University Policy and Procedures.

Ethics File No.:**22246**

Principal Investigator:
Ms. Viviane Vladimirschi, Graduate Student
Centre for Distance Education\Doctor of Education in Distance Education

Supervisor:
Dr. Rory McGreal (Supervisor)

Project Title:
Professional Development Guidelines for OER Use: A Case Study of Brazilian Fundamental Education Public School Teachers'

Effective Date: June 24, 2016 **Expiry Date**: June 23, 2017

Restrictions:

Any modification or amendment to the approved research must be submitted to the AUREB for approval.

Ethical approval is valid *for a period of one year*. An annual request for renewal must be submitted and approved by the above expiry date if a project is ongoing beyond one year.

A Project Completion (Final) Report must be submitted when the research is complete *(i.e., all participant contact and data collection is concluded, no follow-up with participants is anticipated and findings have been made available/provided to participants (if applicable))* or the research is terminated.

Approved by: **Date:** June 24, 2016

Debra Hoven, Chair
Centre for Distance Education, Departmental Ethics Review Committee

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Athabasca University Research Ethics Board
University Research Services, Research Centre
1 University Drive, Athabasca AB Canada T9S 3A3
E-mail rebsec@athabascau.ca
Telephone: 780.675.6718

Appendix F

Athabasca University
RESEARCH ETHICS BOARD

The future of learning.

CERTIFICATION OF ETHICAL APPROVAL - RENEWAL

The Athabasca University Research Ethics Board (AUREB) has reviewed and approved the research project noted below. The AUREB is constituted and operates in accordance with the current version of the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS)* and Athabasca University Policy and Procedures.

Ethics File No.:22246

Principal Investigator: Viviane Vladimirschi, Graduate Student, Centre for Distance Education

Supervisor (if applicable): Rory McGreal, Centre for Distance Education

Project Title: 'Professional Development Guidelines for OER Use: A Case Study of Brazilian Fundamental Education Public School Teachers'

Effective Date: June 8, 2017 **Expiry Date**: June 7, 2018

Restrictions:

- Any modification or amendment to the approved research must be submitted to the AUREB for approval.
- Ethical approval is *valid for a period of one year*. An annual request for renewal must be submitted and approved by the above expiry date if a project is ongoing beyond one year.
- A Project Completion (Final) Report must be submitted when the research is complete *(i.e., all participant contact and data collection is concluded, no follow-up with participants is anticipated and findings have been made available/provided to participants (if applicable))* or the research is terminated.

Approved by: **Date: June 8 2017**

Sherri Melrose, Chair
Athabasca University Research Ethics Board

Athabasca University Research Ethics Board
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