The Use of Digital Technologies by Teachers in Their Pedagogical Practice and the Experiences and Conditions that Enable Their Work: A Case Study

by

Thiago A. Hinkel

Lic., Universidade do Vale do Rio dos Sinos, Brazil, 2010

M.A. in Education, Universiade da Região de Joinville, Brazil, 2014

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I acknowledge and respect the Lək̓ʷəŋən (Songhees and Esquimalt) Peoples on whose territory the university stands, and the Lək̓ʷəŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.

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Abstract

Digital technologies are pervasive in many areas of life in the 21st century, including education (Haleem et al., 2022), and teachers and schools have traditionally been associated with being responsible for developing in students the competencies that will allow them to fully participate in society. There are different frameworks and theories that discuss how student teachers should be educated to use digital technology pedagogically and how students in schools should learn to use it. Based on a selection of three theories, Digital Literacies, Technological Pedagogical Content Knowledge (TPACK), and Maker Pedagogy and Pedagogical Hacking, this study sought to investigate how and to what purposes teachers used digital technologies in their practice for teaching and learning. Additionally, it aimed at understanding some of the experiences and conditions that allowed teachers to do the work they did.

Framed as a qualitative case study, this research drew on literature, the researcher experience, curricular policies, and the experiences and perceptions of four teachers who were known in their schools for the work they did with digital technologies. Findings show that formal education played a decisive role in educating teachers to use digital technologies in their practice. Constant changes brought about by new technological inventions, curriculum renewal, and teachers recognizing themselves as unfinished contributed to teachers engaging in continuing learning practices. These practices happened mainly by means of collaboration with peers and students, professional development opportunities, and looking for help online.

Regarding digital literacies, participants recognized the importance of exposing students to different genres and giving learners the opportunity to communicate their learning and express themselves by means of different formats. Participants also recognized that equipment availability, connection reliability, and foundational digital competencies were required for any

work with digital technologies to be properly done in schools. Student privacy appeared as paramount for participants. There were different systems in place such as lessons, discussions, and privacy impact assessments (PIAs) to guarantee student safety when going online, and these promoted different strategies that allowed students to develop a sense of digital citizenship. In conclusion, the study indicated that technology played an important role in instructional delivery and in student activities with a focus on real-life application. Surprisingly, teacher librarians demonstrated a vital role in the schools, providing support for both teachers and students.

Keywords: 21st century competencies, digital literacies, digital technologies, teacher education, teacher work, TPACK, maker pedagogy, pedagogical hacking, teacher librarianship.

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Abbreviations

ADST	Applied Design, Skills, and Technology
BC	British Columbia
BCC	Blind Carbon Copy
BYOD	Bring Your Own Device
CC	Carbon Copy
DOS	Disk Operating System
GUI	Graphical User Interface
ICT	Information and Communication Technologies
FIPPA	Freedom of Information and Protection of Privacy Act
LMS	Learning Management System
MHN	Maslow's Hierarchy of Needs
PC	Personal Computer
PIA	Privacy Impact Assessment
PCK	Pedagogical Content Knowledge
PLN	Personal/Professional Learning Network
Pro D	Professional Development
QR Code	Quick Response Code
RAM	Random Access Memory
RPG	Role-Playing Game
SD	School District
TA	Teacher Assistant
TOC	Teacher on Call
TC	Teacher Candidate
TPACK	Technological Pedagogical Content Knowledge
URL	Uniform Resource Locator
UVic	University of Victoria
Wi-Fi	Wireless Fidelity

Acknowledgements

Going through my doctoral program and writing this dissertation involved a great deal of time and effort, and it would have not been possible without the abundant guidance and support I received. Hence, I would like to express my deepest gratitude to those who contributed to my trajectory.

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Finally, I want to acknowledge and respect the Lək̓ʷəŋən (Songhees and Esquimalt) Peoples on whose territory the University of Victoria stands, and the Lək̓ʷəŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day. As a settler and uninvited guest on this land, I appreciate having had the opportunity to learn more about the principles of its original and rightful stewards, whose history with the land dates to time immemorial. Indigenous knowledge and sense of care for the land and its inhabitants helped me locate myself and feel at home in a place with geological and climate characteristics so different from those of my home country of Brazil. I would also like to thank the University of Victoria and all the systems it has in place to support students, such as awards and scholarships, academic success units, student societies, food bank, library, and student wellness centre. In addition to being a student at UVic, the university was also my home and became my place of work. For that, I would like to thank Residence Services (Family Housing), the Division of Continuing Studies (English Language Centre), the Department of Curriculum and Instruction, and the Division of Learning and Teaching Support and Innovation (LTSI).

Dedication

I dedicate this dissertation to my wife, Eli, and our son, Felipe. For your love, patience, companionship, and encouragement, I am forever thankful.

Chapter 1: Rationale and Researcher's Trajectory

Rationale

When I started planning to pursue a PhD in education, knowingly one involving digital technologies, I could not have imagined I would be here today, around six years later, writing from within a post-pandemic context. Signs of a possible worldwide event such as this had been showing on an increasing scale, and epidemiologists were attuned to that (Mackenzie, 2020), but I think we can affirm today it has caught most by surprise, especially when it comes to how rapidly it spread worldwide. And one of the immediate effects COVID-19 exerted was a shift in the way we do things as humans, from simple day-to-day activities such as getting groceries to more complex ones like working and studying; and many of these adaptations were possible due to the technologies that existed and were available to a significant number of the world's population.

Zoom meetings today are such an ordinary activity for many that it might be hard to believe that a few years ago most of us had never been part of one. Some of the activities we do today by using digital technologies, described in a not-so-distant past as 'what things might look like in the future', became part of the norm, and the speed at which people acquired the necessary skills to be able to use them was impressive. Using Zoom as an alternative for communication became prevalent in many different contexts, including education. During the pandemic, teachers and students relied on this widely accepted video conference application to go about their business in a time in which one of the only certainties we had was that we should stay physically apart. These changes in behaviours and new routines have been so significant that even new uses were given to words, which the linguist in me wants to understand as a sign of something happening in culture (McDonald, 2005). For example, *Zoombombing* is now referred

to as “the act of someone taking part in a video conference to which they have not been invited, often with the intention of interrupting and annoying the people in the meeting” (Cambridge, n.d.).

While mostly enabling, the technologies that made this shift in the way we do things possible have also brought challenges with them. Soon it became clear that interacting with others through a computer for hours, although doable, was not the same as doing it in-person. After spending hours in front of a screen and being watched constantly, people started describing feeling *Zoom fatigue* (Daigle, 2020) – an expression still to make it to the official canon (Collins, n.d.). In response to those emerging struggles, some practices were thought over and adapted. In education, for instance, one of the solutions included conducting shorter classes or lectures (D. Li, 2022). This example of a pedagogical implication resulting from the adoption of a digital technology because of COVID-19 can be seen as an indication that there is more to employing these technologies than just mastering operational skills. Because they are used by people and for doing people things, there are other factors to be considered about how we use digital technologies to do our activities, especially one as complex and intricate as teaching and learning.

What was described above was one of the drivers of this doctoral research, which aimed at knowing more (King & Horrocks, 2010) about the conditions that enable teachers to work with digital technologies and the literacies those technologies enabled to enrich their pedagogical practice and enhance student learning. More specifically, this study sought to understand how participants came to learn about information and communication technologies (ICTs) to be willing to use them in their work, and to get a sense of how the conditions for them to do that are created. This was achieved based on an interpretivist approach, which looks at how people

experience their context and what it represents to them (King & Horrocks, 2010). By telling a story based on the experiences of participants, this study contains idiographic characteristics by "describing aspects of the social world by offering a detailed account of specific social settings, processes or relationships" (King & Horrocks, 2010, p. 11).

Ultimately, this dissertation meant to answer the following research questions:

1. How and to what purposes do four teachers in two local school districts on Vancouver Island, BC who have committed to working with digital technologies use these technologies in their pedagogical practice?
2. What are the experiences and conditions that create possibilities for these teachers to understand and utilize digital technologies, and how are these experiences and conditions being created/enhanced for them?

More details about this study will be presented in following sections, and what comes next is a description of my own trajectory with digital technologies, considering personal, educational, and pedagogical experiences. It is intended to help me locate myself as a researcher and offer potential readers a perspective of where I am coming from, which determines what I am able to perceive.

Researcher's Trajectory

I am not sure when I saw a computer in person for the first time, but my imagination was already populated with images of these machines when I was very young. From the age of seven, I have a vivid memory of making believe one of the places I used to play, a space in my grandmother's house, was filled with computer screens. I played I could control them from a central terminal attached to a swing in the middle of the room. I imagined I could sit there and perform the most varied tasks and play the coolest games by operating those screens from a

distance. However, it was not until a few years later that what had only been imagination became reality, at least to some extent.

This usually comes as a surprise to many, but Brazil, the country I was born and lived in for most of my life, was one of the leading countries regarding the quantity of microcomputers produced domestically during the eighties (Segura, 2014). Within that context, I was very lucky to have owned a TK85, a Brazilian clone of Sinclair's ZX81, “a low-cost introduction to home computing for the general public” (“ZX81,” n.d.). A family acquaintance had upgraded their system and, knowing of my interest, thought their old computer needed a new home. I consider this a crucial event in my personal history because my family would not have been able to afford such equipment at the time. Although excitement was the main driving force then, a high level of challenge was also in place since there was no one to teach me how to use the microcomputer.

The TK85 was quite different from what we recognize as a computer today. It was made up of a single piece, a bulky keyboard that was connected to a television (which worked as a monitor). Because the device had no hard drive in it, the storage and retrieval of data was made by means of cassettes, which, in turn, required a cassette player to be connected to the TK85. In addition to learning where all the cables went and how each of the parts contributed to the whole setup, this first computer taught me a lot about English, a language I would many years later become a teacher of. Although made in Brazil, the layout and operating system of the TK85 were all in English. Moreover, I had no one to teach me coding at that time and maybe was indeed too young for that. Thus, I resorted to computer magazines that contained pages full of code which users could type into their TKs to get a simple application or game running. Doing exactly that was one of my favourite activities for quite some time.

However, it took a great deal of time and effort to transport the many pages of code from the magazines into the TK85. Also, the level of accuracy had to be perfect – one missing or misplaced character could cause the whole thing not to work properly in the end. A learning highlight for me during that time was to have a family member, usually one of my aunts, read the lines of code out loud to me, helping immensely in the laborious job of having to read and type. Such experience helped me with the spelling of words in English, especially verbs; I am sure that exercise also made me a faster typist. After typing in so many code lines and observing how some of them affected the way the applications ran, I started realizing that I could adjust the code to personalize things without breaking the program. Nonetheless, it was not until a few years later that I had for the first time the opportunity to learn about computers and coding by means of formal instruction.

The programming language the TK85 used was not the most appealing and appropriate option to a child, and my parents and I were thrilled to learn about a computer course for children that started being offered in my hometown of Novo Hamburgo. It was based on a computer language called Logo, which worked on another line of computers called MSX. The main idea behind this language was to enter commands to control a turtle that would execute them on the screen. By using Logo, "students could understand, predict, and reason about the turtle's motion by imagining what they would do if they were the turtle" ("Logo," n.d.). Those classes caused me to think in computer language instead of only reproducing lines of code, as I used to do on the TK85. They also helped me visualize and explore concepts I was learning in school, such as angles from geometry classes and colour mixing from arts. The only drawback for me with Logo was not having where to practice what I was learning. My TK85 could not run

it, and this time I could not count on the generosity of someone to gift me with yet another piece of technology we could not afford.

Not too long after that, the school I studied in at the time inaugurated its first computer lab. They started with half a dozen MSXs and invited students to register for classes. I was one of the first students to sign up, and a new chapter in my history with computers started. Surprisingly not many people were interested in taking those classes at the time, and our teacher had extra time slots to offer to a small group of enthusiasts, which I was part of. In addition to our regular lessons, some classmates and I would spend many afternoons in the lab with our teacher trying to figure out a way to create our own games by using Logo. Our teacher had just graduated, and we all grew together throughout that experience. With no internet available to us at the time, our teacher was the only channel we had to get access to new commands and strings to be used in our programs. We as students came up with many ideas, and our teacher would spend extra sessions with us in the computer lab scrambling through the limited resources that were available at the time to help us materialize them.

Although popular for a while, Logo had its limitations and soon became obsolete. This was when another chapter in my trajectory with computers started, one involving a different type of technology and for a new purpose. By means of yet another second-hand computer, I had then at home gained access for the first time to a personal computer (PC), which, I must add, has a similar internal architecture of computers used today. The PC allowed me to learn how to operate Microsoft DOS, a language that later was used as the base for Microsoft Windows (Ozkaya, n.d.). This was an important step for me in getting to understand how computers operated regarding files and storage, for example. However, that was not the only thing I was able to learn while exploring that system. Because the computer had a word processor application installed in

it and came with a dot matrix printer, I could, for the first time, use a computer to develop my literacy skills.

Most of the typing I had done up to that point had mainly to do with using a keyboard to input commands and playing around with lines of code. With this new setup, however, I could now practice my literacy skills by exploring with different genres. That was done mainly by typing and printing varied pieces, from birthday cards to computer instructional guides aimed at family members. And it was from within such a context that I had my first involvement with producing educational materials by using digital technologies, which was also my first remunerated job ever. A family friend who taught a sales course for local businesses owned some textbooks containing different lessons. He wanted them transformed into smaller, condensed pieces, and I offered to do the work for him. The many hours spent on that project added to my ability to both summarize and build content, which was later printed to be handed out to his students. I can still hear the noise of the dot matrix printer today in the back of my mind just by thinking of that experience, which involved some weeks of intense labour. Also, thinking of how much easier computers are to operate today, both hardware and software wise, it still impresses me how I was able to do all that work by using a computer that had no mouse.

The chapter described above also marks a period of educational shift for me as I moved from the school where I did my elementary and middle years to a larger institution. My high school was located inside a larger campus where a college also operated in the evening, which appears to be a more common type of institution in Brazil than it is in Canada. A bigger place also meant bigger computer labs – and connected to the internet! I soon learned that the labs were available to students after school hours and would stay there for long periods after classes were done. My favourite computer activity then was to visit websites. In a time when search

engines did not yet exist, we had to manually type in the addresses of the pages we wanted to visit. We would go into the school library and loan magazines that contained lists of addresses, or uniform resource locators (URLs).

I remember one of the first websites I ever visited was NASA's and was mesmerized to navigate their library containing stunning images. I would often download some of the pictures, save them on floppy disks, and then upload them on my computer at home to be used as desktop background images. It was also during this time that I recall for the first time being taken to a technology lab by a teacher to use computers to enhance the learning that was happening in the classroom. Prior to that, I had only been to computer labs at school to learn how to operate computers and because I had signed up to non-curricular classes. Now, however, I had teachers who were using technology to enhance their teaching in, for example, biology, English, and history.

Shortly after that, in the late nineties, my family contracted an internet service for our home computer. The first dial-up internet packages available then were based on access time, and the one my family signed up to provided a 20-hour monthly service. I was the only member of the family at the time who would use those hours and had to be very careful not to run out of time before the month was over. Each extra hour would cost a small fortune, and my parents were not happy when I went over – which was not uncommon. The activity I recall doing the most then was going into chat rooms to practice my English. Being able to communicate in the language of Shakespeare had always been one of my dreams, and having the possibility to talk to fluent speakers was a highlight for me. I soon made friends with people from different English-speaking countries and once again had the opportunity to develop important communication skills mediated by a computer. Also, with a better printer hooked up to my computer then, much

quieter and able to print in colour, I could develop my content-producing skills, taking my literacy skills to a higher level. Not only could I then use a computer to type in and print schoolwork, but also people would come to me seeking help to design and print materials such as birthday invitations, posters, and pamphlets, to name a few.

The next step in my trajectory with digital technologies and the literacies they enable took place at university. There were a few detours at the beginning of my academic journey, I confess. Having changed my major a couple of times, first navigating the fields of Theology and then Psychology, I found my spot and settled down in an English teaching program at a Jesuit university. One of the first lessons I remember learning that had to do with technology was how to make proper use of emails, a service that was starting to gain popularity. As student teachers, our professor wanted to make sure we were comfortable using a genre which soon would "become an essential part of society as every student, employee, and organization uses emails for different purposes" (Tang, 2020, para. 19). The emphasis of those lessons lay mainly in communication proficiency, but the technological skills that were required to materialize emails were also acquired as we made progress. Although not the focus, we learned how to technically operate email platforms, including using features such as carbon copy (CC) and blind carbon copy (BCC), in addition to using language strategies to become more efficient when communicating with professors and future employers. Another example that goes in this direction has to do with academic genres, such as doing presentations using slides and writing papers. I was taught what they should look like and what pieces they should contain, but the part about how to build them by using different types of software was learned consequently.

Similar to the experience I had with some of my high school teachers, some of my professors at post-secondary would also use technology to enhance our learning. During my

training to become an English teacher, I learned that an important point in language teaching is providing learners with authentic materials whenever possible – and authentic in this context means pieces that have not been adapted for the purpose of teaching. In that sense, the internet provided us with just that. We were often taken to a computer lab, where we could collaborate with peers as we navigated and collected artefacts and resources to be eventually added to our teaching repository. I was inspired by the approach of my professors and, also because of my previous experience, did not have to think twice when the time came for me to do my practicums. I was certain both my practicum projects would include digital technologies.

I did my two practicums at a catholic school, with grades five and ten respectively. With my elementary students, I designed an e-pen pal project in which they could explore and use the English they were learning to put together a short introduction about themselves. They were then invited to go into a pen pal portal and exchange their work with other students from different parts of the world. My grade five students often expressed their satisfaction with the opportunity they had to use English for the first time for authentic communication purposes and with the fact they were taken to the school computer lab for the first time. In mimicking some of the strategies I had been exposed to as a student in my teaching program, I also tried to focus on communication skills whilst also making sure students had the opportunity to develop digital skills, such as using the search feature while navigating a website.

In turn, the work I did with my high school students for my secondary practicum involved having them play a video game and then blog about their experience with it. Based on the suggestion of one of my students, I selected an open-ended game called *Scribblenauts*. It requires players to solve challenges by making items appear on the screen by typing in their names in English. This collaborative, task-solving project required students to work together as

they used vocabulary learned in class to try to beat the game. They were then invited to craft blog posts, which also used language pieces they were being taught, that would focus on the strategies they used to complete each of the levels in the game. They were then invited to share their work with their peers, who could comment on their posts. The idea was to use the strategies described by peers to beat levels of the game they had not initially been successful at. A highlight for that group was playing a computer game at school and practicing blogging, a genre that was growing in popularity at the time. Again, there was a strong focus on language use, but digital skills such as installing a game and creating and replying to online posts were also acquired.

The last year of my undergraduate program was marked by two significant experiences, namely my involvement as a teacher assistant (TA) in online courses and the writing of my thesis about the learning of English by players of video games. As a TA, I had the opportunity to assist professors build course content and make it available on the learning management system (LMS) being used at the time. I was also in charge of offering support regarding class topics and navigation and submission of student work. I took a lot out of that experience, especially because it allowed me to use technology to enact pedagogy. It also gave me the foundations to do the work I do today as an online sessional instructor and learning experience designer at the University of Victoria (UVic).

As for my undergrad thesis, I was inspired by my own journey as a player of video games and set out to learn more about the role games play in helping people learn languages. I was particularly interested in the accidental learning that occurs as players struggle to make sense of the language pieces in games to be able to make progress, more specifically in role-playing games (RPG). In Hinkel (2010), I reflected on how I had learned a great deal of English myself

through play and was thrilled to explore theories that corroborated my hypothesis: people play video games primarily to have fun, but their involvement also allows them to make significant language progress.

After that, I continued to explore and incorporate digital technologies in my practice as an English teacher. I had the chance to teach the most diverse age groups and at different proficiency levels. Whenever possible, I strove to offer my students access to authentic materials in English and the opportunity to collaborate by means of using digital tools. In more recent years, with the advent of smartphones, I was able to try different strategies to offer more personalized learning activities to my students. Traditionally, English classes often entailed a teacher playing an audio recording for the whole group to listen to at the same time and then respond to prompts. Since students in a group can be at different levels of proficiency, it is difficult to address each person's needs while maintaining class flow. Because of smartphones, however, I was able to share the recordings with students beforehand, and they could each play the material on their own device during class and work on the proposed activities at their own pace. Smartphones also made it possible for my students to communicate with one another and with me in English outside class by means of instant messaging groups that were created for that purpose. That was also an instructional event as students were invited to use the language they were learning in an authentic context.

Although I taught at different settings, I did relate the most to working with young adults, often university students who would study English in the evenings to meet academic and professional expectations. Because I was most comfortable working with this age group and wanted to advance in my career, I decided to continue my studies to obtain the credentials that would allow me to teach at a post-secondary level, more specifically in teacher education

programs. The master's program to which I applied had just launched, and faculty were still in the process of organizing the different areas in the program. During my application interview, I was asked about my research interest and replied I would like it to be, if possible, in the area of digital technologies. I was told they did not foresee any of the supervisors working in that area, and they asked me whether I would be interested in developing my research in the field of literacies, since my background was language teaching. I concurred and soon after that learned I had been accepted by Univille. When the program started and I had the first meeting with the supervisor I had been assigned to, I was thrilled to learn she was willing to support my work with technology in education, despite her lack of familiarity with that specific field. That day was the first time I heard the expression digital literacy.

My master's research involved investigating the digital literacy trajectory of student teachers and teachers and their understanding of the role of technology in education (Hinkel, 2014). Since I was interested in getting to know the contributions of their formal education to their perception and (future) practice, participants were all connected to the same teacher education program. I had the opportunity to talk to people who were just starting in the program and others who were just about to graduate. I also interviewed people who had already graduated from the same university and were already working as teachers. My findings showed that the program, although not offering specific courses on how to teach with technology, often required participants to use digital means to access course materials and hand in assignments, which contributed to their familiarity with different types of software and technology. Participants also shared that some of their professors motivated them to think about and consider digital technologies when devising their practicum projects, which some were more inclined to do than others. Finally, working with groups that represented different time periods also allowed me to

realize how fast new technologies became popular, which contrasted with a teacher education program that did not readily adapt to include them.

Today, as a sessional instructor at UVic, I continue to investigate and explore digital technologies in education. I have been teaching an online course offered by the department of Curriculum and Instruction since the fall term of 2018 called Distributed and Open Learning. In it, students from other departments and teacher candidates alike are invited to navigate different technologies and online platforms to detect potential pedagogical uses for them. By the end of the course, they are asked to use an online slide platform and 'hack' it so that it behaves as an LMS. I do not teach my students the technicalities of using that and other platforms visited during the course. My objective is for my students to become familiar with them and think of them as teaching apparatuses; my focus lies on pedagogy. However, by having to use these tools for pedagogical purposes, my students tell me they also end up learning technical skills, which can easily be transferred to different areas of their academic and professional lives. Teaching this online course has also helped me reflect about my own practice and how to utilize technologies without necessarily focusing on them.

The different chapters in my personal, educational, and professional trajectory presented above describe some of the events and experiences that have enabled me to get where I am today regarding how I understand and utilize digital technologies in education. It is also with this theoretical and experiential luggage that I got to the point of being a doctoral student. Additionally, it was the experiences that I have had that gave me the lenses I wore to go about completing this research – defining both what I was and was not able to see. In this study, I set out to learn more about the trajectory of yet other teachers who live and work on Vancouver Island, a place where I am right now. I was motivated to know more about the school system and

teacher education here and to contribute to them by means of my research and work. The fact I have a child that goes to school here also made me want to know how digital technologies are being used in schools and the conditions that have allowed teachers to understand and use them.

After describing my trajectory with digital technologies and reflecting about how that involvement has located me to talk about the topic of this study, I now present an overview of the subsequent chapters in this dissertation. Chapter 2, Literature Review, will present the theories I have explored to help me define the theoretical background of my study. I sought to select three theories that discuss the use of digital technologies in education, especially ones that could help me understand how to prepare teachers to use them. Chapter 3, Philosophical Assumptions, Methodology, and Methods, will discuss the methodology that I have chosen to guide this study and the methods I used to define my site, recruit participants, and collect and analyse data. In Chapter 4, Context and Participants, I describe each of the four participants that were recruited for this study and the context of the schools where they worked. Chapter 5, Findings, describes how and to what purposes participants used digital technologies in their pedagogical practice and discusses the experiences and conditions that made it possible for them to do their work. In Chapter 6, Discussion, I explore the 'so what' of this study. I do that by analysing and interpreting what was learned when comparing what was said by participants with what the curriculum, literature review, and my own experience say about digital technologies in education. Finally, in Chapter 7, Implications and Conclusion, I present a summary of key findings and reflect on what could be done with the findings stemming out of this study, highlighting contributions to the fields of education, teacher education, and teaching practice. I also reflect on my journey as a researcher and the lessons that I learned while conducting this study.

Chapter 2: Literature Review

A study about digital technologies in education, like any other academic study, should be guided by a clear theoretical framework, which Merriam defines as "the underlying structure, the scaffolding or frame" (2009, p. 66) of a study. Collins and Stockton, in turn, describe theoretical framework as "the use of a theory (or theories) in a study that simultaneously conveys the deepest values of the researcher(s) and provides a clearly articulated signpost or lens for how the study will process new knowledge" (2018, p. 2). Merriam argues that theoretical frameworks are discipline-specific, "[a]ll investigations are informed by some discipline-specific theoretical framework" (2009, p. 16), and suggests that a first step in defining the theoretical framework of a study consists in identifying its disciplinary orientation. This is a study in education, and, thus, that is its disciplinary orientation.

Once the disciplinary orientation has been identified, Merriam (2009) suggests the next step involved in defining the theoretical framework of a study is to carry out a literature review. The author defines literature as "the theoretical or conceptual writing in an area (the "think" pieces) and the empirical data based research studies in which someone has gone out and collected and analyzed data" (Merriam, 2009, p. 71). Literature reviews allow researchers to know what other people have thought and researched about and provide a foundation that will permit a researcher to contribute to a specific knowledge base. In Merriam's (2009) own words:

> Drawing from the literature wherein the theoretical framework is lodged you identify what is known about the topic (citing appropriate literature), what aspect of the topic you are going to focus on, what is not known (the "gap" in the knowledge base), why it is important to know it, and the precise purpose of the study. (2009, p. 68)

Additionally, Merriam argues that the sense that can be made of the data that is collected and analysed will be influenced by the theoretical framework of a study; "our analysis and interpretation – our study's findings – will reflect the constructs, concepts, language, models, and theories that structured the study in the first place" (2009, p. 70).

Hence, this chapter presents the result of the literature review I carried out for this study. It describes and discusses the three theories I have explored and selected to help me understand the context I planned to investigate; they are: 1) Digital Literacies, 2) Technological Pedagogical Content Knowledge (TPACK), and 3) Maker Pedagogy and Pedagogical Hacking. I draw on the definition of theory proposed by Collins and Stockton, who claim that "a theory is a big idea that organizes many other ideas with a high degree of explanatory power" (2018, p. 2). In addition to my own trajectory with digital technologies, described in the previous chapter, and the methodology used in this study, presented in the following chapter, these theories served as one of the lenses through which I was able to read the situation. Ultimately, this chapter covers aspects of incorporating technology in education that I used to analyse the data I collected. I begin by describing how I came across these theories and how my experiences and expectations supported me in selecting them. I then finish the chapter by summarizing the three theories based on my literature review.

One of the required steps towards advancing in my doctoral program included writing two candidacy exams, which I did in the spring term of 2020. It was a period in which COVID-19 had just started spreading globally, and many physical distancing measures began coming into effect in Canada. I wrote the first paper just before those restrictions were enacted and the second one in isolation in the study office I had access to at the university. Candidacy entailed responding to two questions developed by my research committee. While one of them, discussed

in this chapter, focused on the content of my research per se, namely a study in education involving digital technologies, the other one asked me about what methodologies I could potentially use to carry out my study.

The first exam contained one question, which was divided into two parts:

- How do we educate the next generation of teachers to engage with digital technologies and the digital literacies they generate to critically prepare students for the emerging modern society? What are three theories, principles, and practices of digital technology education that could inform a study of preparing teacher education candidates for their future practices?

I started the process of working on my first candidacy exam by analysing part one of the question to try to detect guiding points I thought could help me write the answer to the second part. I first highlighted three phrases I believed summarized part one and that captured my initial research intentions, namely 'digital technologies', 'digital literacies', and 'critically prepare students.' I could see how the two parts of the question were interrelated and wrote a unified answer to both. It was my understanding at the time that the *theories, principles, and practices guiding a study* could also be used as an approach to *how to educate the next generation of teachers*. Before I used these guiding points as searching terms for an academic literature review, I took the time to reflect about them based on my previous personal and professional experiences with digital technologies in the context of education.

The exercise mentioned in the paragraph above helped me consolidate ideas I had been reflecting about mainly throughout my practice as a teacher. It also provided me with a map that I later used to start putting together a literature review, which is presented in the following sections.

Digital Literacies

Teachers and schools have traditionally been associated with contributing to the process through which people will develop the skills that enable them to read and write, thus becoming literate. Consequently, teacher education programs share such responsibility in the sense they are the main, or at least the official, institutional system responsible for preparing teachers to guide students into using language to make sense of and represent information. Before I present a definition of digital literacies based on my literature review that informs this study, I will first discuss the term literacy. I will do that by drawing especially on literature from the Brazilian context, where most of my educational and pedagogical journeys took place. I do that mainly because scholarship on literacy has a longer history than that of digital literacies and because the former seems to inform the latter. This approach also allows for a line of thought to be developed chronologically.

The literature review I carried out revealed that there does not seem to be a consensus among scholars regarding a universal definition for literacy and how it should be approached in education. Terra (2013) attests to that when she claims that the large quantity of scholars working towards defining the term literacy is proportional to the number of different definitions it has received. Nonetheless, there seems to be unanimity regarding the importance of literacy, regardless of how it is defined, and the essential role it plays in all fields of study. The new British Columbia curriculum, for instance, places literacy (alongside with numeracy) at its very core. On their curriculum redesign web page (British Columbia Ministry of Education, n.d.-c), the Ministry states the following:

> Literacy is the ability to understand, critically analyze, and create a variety of forms of communication, including oral, written, visual, digital, and multimedia, in order to

> accomplish one's goals. Numeracy is the ability to understand and apply mathematical concepts, processes, and skills to solve problems in a variety of contexts. Literacy and numeracy are fundamental to all learning. While they are commonly associated with language learning and mathematics, literacy and numeracy are applied in all areas of learning. (paras. 9-11)

The different definitions literacy has received can be associated with diverse ways of seeing and understanding the world but also with how perspectives can change over time based on new realities and challenges. Chaka (2019) reflects about the evolution of the concept of literacy over the year and states:

> Throughout its evolutionary trajectory, literacy has mutated and undergone definitional shifts. All of these mutations and definitional shifts have to do with the theorisation of literacy as a concept that resonates with how literacy itself is viewed in a given period. This implies that these evolutionary mutations and shifts of literacy are largely informed by the process of periodisation. (2019, p. 55)

The author goes on to explain what they mean by process of periodisation; it "refers to time frames through which a concept or practice is understood and represented in given designated periods with a view to mapping out how it develops within these designated historical trajectories" (Chaka, 2019, p. 55). Along those lines, the following paragraphs will present a discussion about the concept of literacy and a reflection on how it has received new definitions over the years as a response to changes is society and the advent of new technologies.

A more traditional approach to literacy, usually associated with meeting inflexible standards, is described by Botzakis et al. as "a one-size-fits-all sets of skills and behaviours" (2014, p. 223) that, once mastered, can enable a person to read and write proficiently. In a

Brazilian context, this approach is referred to as *alfabetização*, defined by Soares as the acquisition of the conventional system of writing (2017, p. 199). This way of seeing literacy, as a system that needs to be acquired and detached from a social context, has more recently been criticized. Brian Street refers to it as the autonomous model of literacy, which he posits "disguises the cultural and ideological assumptions that underpin it so that it can then be presented as though they are neutral and universal" (2006, p. 2).

Based on the work of Johnston (2010) and on the concept of periodisation, Chaka (2019) divides this more traditional view of literacy into two periods in recent history, each containing their own characteristics. The first period the author refers to comprehends the mid-20th century, when "literacy was understood to be, as pointed out by Johnston (2010), the ability to read, to write, to speak, and to listen" (Chaka, 2019, p. 55). The second period encompasses the final portion of the 20th century and the initial portion of the 21st century, when "literacy came to be associated with acquiring a set of skills (e.g., reading, writing, speaking and listening skills, and information literacy skills) which are measurable and testable" (Chaka, 2019, p. 55). The author concludes by stating that what these two perspectives have in common is "their one-dimensional, cognitivist and instrumentalist view of literacy. Literacy came to be equated with a language facility and with skills" (Chaka, 2019, pp. 55–56), disregarding plural practices and literacies.

On the other hand, more contemporary perspectives, which this study subscribes to, understand literacy as more than a set of static abilities that can be applied to any situation regardless of context. Street refers to this as the ideological model of literacy, which, according to him, "posits instead that literacy is a social practice, not simply a technical and neutral skill; that it is always embedded in socially constructed epistemological principles" (2006, p. 2). Mendoza adds to that when she affirms that "[c]ontemporary educators understand that literacy

does not consist only of grammar, spelling, and orthography; it is a social practice that binds together communities that co-construct knowledge and shape the worlds in which they live, work, and play" (2018, p. 413). And this concept of literacy, one that takes into consideration different social contexts and different social practices by participants, can be understood because of changes in society. As argued by Vasquez at al., "[n]ew definitions of what it means to be literate and how to teach literacy have arisen from changing students demographics and students with different linguistic repertoires" (2019, p. 300).

The work of Chaka (2019) also includes a list with descriptions of more current definitions of literacy, all of which view it as a social practice. The examples the author presents are "critical literacies; New Literacy Studies (NLS); new literacies; multiliteracies; multicultural literacies; pluralistic literacies; globalised literacies; multimodal literacies; digital literacies; adolescent, transitional and emergent literacies; mobile literacies" (Chaka, 2019, p. 56). This paper reflects about some of them, which more closely relate to the purposes of the study contained in it, namely critical literacies, NLS, multiliteracies, and digital literacies. The latter is also described in more detail in the last part of this section.

Chaka (2019) explains that the concept of critical literacies draws on different critical traditions and, in its core, has to do with the empowerment and emancipation of individuals. Closely related to the concept of critical pedagogy from Paulo Freire and critical discourse analysis from Normal Fairclough, "critical literacies challenge and critique skewed power and ideological relations and the (mis)construction of realities with a view to unmasking or transforming them" (Chaka, 2019, p. 56). In addition to developing in people the ability to read, write, listen, and speak while employing a critical lens, critical literacies also involve "the ability to decode and manipulate texts, discourses, genres and practices. Moreover, they entail the

capabilities to engage with sophisticated and multimodal texts, discourses and genres, and the manner in which such texts, discourses and genres (re)position reader subjectivities (Chaka, 2019, p. 56). For Vasquez et al., critical literacy is a way of being and participating in the world; "it means looking at an issue or topic in different ways, analysing it, and suggesting possibilities for change and improvement" (2019, p. 300).

NLS, in turn, is defined by Chaka (2019) as being a composite work, which means it has both theoretical and research traditions. It is attributed to the New London Group and draws on three different schools of thought, systemic functional linguistics, critical discourse analysis, and cultural anthropology. The author claims NLS began as a response to a skill-based view of literacy. According to the author, it understands "literacy as a social practice, and theorises it as multiple literacies that change across time and space" (Chaka, 2019, p. 56). Moreover, the author claims that NLS challenges the notion of literacy being used in the singular and discusses the notion of marginalized versus dominant literacies.

Closely related to and stemming from NLS, the concept of multiliteracies emphasizes the idea that literacies are manifold. They are multi in the sense that meaning making in this theory is understood as involving different domains, such as representational, social, structural, intertextual, and ideological. Additionally, multiliteracies considers that texts are multimodal and contain elements that go beyond the written word; "some of the diverse modes through which texts and meanings are exchanged and encoded are: written, oral, visual, audio, spatial, gestural, behavioural, tactile modes" (Chaka, 2019, p. 57). Finally, multiliteracies considers that the world which literacy users live in is comprised of many different, concurrent languages. That notion adds yet another layer to multiliteracies, namely a multilingual dimension.

Silveira, Rohling, & Rodrigues (2012) add to the notion of multiliteracies when they claim that the term literacy should be used in the plural. According to the authors, *literacies* are varied and encompass a diversity of social uses of language. They understand that a person can be proficient in interpreting and producing a specific type of genre while not showing the same level of ability with a different type of material; one can be literate in reading and producing literary works but not be as proficient in reading legal texts (2012, p. 76). In that direction, Bazalgette & Buckingham (2013) assert that there has been increased recognition by literacy educators that schools should present students with the possibility of navigating and producing a large variety of formats, or genres. Coscarelli adds to that notion when she claims that teachers should teach their students how to deal with a variety of texts, from different genres, in all environments, including the digital one (2009, p. 549).

Like the term literacies, digital literacy has also received different definitions coming from a variety of academic fields, such as "computer literacy, information and communications technology (ICT) literacy, media literacy, information literacy, and e-literacy" (Lohnes Watulak, 2016, p. 504). Similarly to the discussion about literacy, Lohnes Watulak (2016) also points that the many attempts to try to define digital literacy seem to range from placing it as the mastery of a set of technological skills, "the ability to read, write, and otherwise deal with information using the technologies and formats of the time" (Bawden et al., 2008, p. 18), to a look that goes beyond operational affordances, thus valuing more the things that ICTs are able to generate and how people relate to them. The latter provides a more dynamic view of digital literacy, with which this study more closely aligns, one that takes into consideration context and social roles in meaning making. Additionally, this socio-cultural perspective (Street, 1984) on the term digital literacy "includes an understanding of the social and cultural norms around technology use, and

the valued practices within those norms" (Lohnes Watulak, 2016, p. 504). Finally, as suggested by Rojo (2007) and Bazalgette & Buckingham (2013), literacy takes on a multimodal perspective if we consider that, due to the advent and popularization ICTs, people are more and more required to interpret and produce not only written but also auditory and visual signs. In the words of Murphy et al., "information has always encompassed forms beyond text" (2024, p. 175).

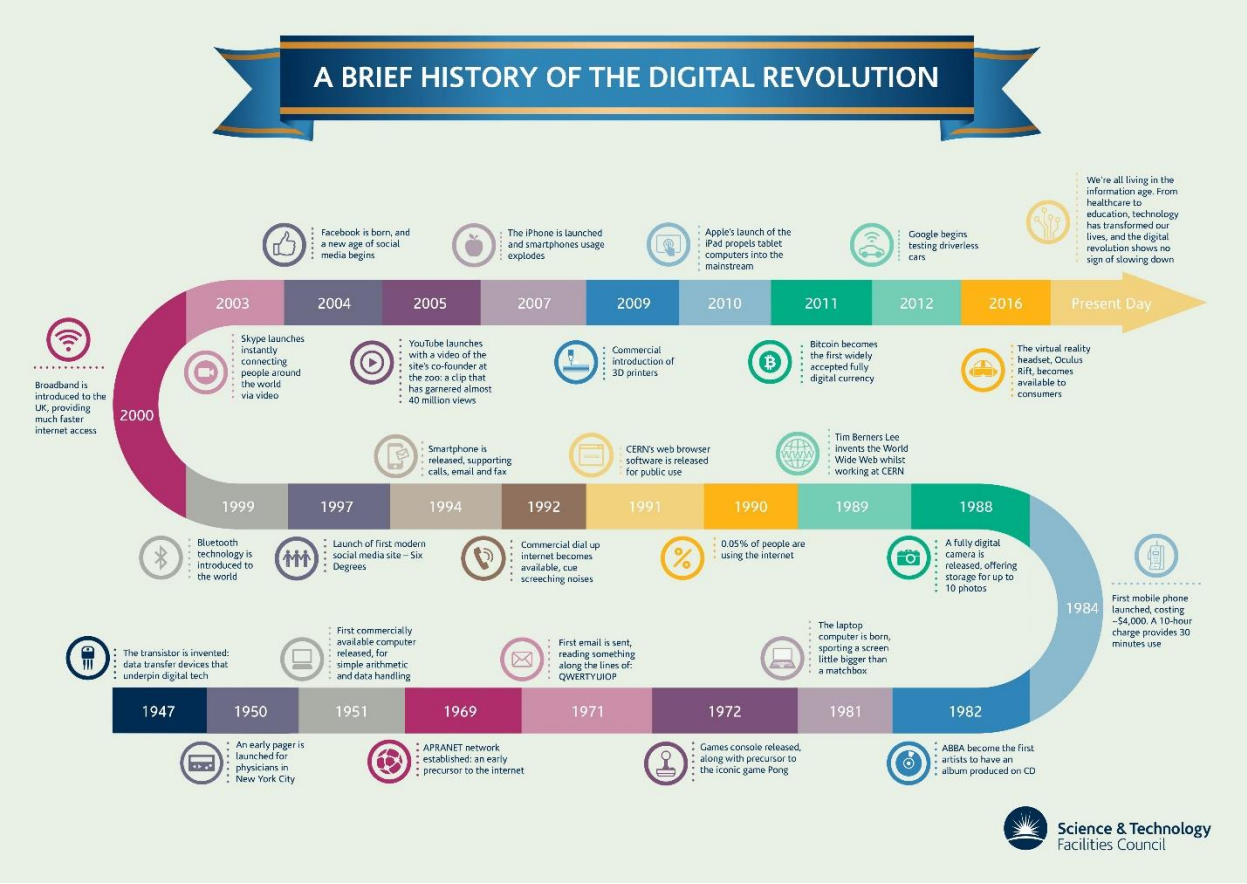
Considering what digital technologies enable people to be exposed to and produce in terms of genres, Moita Lopes (2012) argues that two main possibilities exist. On the one hand, ICTs can emulate, or imitate, what has traditionally been done with pen and paper (and other non-digital technologies) since the advent of writing. For instance, digital machines today allow people to read and write academic papers by having them shown on a screen instead of a printed copy or physically represented by other tangible means. In this case, Moita Lopes claims, there is no change in genre or function; it simply represents the use of a technological tool to do the same things that used to be done without a digital technology (2012, p. 211). On the other hand, as Ribeiro and Coscarelli (2010) claim, new technologies bring about novel genres that were not possible before computers were invented. Examples include online chats, blog posts, text messages, and social media posts, to mention a few. The authors conclude by saying that the new possibilities of making sense of and producing knowledge by means of language that arose with the advent of ICTs have received increased interest by scholars in the field of literacies.

To conclude the discussion around defining digital literacies, I refer back to the work of Chaka (2019). The author states that "digital literacies emanate from the increasing digitisation of the different facets of our human lives" (2019, p. 58), and that those facets include the advent of different digital devices, software and applications, platforms, services, and web-based technologies. Chaka describes different periods or epochs of digital revolution and argues that

digital literacies were shaped as a response to inventions in each of those periods (See Figure 1); "the digitisation of different aspects of our human lives – including the digitisation of literacies – has been driven and enabled by the successive epochs of the digital revolution" (2019, p. 59). Based on the work of Goodwin (2016), Chaka affirms we are now living in the post-digital age, a time when "digital technologies (and devices) form a seamless backbone of our everyday lives, and operate silently in the background, as is the case with the Internet, instant messaging, and livestreaming in most societies today" (2019, p. 56).

Figure 1

Infographic of a Brief History of the Digital Revolution



Note. From "A Brief History of the Digital Revolution," by Science and Technology Facilities Council, n.d.

For Chaka, digital literacies ultimately has to do with becoming familiar with diverse digital devices, platforms, and services, and entails "the ability to use and manipulate them appropriately for the disparate purposes for which they are meant in line with the prevailing and deictic social, cultural and technological expectations (2019, p. 60). Additionally, Chaka also argues that digital literacies involve a layer of digital and cultural savviness and responsibility; "digital literacies entail that users will observe the etiquette for deploying and using different digital devices in their respective real-world and real-time environments" (2019, p. 60).

Having student teachers and teachers in mind and a possible approach to digital literacies in education, I first draw on the work of Hockly (2021). The author claims that "it is widely accepted that digital literacies need to be overtly taught, and that learners who grow up with digital technologies are not automatically effective users of these technologies" (2021, p. 634). As many studies demonstrate, the understanding that people need literacy education has made its way into teacher education. The book, *Digital Literacy for Teachers*, edited by Tomczyk & Fedeli (2022), contains 26 different chapters with studies that demonstrate that teacher education programs in different countries contain requirements intended at educating preservice teachers regarding digital literacy so that they can more comfortably teach their students.

Additionally, a recent study by Arya et al. (2024) demonstrates that there has been a push by curricular standards and professional organizations for "K-12 teachers to integrate technology in literacy instruction" (2024, p. 21). Additionally, the authors (Arya et al., 2024) mention examples of different guidelines that have been created by researchers to help teachers integrate technology in their pedagogy (Baxa & Christ, 2018; Cahill & McGill-Franzen, 2013; Dragulanescu, 2002; Israelson, 2015). The paper by Arya et al. (2024) also presents data from different studies (Alelaimat et al., 2020; Curcic et al., 2015; Foulger et al., 2013; Nelson, 2020;

Voogt & McKenney, 2017; Wetzel et al., 2014; Wilson et al., 2020) that surveyed both preservice teachers and teachers in different countries regarding their preparation to adopt digital technologies in their practice. Results from those studies confirm that participants were proficient with technologies for personal uses, which did not automatically transfer to using technology to teach – also demonstrated by Roulston et al. (2019). Participants in these reviewed studies reported having received education on how to use technologies to teach but were concerned it was not enough; many claim they needed to seek additional education after having graduated by means of professional development initiatives and other educational opportunities to be able to feel comfortable in using digital technologies in their pedagogical practice.

According to Mendoza (2018), literacy courses in the teacher education programs that were part of her study focused on helping students develop both academic and digital 21st century literacy skills. While the former "involves socializing students into talking and writing to some extent like scientists, historians, and literary critics" (2018, p. 413), the latter has to do with preparing "students to be effective communicators in an increasingly globalized, digital world" (2018, p. 413). The study by Mendoza demonstrates that an approach that takes into considerations different types of literacies has the potential to help merge "school-based academic literacies with digital practices such as website/video/meme creation, participation in chatrooms and Internet forums, and the cultivation of an online following" (2018, p. 413).

Along those lines, the study developed by Freire, Cavalcanti, & Possenti (2007) contributes to the discussion. The authors observed a teacher education program online in which teacher candidates utilized digital technologies to interact with course materials, peers, instructions, and an educational institution. By having access and responding to digital genres,

participants took on the role of readers and writers, which caused them to achieve higher levels of proficiency in academic and pedagogical genres as well as in digital technologies per se.

In another study involving teacher candidates (TCs), Hinkel (2014) reports that participants acknowledged they developed digital literacy skills by having to respond to the curricular demands of their program, such as navigating academic material and preparing class presentations. Additionally, Hinkel (2014) concludes that, although preferring to read from books and printed materials, the TCs in his study would rather use computers to type (write) their assignments, which contributed to their overall literacy and digital literacy skills. In addition, they developed a pedagogical mindset in relation to digital technologies by means of observing classes in schools and developing practicum projects, despite not having official courses that introduced them to ICTs and their use as pedagogical tools.

In sum, this study understands digital literacies as a theory in that it tries to explain the role of technology in education, with a focus on the diverse literacies it can generate while considering the linguistic and social intricacies behind them. Digital literacies was selected and presented as a theory as it fits the objective of this study, which aimed at understanding how teachers are using technology in their practice and what experiences have enabled them to do so. In addition, by promoting the inclusion of a variety of genres in education, especially those students cherish in personal settings, such as social media content and games, an approach to education based on digital literacies can build on the interest of students to make education more personalized and meaningful. Also, digital literacies can enable people to make sense of and produce knowledge through language, which is all-encompassing in the sense that all areas of knowledge depend on some facet of language to store, retrieve, and share information. In that

sense, the theory described in this section aligns with Technological Pedagogical Content Knowledge (TPACK), the next theory that is presented.

Technological Pedagogical Content Knowledge

The previous section discussed a theory that claims people make sense of the world and participate in it by means of using language and navigating different genres, which more and more are mediated by digital technologies. However, it did not necessarily encompass how to use technologies as teaching tools and how teaching in diverse subject areas can benefit from the use of ICTs. This section, in turn, will describe TPACK as a theory that posits that teaching comprehends different types of knowledge, technology being one of them. It aims at looking at preservice and inservice teachers and indicating ways they can learn about technology themselves so that they can eventually use it to teach in schools.

However, before diving into a more thorough discussion about TPACK, it is important to first make a consideration about its nomenclature. When it was initially coined, Technological Pedagogical Content Knowledge was referred to as TPCK, which was soon demonstrated to be a problematic acronym. Thompson and Mishra (2007) argue that TPCK is difficult to pronounce, and getting the correct order of the letters that make it up can be confusing, even for those who are familiar with the theory. They claim that Technological Pedagogical Content Knowledge is a "simple, yet powerful idea and the complicated name and acronym does disservice to its utility and power" (2007, p. 38).

In response to the issue around the acronym for this theory, the authors explain that a renaming exercise was proposed during the 9th Annual National Technology Leadership Summit. Thompson and Mishra describe the exercise as follows:

> [w]e asked each of the teacher education association leaders and journal editors attending the summit to create a new, friendlier terminology for TPCK—one that captured its essential qualities and yet was easy to use and remember. During the two-day conference, participants created suggestions for a new name and after much deliberation, the name TPACK (pronounced "tee-pack") emerged as a substitute. (2007, p. 38)

The authors go on to explain that the new proposed name did more than simply add a vowel to the acronym; they argue it helped capture the two main aspects of the theory:

> First, it emphasizes, through the letters, the three kinds of knowledge (Technology, Pedagogy And Content) that we believe are essential building blocks for intelligent technology integration. Second, and as important, it captures the fact that these three knowledge domains should not be taken in isolation, but rather that they form an integrated whole, a "Total PACKage" as it were, for helping teachers take advantage of technology to improve student learning. (2007, p. 38)

Hence, Technological Pedagogical Content Knowledge will be referred to as TPACK in this document, and it is discussed in more detail in the following paragraphs.

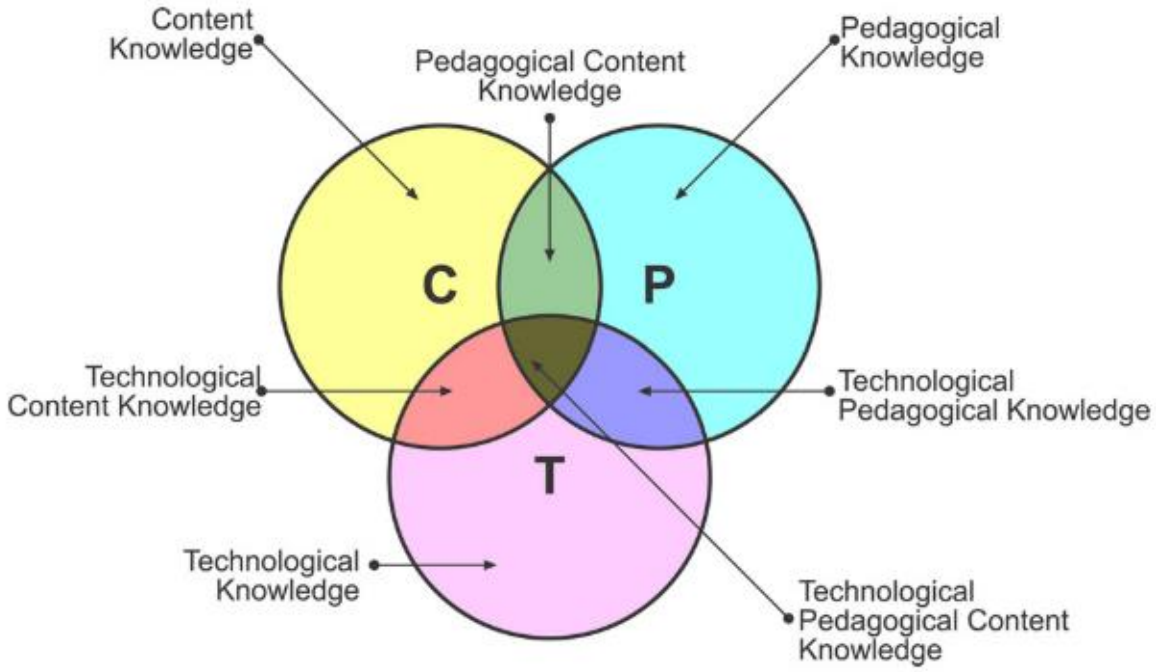
Koehler, Mishra, & Yahya (2007) claim there has been much discussion around what teachers should know about digital technologies to effectively be able to use them when teaching. According to the authors, there is also uncertainty among scholars regarding how such "technological knowledge" (Koehler et al., 2007, p. 741) should be acquired. They report that traditional approaches, usually by means of workshops and courses focusing on ITCs alone, have rendered teachers unable to significantly incorporate technology in classrooms. In their view, instead of acquiring digital skills detached from context, teachers and student teachers should be encouraged to use technology to tackle actual educational problems. That should enable them to

develop meaningful and transferrable technological skills. They argue that "intelligent pedagogical uses of technology require the development of a complex, situated form of knowledge" (Koehler et al., 2007, p. 741). Technological Pedagogical Content Knowledge (TPACK) is a theory that has been developed to address this belief.

In their extensive literature review, Voogt et al. (2013) point to Koehler & Mishra (2005) as the ones responsible for introducing the concept of TPACK, which can be understood as an extension of the work of Shulman (1986) on Pedagogical Content Knowledge (PCK). Shulman describes PCK as the amalgamation of subject-matter knowledge with pedagogical knowledge by means of "the most useful forms of representation of [...] ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations" to help others comprehend a specific topic (1986, pp. 6–7). Voogt et al. (2013) explain that Koehler, Mishra, & Yahya (2007) furthered the work of Shulman (1986) by adding another layer to it, one that includes a technological perspective. Koehler et al. (2007) describe TPACK as an integration of knowledge or rather understanding about technology from using it, with pedagogy, and content as shown in Figure 2. According to them, in this model technology is seen as more than a mere tool; it is rather a way of thinking and seeing the world and is meant to be used within a context and for specific purposes. In the case of teachers, "it is not only about what technology can do, but also, and perhaps more importantly, what technology can do for them" (Koehler et al., 2007, p. 742).

Figure 2

Diagram of Technological Pedagogical Content Knowledge (TPACK)



Note. From "Tracing the development of teacher knowledge in a design seminar: Integrating content, pedagogy and technology," by M. J. Koehler, P. Mishra, & K. Yahya, 2007, Computers & Education, 49, p. 742.

When defining each of the elements in TPACK, Koehler et al. (2007) say that content (C) has to do with curricular subjects to be covered and varies according to educational area and context (e.g., middle school social studies and an undergraduate course on linguistics). Technology (T), in turn, is described as the tangible means that allow information to be represented. In this context, such means are mainly related to digital equipment, but they also include lower forms of technology, for instance, printed material and whiteboards. The authors define pedagogy (P) as "the process and practice or methods of teaching and learning, including the purpose(s), values, techniques or methods used to teach, and strategies for evaluating student

learning" (Koehler et al., 2007, p. 743). Although explaining each of these constructs individually, the authors reinforce that their approach aims at combining the three elements, which results in specific types of knowledge.

Koehler et al. (2007) maintain that the amalgamation of P and C results in Pedagogical Content Knowledge, which relates to the pedagogy involved in teaching a particular subject matter. It comprises developing concepts and epistemologies, elaborating teaching methods, and establishing difficulty levels. Accordingly, the pairing of T and C creates Technological Content Knowledge, which has to do with ways of representing content and with the role of technology in allowing a specific subject-matter to be transformed and represented in diverse manners. Finally, Technological Pedagogical Knowledge derives from aggregating T and P. According to the authors, this type of knowledge includes getting to know different types of technologies (tools) and understanding how they can be employed to perform specific tasks related to teaching. It also refers to using pedagogical thinking to explore a specific technology to its full extent. At last, the combination of the three elements results in Technological Pedagogical Content Knowledge, which synthesizes the complexity and multidimensionality of successfully employing technology in education.

However, Koehler et al. (2007) not only describe the epistemological characteristics of TPACK; they also suggest how it can be implemented in the context of teacher education. To integrate TPACK and better understand the intricate relationship between the elements in it, the authors propose an approach they name *learning technology by design*. This approach draws on a constructivist paradigm, which maintains that what people learn and understand is constructed by them (Tennyson & Volk, 2015), and focuses on design thinking initiatives such as "learning-by-doing, problem-based learning, collaborative learning frameworks, and design-based learning"

(2007, p. 744). Unlike traditional course formats that place student teachers and teachers as mere receivers of information and training, learning technology by design allows participants to work on solving pedagogical problems by exploring and employing technological solutions. According to the authors, this approach causes participants to consider multiple ways of solving real-life pedagogical problems, which, in turn, fosters a deeper understanding of each of the elements of TPACK and their intertwining properties.

In two different cases studies in which the learning technology by design framework was applied to endorse TPACK (Koehler et al., 2004; Koehler & Mishra, 2005), the authors observed that participants gained technology literacy skills by thinking about their own relationship with digital equipment as they developed pedagogical artefacts. Moreover, as the timeline of their observations advanced, participants demonstrated a shift towards perceiving technology, pedagogy, and content no longer as individual, separated pieces but as interdependent elements, which has allowed the authors to validate the learning technology by design approach as a means of achieving TPACK.

TPACK is a theory I was not familiar with before starting my doctoral program. During my first candidacy exam, it helped me fill a gap regarding my understanding about how to incorporate technology in education, more specifically in teacher education. My master's research had focused mainly on the theory of digital literacies, which maintains people make sense of and represent information and knowledge by means of using language and the multiple literacies that are made possible by different technologies (Hinkel, 2014), and TPACK has shown me how technology can eventually be used by teachers to teach content related to different subject areas. Ultimately, what made me select TPACK to inform this study is that it does not focus solely on learning about the technology or using technology for technology sake.

This theory instead proposes a systemic approach in which content, pedagogy, and technology are seen as part of a whole.

TPACK has been demonstrated to be a valid theory into a discussion about introducing digital technologies into teacher education (Koehler & Mishra, 2005; Voithofer et al., 2019; Voogt & McKenney, 2017). It not only addresses each of the elements in it individually, but it also presents possibilities to integrate them. This resembles how people use ICTs to do things and get things done in real life: it is not about learning how to use digital technology simply for the sake of it, but rather to know how to use it to achieve or do something. In the context of education, this reflects in using technology pedagogically to enhance student learning while giving students and teachers alike meaningful and transferable digital skills. Due to my professional background in language and literacy learning and teaching, I had a rather limited view of how technologies can be used in education and in teacher education before being introduced to this theory. It allowed me to see how an approach to digital technologies in teacher education programs can have a broader scope, expanding their use to include purposes other than solely advancing digital literacy practices.

After having presented a discussion about Digital Literacies and TPACK, the last section in this chapter will describe a third theory I selected to inform this study, namely Maker Pedagogy and Pedagogical Hacking. It will focus on how to educate and enable teachers to respond to new technological inventions that may come about and how these professionals can creatively use existing technology, which involves, among others, subverting normative uses to achieve pedagogical objectives.

Maker Pedagogy and Pedagogical Hacking

New digital technologies bring about changes and possibilities that affect, directly or indirectly, several areas of human activity and interaction. Examples of that include how heavily we rely today on online banking applications to manage finances and our use of social media platforms to keep in touch with friends and acquaintances. Not only do people have to constantly learn how to operate new devices and applications to be able to continue participating in society, being critical about using them has received increasing attention. By understanding how technology works and reflecting about how to use it critically, people can protect themselves from current issues in the digital realm, such as online bullying or having private data stolen from not knowing how to properly log off from public devices after using them. Similarly, a more thorough understanding of technological apparatuses and applications can result in creative and safer pedagogical uses of them.

According to García-Martín et al. (2016), the changes brought about by technological advances, in part, result from the combination of "literacy, technology, and everyday social practice" (2016, p. 43) and, if not addressed appropriately and contextually, can become a cause for concern in education due to the uncertainty related to how they should be approached. Although there are innovations and projects in education that try to tackle these challenges, the authors argue that these iterations are not always able to respond to novel interactional demands quickly enough. They maintain that, although policy makers have long addressed "the need for teachers and their students to engage with digital literacies at all stages of education" (García-Martín et al., 2016, p. 43), research done in schools demonstrates that is not always the case. And one of the challenges lies in the fact that technology is ever evolving, which makes it hard for

people, teachers and students included, to keep up with these changes while having to navigate them.

Indeed, a search for educational policies containing recommendations and guidelines regarding the use of digital technologies in education is abundant. Nevertheless, many of them seem to focus on the proposal of standards for education in the 21st century and the development of sets of static competencies by teachers and students alike. In *Digital Literacy in Teacher Education: Are Teacher Educators Competent?*, Borthwick & Hansen (2017) present the example of an organization, namely the International Society for Technology in Education and the U.S. Department of Education, that proposes a set of standards regarding the response to and use of digital technologies in education. Throughout their work, the authors urge for the implementation of these standards in teacher education programs to make future teachers competent. In fact, their concern regarding the development of such competencies is so prevalent that they use the word *competent* in each of the headings in their paper, Why Should We Care Whether Teacher Education Faculty Are Competent?; How Can We Judge Whether Teacher Education Faculty Are Competent?; Aren't Teacher Educators Already Competent?; How Can We Guide Teacher Educators to Become More Competent? (Borthwick & Hansen, 2017).

Despite being prevalent, a competency-based approach to digital literacies can become problematic if users are relying mainly on the development of a set of static abilities. García-Martín et al. (2016) argue that the field of digital technologies is ever changing, with new equipment and applications being developed very rapidly. Consequently, they state that "[i]nitial teacher education cannot be expected to prepare the profession for continuing waves of technological innovation and can therefore never be completely future-proof (2016, p. 44). In *Digital technologies in teacher education: from mythologies to making*, Bullock (2016) reflects

on how some approaches to digital technologies have failed to promote a reform in education and proposes a way forward by the reframing of how ICTs are theorized in teacher education.

According to Bullock (2016), one of the myths revolving around digital technologies is that they are often seen as the solution to the problems in education, especially within "the view that quality teaching is simply a matter of delivering the correct content to the correct group of students in the most efficient way possible" (2016, p. 5). He looks back in time and uses the examples of other technologies that were also associated with this view, such as the radio and television. He argues that these two inventions were regarded as effective means of communicating knowledge and were expected to eventually replace teachers, which never happened; many years have gone by and, although it still contributes to education, broadcast has not erased the need for teachers. Considering digital technologies, Bullock (2016) then gives the example of Massive Open Online Courses (MOOCs) and reflects on how they seemed to have lost their status of being the ultimate solution to education as fast as they became popular, due mainly to small rates of completion associated with them. All in all, Bullock (2016) concludes that education has survived several waves of technological advances and makes the claim that pedagogy itself is also a technology. Still, based on the work of Darling-Hammond (2006), Bullock (2016) claims that technologies per se have not been able to cause a reform in education because of the complexity of teaching. In addition to that, he argues that such complexity also makes it difficult for teachers to consider the inclusion of ICTs in their future practice, "[t]eaching with digital technologies can add further complications to an already complex endeavour" (Bullock, 2016, p. 7).

In this direction, Bullock advocates that teachers should be prepared to employ digital technologies appropriately in their practice in schools, and he expresses that when stating that

teacher education should "enable teacher candidates to think about the ways in which technology might be used to augment existing classroom discourse" (2016, p. 8) and "to think about the ways in which digital technologies can be used to create new knowledge or new digital artefacts" (2016, p. 9). However, he understands that constant changes brought about new technologies and new uses of them can be a hindrance; people will feel comfortable about using a specific technology after getting professional development about it only to have it become obsolete in a short period.

In response to a context of rapid technological development, Bullock (2016) argues that teachers should have the opportunity to learn about technology in a way that they can get to understand its nature and its inner working mechanisms. The author seems convinced that such an approach, one that goes beyond a set of standardized operational skills, can offer teachers more of what they need to respond to and utilize the new technological inventions that will come into existence throughout their careers as educators. "Neither teacher educators, nor teacher candidates, can hope to anticipate the technology knowledge (technical competencies) that will be required in the future" (Bullock, 2016, p. 10). One of the possibilities to keep up with constant changes in the context of teacher education when it comes to digital technologies, he argues, is by means of an approach based on the maker pedagogy theory.

Rooted in the maker movement, Bullock (2016) reports that maker pedagogy has manifested itself in both older and more recent iterations and has to do, in general, with making things. Once a trend in the Victorian Era, the maker movement seems to have found fertile soil in the digital era as all sorts of technologies become available and affordable outside the industrial realm. In addition, it is a movement that looks at reclaiming the creative and productive human force that has long been captured by mass scale production systems. As Bullock puts it, "[j]ust as

the Arts and Crafts movement sought to reclaim individual craftwork from industry, so too does the maker movement seek to encourage others to make items that seem to be only within the purview of large technological companies" (2016, p. 11). Bullock defines maker pedagogy as "an approach to teacher education that engages candidates in making technological things – circuits, simple robots, video games and simulations, and re-cycled artefacts" (2016, p. 12). He proposes four principles to guide the application of maker pedagogy to education and teacher education, namely, *ethical hacking*, *adapting*, *designing*, and *creating*.

Bullock (2016) describes that *ethical hacking* has to do with taking technology apart to generate knowledge about it, which can apply to both material and nonmaterial apparatuses. An example includes disassembling broken pieces of technology, such as phones or cameras, to know what parts they contain inside and understand how they relate to one another and make things work. The second principle, *adapting*, is described by the author as the employment of technological artefacts and software to ends they were not originally intended for. An example includes the creative use of an educator in a school district on Vancouver Island is making of some of the Google services. He uses Google Sheets to keep track of student progress and Google Slides to allow students to put together a learning portfolios (Hopper et al., 2023; Sanford et al., 2023). Neither of those tools were intended to be used for pedagogical purposes, but the teacher in the study was able to come up with a creative solution when an official option that meets his needs is not available.

Bullock (2016) goes on to say that *designing* focuses on utilizing technology to overcome everyday challenges and conundrums. This principle aligns with TPACK and involves learning how to use technology to solve actual problems. An example includes listing common conflicts faced by teachers and students in schools regarding booking equipment and proposing tools to

help solve them. Finally, the author states that *creating* refers both to documenting the scholarship that was acquired while exploring tools and creative uses for them and to savouring the artefacts that were created by means of making. This principle works together with the previous three and could be explored alongside the digital literacies theory presented earlier in this chapter, as both have to do with using language and literacies to communicate and share knowledge. *Creating* provides an opportunity to document what was learned by means of taking things apart and finding new ways of using them to then share findings with peers and a broader audience.

It is important to note that hacking is a word that has often been associated with negative actions, such as hacking into one's computer to obtain online banking passwords or stealing and encrypting private information from large databases for the purposes of ransomware. However, that is not the meaning that is given to hacking in this document. In the introduction of the edited book, *Hacking Education in a Digital Age: Teacher Education, Curriculum, and Literacies*, Smith, Ng-A-Fook, Radford, & Pratt (2018) go back in time and explore previous meanings of the word hacking. Unlike its most recent definition, which is often associated with malicious acts with the use of ICTs to commit crimes, hacking was first related to using things for purposes different than those they were originally intended for. As Smith et al. suggest, "hacking is ultimately pedagogical, an act wherein people seek to unravel, deconstruct, devise and create in support of our desires to know more about the world we live in" (2018, p. xii). According to the authors, hacking has to do with getting into the heart of things, understanding how they work and the powers that control them, and then proposing novel uses for them, often based on personal interests and objectives. That type of hacking is referred to as pedagogical hacking, which is a response to a system that tends to compartmentalize people and skills and, in the context of

digital technologies, wants to produce a workforce that is “compliant and instrumental in their thinking and practice” (Smith et al., 2018, p. xv).

Ultimately, maker pedagogy and pedagogical hacking can be understood as a response to more traditional approaches to technology in education that tend to value the acquisition of a static set of abilities, which can be associated with creating a mass of efficient and technologically skilled people to supply the demands of an ever-growing and unjust neoliberal economy. Maker pedagogy and pedagogical hacking focus on taking apart both material and nonmaterial artefacts, such as old printers and user agreement documents, to make new things and disobey predetermined purposes, which has the potential to help foster possibilities for developing a more critical perspective about digital technologies in education while exploring them creatively. Sensors, cogs, and motors from old printers can be creatively repurposed to build robots; this practice has the potential to engage students in hands-on, fun activities while teaching them concepts in physics, electronics, and mechanics. Along those lines, a more thorough analysis of user agreement policies of social media platforms, for example, can help students make a more informed decision regarding what exactly they are agreeing to if they decide to sign up for a new account or keep an existing one. Maker pedagogy and pedagogical hacking can provide opportunities for more thorough discussions around personal data storage and privacy.

Additionally, maker pedagogy and pedagogical hacking offer a practical way to prepare teachers and, consequently, students to deal with and respond to technologies that have yet not been invented. Bullock (2016) posits that maker pedagogy enables people to learn about technology by considering the philosophy and history behind it, which can help students and teachers surpass static technological and informational competencies. For instance, it can be

argued that most of the uses people make of technology today often entail interacting with front-end applications, or "the layer or element that the user has the ability to use, see, and interact with through buttons, images, interactive elements, navigational menus, and text" (*Front-End Applications*, n.d., para. 1). Before the advent and popularization of graphical user interfaces (GUI), which "created a comfortable environment that made personal computers attractive to the average person" (*Web 101: A History of the GUI*, 1997, para. 4), any computer operation "had to be handled as a command-line operation (meaning, you'd have to type text commands)" (1997, para. 4). There is no doubt that the GUI has contributed to the popularization of digital devices (Reimer, 2005; *Web 101: A History of the GUI*, 1997), but it also made users less cognisant of what goes on in the back end of digital devices and applications. Back-end applications "dictate everything that happens behind the scenes of a website" (*Front-End Applications*, n.d., para. 11) and can determine, for example, what happens to the data we constantly generate as we use different applications. By inviting people to understand and explore the heart of digital technologies, or their inner workings, maker pedagogy with a focus on pedagogical hacking can ultimately equip students and teachers to respond to and critically operate new technological inventions that may come about.

All in all, maker pedagogy and pedagogical hacking are presented as a theory in this document in the sense that they explain how teachers and students should be educated about technology so that they can be better prepared to navigate new inventions that may come about. As a theory, it suggests this can be achieved by taking artefacts apart and finding novel uses for them to tackle everyday challenges while documenting what was learned to be shared with others.

I planned my data collection, which will be described in detail in the following chapter, in a way that it allowed me to potentially observe characteristics of the three theories presented in this chapter. One of my objectives was to hear from my participants about their trajectory as teachers and how they got to understand digital technologies and started using them in their practice. I was interested in learning about the role technology played in their practice to enhance their students' literacies. Having TPACK in mind, I planned to hear from participants how much integration between technology, pedagogy, and content they have experienced during their initial teacher education and other iterations that might have provided them with what they need to do the work they do with ICTs. Finally, I was interested in learning how participants tackle technologies that are new to them and how prepared they feel to explore technologies that might still come into existence and how to help their students approach them critically. Also, I aimed at learning to what extent participants must hack the technologies that are available to them to be able to enact their pedagogical objectives.

Collins and Stockton argue that the theoretical framework of a study is located at the intersection of "(1) existing knowledge and previously formed ideas about complex phenomena, (2) the researcher's epistemological dispositions, and (3) a lens and a methodically analytic approach" (2018, p. 2). In this literature review chapter, I aimed at covering the first point presented by the authors, namely existing theories that try to explain the complex phenomenon of employing digital technologies in education. The following chapter will address the second and third points, more specifically the methodology that informs this study and the methods that were used for data collection and analysis.

Chapter 3: Philosophical Assumptions, Methodology, and Methods

After having presented the rationale for this study along with my own trajectory with the topic of digital technologies in education and having described three theories I have selected to support it theoretically, this chapter will discuss philosophical assumptions underlying this research and present the methodology and methods utilized. I start by reflecting about the ontological and epistemological reasoning supporting this study, defining what assumptions about the world it shares, what type of knowledge it produced, and my role as the researcher. I then describe the methodology I used, namely case studies. Finally, I report on the methods I employed in this research, including details about site and sample, participant recruitment, and procedures for data collection and analysis.

Philosophical Positioning

This is an interpretive qualitative study and assumes that social reality is not something pre-existent and independent of our interpretation of it, but rather that the "activities of our mind select and give meaning to the world around us" (King & Horrocks, 2010, p. 12). Regarding how we exist in the world, this research subscribes to a relativist ontology, which maintains that there are multiple interpretations to social phenomena and that "[o]ur understanding and experiences are relative to our specific cultural and social frames of reference, being open to a range of interpretations" (King & Horrocks, 2010, p. 9).

Regarding what is considered knowledge, this research is based on a social constructionist epistemology, which seeks to "place emphasis on social interaction and the construction of meaning in situ" (Somekh & Lewin, 2011, p. 53). It assumes that "social reality is constructed through language, which produces particular versions of events" (King & Horrocks, 2010, p. 20). Language is seen as something we use to do things and construct them.

Thus, language is conceptualised as being productive and as having "the potential to construct particular versions of reality" (King & Horrocks, 2010, p. 22). It is also based on the premise that knowledge, or "meaning is not out there waiting to be discovered; rather it is brought into being in the process of social exchange" (King & Horrocks, 2010, p. 22).

As a researcher, I got involved with a particular context and, based on my own experience with the topic and what literature says about it, reported on a case of educational activity, representing the significance that participants brought to it. Finally, instead of seeking an unbiased approach, which would position me as neutrally as possible in relation to my object of study, I considered my own history and where I read the situation from as an important aspect of co-constructing knowledge. This can be characterized as a reflexive approach, which "requires researchers to consider their contribution to the construction of meaning" (King & Horrocks, 2010, p. 22). This doctoral research ultimately used data collected from different participants to tell a story that amalgamates academic knowledge with mine and their perspective to create a verisimilar report.

Methodology

I decided to use case study for this research because "it provides the opportunity to explore existing practices in a "case" to inform current practice and illuminate discoveries to others practising in similar ways" (Corcoran et al., 2004, as cited in Eady et al., 2023, p. 161), and this section summarizes what case study is as a research methodology, why case study methodology is best suited to this research, and how my study employed it.

Case Study

Chadderton & Torrance (2011) explain that case study is an approach to research that has diverse definitions, which will depend on the theoretical framework that guides it. They

exemplify that there are case studies that take on a more objective lens, in which the researcher observes a case from the outside while studying a specific individual. Alternatively, the authors also present a perspective whose ontology leans more towards the construction of meaning in a specific context as social interaction happens. This phenomenological approach to case study, which explores "the experiences of individuals about a phenomenon" (Creswell & Creswell Báez, 2021, p. 553), is the one that guides the work of Chadderton & Torrance (2011) and the one that is the most closely related to my own research. Another difference between approaches lies on where the limits of a case should be set and whether the researcher is able to create a definite report of a case as an outsider or different potential interpretations of a case as an insider. Notwithstanding, what all definitions of case studies have in common is "the emphasis on study-in-depth" (Chadderton & Torrance, 2011, p. 53).

The definition of case study advocated by Chadderton & Torrance (2011) combines a focus on a specific policy, practice, or phenomenon and the place where it is enacted. When adding individuals to their equation, the authors claim that the question that should be asked is regarding the individuals' view on the case in question. In their own words, "case study is an 'approach' to research which seeks to engage with and report the complexity of social and educational activity, in order to represent the meanings that individual social actors bring to those settings and manufacture in them" (Chadderton & Torrance, 2011, p. 53). Moreover, the authors posit that the objective of using case study as a methodology should not be on analysing and theorizing but should rather be on identifying and describing. The authors add that case study is not a methodology that allows for generalizations. However, based on the work of Stake (1994), they posit that a well-developed case study can create a sense of naturalistic generalization in a reader, who, in turn, "recognizes aspects of their own experience in the case

and intuitively generalizes from the case to their own situation, rather than the sample (of one) being statistically representative of the population as a whole" (Chadderton & Torrance, 2011, p. 54). In other words, a case study "is bounded by time and place, and its borders can clearly be separated from the larger context of which it is a part" (Creswell & Creswell Báez, 2021, p. 552). Researchers can create the limits for a case study by clearly identifying and describing it, including who the participants are, and place and time the case is bound to.

Epistemologically speaking, Chadderton & Torrance (2011) argue that case studies can employ a combination of data sources (participants, documents, and artefacts) and collection strategies (interviews and observations) to investigate and probe a case until a "thick description" (Geertz, 1973) is obtained and then present it based on the view of participants. Thus, case studies can help demonstrate how individuals enact a certain policy, practice, or phenomenon, which may bring about important findings regarding potential (im)practicalities and challenges. However, an epistemological challenge in case studies is deciding on where to draw the line of a case (Chadderton & Torrance, 2011; Stake, 2005). Stake (2005) offers guidelines in that sense when he says that what can help researchers define the limit of a case is specificity (as opposed to generalization). He argues that a case can either be "a child or a classroom of children [...]. It is one among others" (Stake, 2005, p. 444). On top of that, the author claims that a case is a system that contains moving parts working according to a pattern. Some parts of this system extend to and overlap with other systems, and it might be difficult to distinguish where the participant ends and where the environment they are inserted in begins (Stake, 2005). However, Stake (2005) concludes that, provided the focus lies on explaining the complexities of a unique, bounded system, we can call a study a case study.

To start imagining how research regarding digital technologies in the context of education could look like within a case study methodology, I drew on a few examples (Andema et al., 2013; Araújo, 2018; Botturi, 2019; Gruszczynska & Pountney, 2013), describing one in detail (Wells & Lyons, 2016). Wells & Lyons (2016), speaking from within an Australian context, argue that schools and teachers are facing a challenge regarding addressing and implementing 21st century skills and literacies in schools. They affirm that guidelines and policies are in place in many school systems, but the discrepancies between what should be done and what is being done is still substantial. However, while new curricula are still to be enacted in schools on a large scale, the authors argue that there have been initiatives stemming from particular schools and teachers. These 'cases' could serve as examples of "relevant pedagogical practices for 21st century learners" (Wells & Lyons, 2016, p. 46). To illustrate their point, the authors present a case study in which a grade 1/2 student made a short film after taking part in a literacy program, which, in turn, resulted from their teacher participating in a professional learning program aimed at developing strategies for personalized learning. The authors present the perspective of both the teacher and the student, of the former regarding their pedagogical decisions and of the latter regarding how they were affected by such pedagogy.

To acquire a deeper understanding of the case, Wells & Lyons (2016) thoroughly analysed the artefact produced by the student regarding the combination of traditional and 21st literacies. By focusing on characteristics such as ideas, audience, language and language features, organization, production, and representation, the authors were able to get a sense of how a 21st century curriculum is enacted in a specific case. They also looked at how the teacher in the case put into practice the objectives of a professional learning program, which was based on the literacy guidelines for their school district. Wells & Lyons (2016) conclude by saying that

the case they studied permitted them to demonstrate how a teacher navigates a 21st century literacies program, which could serve as an example of how to meaningfully work with literacies in schools. In addition, they claim their paper "presented evidence, justification and discussion around one school's response to teaching literacy in and for the 21st century" (Wells & Lyons, 2016, p. 59).

Based on my ontological and epistemological assumptions, and on the discussion about case studies above and examples of research that use it, the next section will describe how my own research was designed by drawing on this methodology. I do that with my research questions in mind:

1. How and to what purposes do four teachers in two local school districts on Vancouver Island, BC who have committed to working with digital technologies use these technologies in their pedagogical practice?
2. What are the experiences and conditions that create possibilities for these teachers to understand and utilize digital technologies, and how are these experiences and conditions being created/enhanced for them?

Methods

Since case study gives researchers the opportunity to describe how a certain policy, practice, or phenomenon is enacted in a specific site and then present the experience through the eyes of their participants (Chadderton & Torrance, 2011), I investigated how teachers navigated institutional policies and societal expectations regarding the use of digital technologies and incorporation of 21st century literacies in their practice. To obtain a thick description of the case, I consulted official documents from the BC government, especially their website that describes the new curriculum in the province (British Columbia Ministry of Education, n.d.-c). I also

described the context where teachers work and the digital resources that are available for them to do their work. I complemented and interpreted the information I gathered by interviewing four teachers. This section describes the site of this study, how participants were recruited, and how I collected and analysed my data.

Site and Sample

The site I investigated includes three different schools on Vancouver Island, in the province of British Columbia in Canada. There are currently 60 school districts and 5,500 schools in BC (British Columbia Ministry of Education, 2021), and the nature of this study only allowed me to investigate a few of them. In addition to that, since the methodology I used is case study, I had no aspirations of working with a sample that is demonstrative of what happens in the entire province. Instead, the objective was to learn about specific cases and describe them in depth, which may or may not resonate with the situation of teachers and schools in different districts of the province.

I started my investigation in the Greater Victoria School District (61). Because it is the district located in the region where I was living, School District 61 was the one I was most familiar with. In addition to my child going to school here, which has allowed me to learn more about how the district operates, the work I had done as a research assistant in the previous three years had allowed me to meet people who teach in the Greater Victoria region. It is important to note that the focus of this study was on teachers working in the province, and in particular this local region, and not necessarily on a specific district or school. Although significant to this study because they represent where teachers are located, school and district specificity was secondary. Nevertheless, relevant differences between schools and districts were detected in what participants had to say, and those differences were addressed when presenting my findings.

In the end, the data I collected is representative of two secondary schools located in the Greater Victoria region and one elementary school located in the Cowichan Valley.

Participants and Recruitment

Participants for this research were teachers with different levels of experience who worked on Vancouver Island, BC and who notably incorporated digital technologies in their practice. I aimed at getting to know personal and professional trajectories and understand more about the experiences and conditions that enabled these teachers to understand and use ICTs at school. I was interesting to know the role TCPK played in their journey and to what extent 21st century technologies are being used to improve students' literacy skills, in both traditional and more contemporary genres. I also sought to know how much of the work they do includes hacking system barriers and potential limitations in the technologies that are available to teachers and students. It's worth noting that recruitment showed to be a more laborious process than I had anticipated; some prospective participants I communicated with ended up not actually participating. Mention to those people is made in this section to capture all the recruitment steps I went through, even those that did not result in recruiting a participant.

Recruitment happened initially by means of sending emails and direct invitations (See Appendix A). It was then expanded by using a technique called snowball sampling (Biernacki & Waldorf, 1981; Sparkes & Smith, 2014). There were two independent threads of investigation, and I am going to describe each one separately. The first one included one teacher, who contacted me to demonstrate their interest in being a participant after having received my recruitment email from someone in their professional circle. The second thread started by my directly contacting someone I knew and asking them whether they would be interested in participating in my study. Following the snowball sampling technique (Sparkes & Smith, 2014),

after I interviewed them, they had a name to suggest for my next interview. I then contacted the teacher they recommended and interviewed them as well. After we talked, they had yet another teacher to recommend. I then interviewed a third person in this thread, who was the last one in this snowball sequence (Sparkes & Smith, 2014). The final poll of participants encompassed four teachers, whose recruitment followed different lines of communication. Also, I must mention there were other potential participants whom I was in touch with, but they either stopped corresponding or were no longer interested in participating after having initially agreed to participate.

The first strategy I used to recruit participants was to rely on insiders, or people who "might identify organisational members who meet the sampling criteria of the study, pass information sheets and letters requesting participation to them, and forward queries to the research team" (King & Horrocks, 2010, p. 31). I sent an introduction note followed by my recruitment email to three different insiders, a principal in a school I had made visits to as part of my research assistant project, a retired teacher who was working as a teacher education practicum mentor, and a coordinator of a teacher education program at a university on Vancouver Island. They were all very receptive when approached and agreed to help spread the word that I was recruiting for my study. By reaching out and having them assist me, I was following the recommendation made by King & Horrocks (2010), who state that:

> If the request is coming through a known and trusted colleague, people are more likely to give it proper consideration than if it had arrived from a stranger, where it might be seen as just another form of junk mail (this may be especially likely to happen with 'cold' requests received via e-mail). (2010, p. 32)

Despite my efforts, I was able to recruit only one participant by means of this insider approach.

The contact with the school principal resulted in no potential participant contacting me to demonstrate interest, whereas one teacher contacted me after having received my recruitment letter through the mentor they had worked with during their practicum. There were a few exchanges between that teacher and me, but we were not able to find a time to meet for an interview. After they stopped responding to my emails, I discontinued communication and attempts to book an interview. However, one teacher contacted me after having read my recruitment email that was sent to them from the teacher education coordinator, and this teacher became the first participant. It is worth noting that all participants were given the opportunity to choose a name they would like to be referred to as in my study, especially having their privacy and anonymity in mind, and this participant chose to be called Diane.

The second strategy I used for recruitment was to directly contact teachers I had previously met. One of them was my child's former teacher. During the 2020/21 school year, my son had the opportunity to use a computer at school for the first time. After creating a SD61 G-Suite account, he gained access to some of the services that are available through the platform, such as Google Drive and Google Docs. Those services were accessed and used mostly at school on Chromebooks, but my son could also access his work from home by entering his username and password. As I was able to observe during that year, my son's teacher used the Chromebooks with the class almost every week, and the work they did seemed to have focused mainly on literacy and numeracy. Some games and other entertainment options were also included.

Because of COVID-19 restrictions, I barely had the opportunity to officially meet my son's teacher that year, let alone ask them more about the intentions and pedagogy behind their work with ICTs. However, they were known in the school community as the "tech person", and

children recognized them as being one of the only teachers to use computers with their students. My child told me many kids had high hopes of being that teacher's student, especially because they would get to use a computer at school. My son was able to make enormous progress that year, particularly because he could use a computer to type in some of his written assignments. We would often sit together at home, and he would proudly show me what he was able to do. I was impressed to learn he had become proficient not only in using Google Docs to type in his work but also in looking for and including images in his work by means of copy and paste functions. The website they used for math was also a highlight for my kid, especially those which had some aspect of gamification.

After the school year was done, I contacted my son's then former teacher to ask about their interest in being a participant. They promptly replied to me saying they would like to participate. We exchanged a few more details, especially to answer questions they had about the study. They understood they would be a good fit and could contribute to my research, so we went ahead and booked a time to meet. A day before the interview they had to cancel and asked to reschedule. We then rebooked our time for the following week, when they also asked to cancel. After that we tried to reschedule one more time, but the interview never happened, and they ended up not being a participant. I stopped communicating after I no longer received replies from them.

Then I moved on to contact a teacher whose work I had been following more closely by means of my involvement as a research assistant. In one of our recent publications, we had investigated the assessment practices of educators who developed strategies to focus on curricular competencies when assessing their students' learning, moving away from more traditional grade-based assessment practices (Fu et al., 2018). This teacher was part of a group of

educators who had created spreadsheets containing lists of competencies related to their subject area and used them as a guide to keep track of student progress. As students completed their work, they could highlight the competencies they thought they have achieved in the spreadsheet. Then, in a dialogue with their teachers, students were given the opportunity to share what they had learned by means of linking artefacts they had collected to demonstrate their progress. In addition to being interested in these teachers' assessment practices, I was particularly keen to learn more about how they had hacked Google Sheets to make it work as an evaluation hub. That teacher was very receptive and promptly agreed to take part in my study. He became the second participant and indicated he would like to be referred to as David in this research.

To continue recruiting participants, I used a strategy called snowball or chain referral sampling, which Biernacki and Waldorf describe as a technique that "yields a study sample through referrals made among people who share or know of others who possess some characteristics that are of research interest" (1981, p. 141). Sparkes and Smith posit that, when employing snowball sampling, "[r]esearchers rely on participants to direct them toward others who meet the study's criteria for inclusion, […] others 'like them' who they feel would provide information rich cases and be useful for the researcher to meet" (2014, p. 71). This technique was particularly useful because it provided me with referrals made based on insider information, which is not always available to the public. In my case specifically, this method was helpful because the number of people I knew and who could be potential research participants was limited. About this strategy, King & Horrocks (2010) say that:

> In snowball sampling, the researcher uses the initial few interviewees (often recruited opportunistically) to recommend other potential participants who fit the inclusion criteria

for the study. They in turn will be asked to suggest further contacts, and so the sample builds up. (2010, p. 34)

And that is exactly how I proceeded. After having interviewed David, he suggested another teacher who worked in a school different than his, but in the same school district. I then contacted them, and they accepted to be interviewed as well. She became participant number three and chose to be referred to as Heather in this study. After I interviewed her, she had yet another recommendation to make, of a teacher who worked in the same school as she did and who had been a partner in different projects, especially when it came to using ICTs. I then contacted this teacher, and, after having accepted to be interviewed, they became the fourth and last participant in my study. He chose to be called George (See Table 1).

Table 1

Participant Recruitment

Initial contact	Number of people contacted	Number of people who replied	Agreed to participate and were interviewed
Insider	3	2	1
Known to researcher	2	2	1
Snowball	2	2	2
Total	7	6	4

Procedures of Data Collection

The data collected for this study came mainly from two different sources, the BC Ministry of Education and the recordings of seven interviews with four different participant teachers. I consulted the website by BC's government that contains its school curriculum (British Columbia Ministry of Education, n.d.-c) for two main different purposes. The first one was to learn more about the BC curriculum itself to be able to present the curricular context of this

study. I did that mainly by reading the curriculum overview page (British Columbia Ministry of Education, n.d.-a), which describes why a curricular renewal was needed, what the main features in the curriculum are, and how it is structured.

The second purpose was to identify the references the curriculum makes to digital technologies and digital literacies so that a comparison could be made with what my personal experience and the literature say about ICTs in education. I collected those references by using the built-in search function in the explore curriculum page (British Columbia Ministry of Education, n.d.-b), which allows for searches to be performed based on keywords. For this study, I ran a query by using the keyword *digital*, which resulted in 190 different pages containing one or more entries each. I used a broader term so that I would obtain as many results as possible, which I later visited individually and filtered according to the objectives of this research. Some entries referred to content repeated in different locations, and repetitions were also computed. The final step involved organizing the entries into a table containing description, subject area, grade, related core competency, elaboration, and number of occurrences (See Appendix B). The total number of entries analysed was 237.

The next phase in the collection, which makes up the major source of data in this study, involved interviewing participants. The rationale for that choice, based on the work of King & Horrocks (2010), is that "if we subscribe to a social and interactive explanation for behaviour, then speaking with people in order to explore their social experiences would be consistent with our ontological position" (2010, p. 10). I conducted two 45-minute interviews with Diane, David, and Heather, and one longer, 55-minute interview with George, for a total of seven interviews. The idea of having two different interviews with each participant was to give them the opportunity to think about the questions over a period that would extend past the interview itself.

Because of time limitations, George was only available for one single interview. Although I could ask him all the questions I had prepared, the session with him lacked that reflective interim the other three participants could experience by being interviewed twice.

Due to COVID-19 restrictions, most of my interviews were conducted mainly remotely. With the exception of the second interview I did with Heather, which happened in-person at the school where she worked, all other interviews took place via Zoom. As suggested by Saldaña (2013), I also took notes during the interviews to have a record of my first impression of what participant were telling me. In addition to working as a memory tool (Saldaña, 2013), these notes aimed at capturing insights and 'aha' moments, which I later used in the process of coding and analysis. The interviews were digitally recorded by using the record feature in Zoom and then were transcribed. Transcription involved two steps. I first uploaded the video or audio recordings of each interview into the video platform inside the university's learning management system, which automatically generates captions – a technique suggested by Hopper et al. (2021). I made sure to be in a quiet space during the interviews and encouraged participants to do the same. That, along with an effort to speak slowly and clearly, rendered auto-captions with accuracy close to 95%.

The second step in transcribing involved manually editing scripts for greater accuracy, especially regarding words and expressions the auto-generator could not correctly transcribe, such as names of people and places, and acronyms. The edition process entailed listening or watching to each of the recordings and making changes by replacing incorrect information or adding other pieces that had not been automatically generated. The built-in pause while typing feature in the video platform was of great use, since changes could easily be made to specific parts of the video without having to constantly click the pause button (Hopper et al., 2021). In

addition to allowing me to have a cleaner version of the interview transcripts, this step also helped me in revisiting the seven interviews I had conducted, thus having a more profound involvement with each one of them. Although I did not have to type in every single word that was said, revisiting each one of the interviews word-by-word gave me a thorough level of immersion with every single line in them. Once each interview had been entirely edited, I then exported them as individual text documents to be later used in the step of data analysis.

As described in more detail in the Participant Consent Form I used (See Appendix C), I employed different strategies to guarantee anonymity and privacy for the people I talked to and the data I collected. First, the email account I used to contact participants was one that is provided to me as part of being a student in my institution. In addition to ensuring a layer of professionalism in my communications, using this account, whose servers are inside Canada, complied with the Freedom of Information and Protection of Privacy Act (FIPPA) (Freedom of Information and Protection of Privacy Act, 1996). Moreover, the recordings of the interviews were uploaded into the video platform inside the university's learning management system, whose servers are also in Canada.

Additionally, access to both my email account and to the learning management system are protected by a multi-factor authentication process, which allows users to get into the platforms only after entering a password and a code generated by a registered second device. Moreover, I only used my personal computer, which is password protected, and university computers, which also require multi-factor authentication for login, to conduct the interviews and handle data. Finally, I made sure to replace the real names of participants with the names they chose to be referred to as in all transcripts when editing them; this way, all records of who exactly had said what were erased. Participants received a copy of the Participant Consent Form

before their first interview and, before they were interviewed, had the chance to ask potential questions about it and provide consent, either written or verbal.

I developed an interview guide based initially on my "own personal experience of the research area, both first-hand experience and stories and anecdotes told by people [I] know" (King & Horrocks, 2010, pp. 35–36) and made sure to "consult the research literature on the subject, to see what previous research suggests" (King & Horrocks, 2010, p. 36). I also tried to include the six types of questions for qualitative research that the authors suggest (Patton, 1990, as cited in King & Horrocks, 2010): Background/demographic questions, Experience/behaviour questions, Opinion/Values questions, Feeling questions, Knowledge questions, and Sensory questions (See Table 2).

Table 2

Six Types of Questions Used in Qualitative Research

Type	Objective
Background/demographic questions	Obtain details of personal and contextual information, such as education, occupation, and location.
Experience/behaviour questions	Obtain information regarding how participants behaved or reacted to experiences they have had
Opinion/values questions	Gather details on what participants think about a topic based on their opinions and values
Feeling questions	Apprehend how participants felt about something at the time it happened and how they relate to it today emotionally
Knowledge questions	Obtain information about what participants know as a fact about a specific situation and knowledge they hold about their specific areas
Sensory questions	Collect information about a situation participants gather by means of using their senses (sight, hearing, touch, taste, and smell)

Note. Adapted from "Interviews in Qualitative Research," by N. King & C. Horrocks, 2010, p. 37.

Additionally, I wrote a script containing an open-ended, flexible set of questions, so that I would "be able to respond to issues that emerge[d] in the course of the interview in order to explore the perspective of the participant on the topics under investigation" (King & Horrocks, 2010, p. 35). Finally, I aimed at devising full questions, as opposed to a list of key points. As suggested by King & Horrocks (2010), that helped me think thoroughly about how I should formulate my questions to avoid inappropriate formulation at the time of the interviews. The result was two interview guides containing eight and nine questions respectively (See Appendix D). King and Horrocks also point to the fact that scripted questions may entail running the risk of missing important issues that emerge during interviews. To avoid missing invaluable insights that arose during the interviews, I made sure to be flexible enough as to allow myself to deviate from the script whenever I felt a follow-up question was needed.

Data Analysis

The data collected from the BC Ministry of Education Curriculum website (British Columbia Ministry of Education, n.d.-c) was analysed and then summarized into a table that compares its contents with the main ideas from the guiding points stemming from my personal experience and the theories discussed in my literature review (See Table 3). This table helped identify converging points, which were used as the main guide when analysing the findings that emerged from the interviews with teachers. The ultimate objective was to triangulate the information obtained from educational policy, my personal experience, literature, and the stories of participants to present a discussion in this doctoral research.

Table 3

Recurring Points throughout the BC Curriculum, the Researcher Experience, and Literature Review

Recurring points	BC Curriculum	Guiding points from researcher experience			Literature review		
		Digital technologies	Digital literacies	Critically prepare students	Digital literacies	TPACK	Maker pedagogy & Pedagogical hacking
Ability to work with current and future technologies	✓	✓		✓		✓	✓
Acquisition of operational skills	✓	✓		✓		✓	✓
Creative uses of technology (hacking)				✓		✓	✓
Critical literacy skills			✓		✓		✓
ICT-enhanced teaching and l earning	✓					✓	
ICT-mediated collaboration	✓					✓	
Integration of technology, pedagogy, and content						✓	
Interpretation and production of varied content	✓		✓		✓		
Privacy and digital citizenship	✓			✓			✓
Production, storage, and sharing of data	✓	✓		✓		✓	✓
Proficiency in digital genres	✓		✓		✓		
Real life application	✓	✓	✓	✓	✓	✓	✓

The documents containing the transcripts of the interviews were imported as separate files into NVivo, which is a software commonly used in qualitative research; it "allows

researchers to manage, analyze, and visualize qualitative data and documents systematically and individually" (Dhakal, 2022, p. 272). NVivo helped manage the files containing the transcripts of the seven interviews by allowing me to organize them as a list. As I finished working on each file, I could rename them as completed, which presented me with an overview on what had already been concluded and what still required work. As for analysing, NVivo allowed me to create different codes, called nodes in the software, to classify the content of each interview. According to Saldaña, a "code in qualitative inquiry is most often a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (2013, p. 3). As I read each transcript and detected areas of interest and patterns (Saldaña, 2013), I would highlight and code them according to the node or nodes I thought they belonged to. The annotation tool in NVivo also proved to be a very useful feature, as it allowed me to enter notes about what I was reading, which often involved making connections between what different participants had said about the same topic. Finally, NVivo allowed me to visualize my data after the coding process was completed. Not only could I have a summary of all the nodes and how many times they appeared in the data (See Appendix E), but I could also access all the notes I had created in a single location.

To create the nodes that I used to code and classify the data I had collected, I used two different approaches. The first involved creating a list of nodes I anticipated would appear in the participants' answers based on the questions I had added to my interview guides (See Appendix D), such as where participants worked and details about the nature of their job. A second approach entailed detecting nodes that stemmed out of the interviews, especially those that repeated in different interviews by different people (Saldaña, 2013). Notes that I took while classifying the data helped me detect emerging nodes, which were named as such (See Appendix

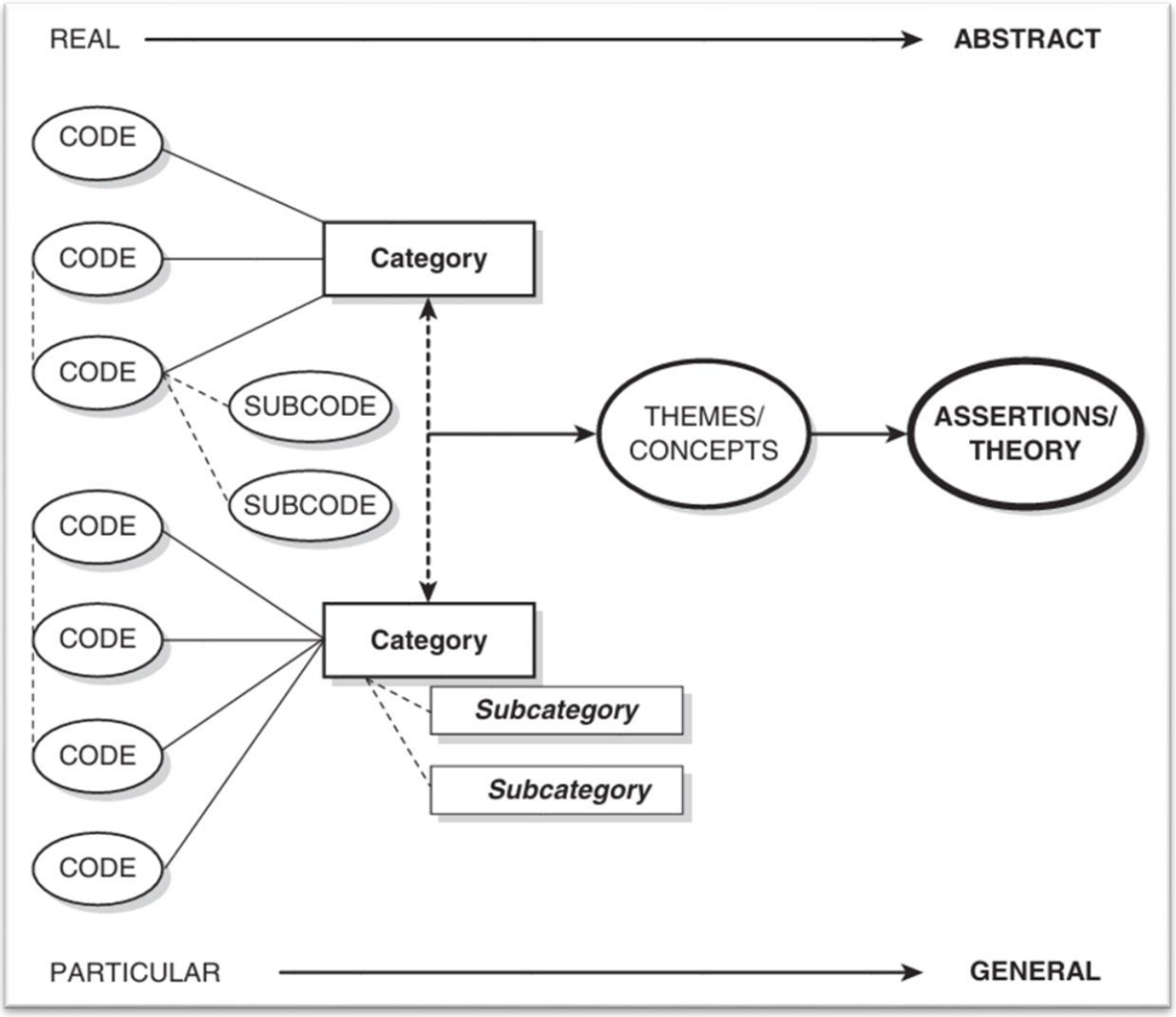
E). An additional step in working with NVivo involved classifying the nodes or codes into higher level structures or categories (Saldaña, 2013), which are called parent nodes in the software. According to Saldaña, to "codify is to arrange things in a systematic order, to make something part of a system or classification, to categorize" (2013, p. 9). Working with this feature allowed me to group or categorize nodes that were similar in nature, which gave me an overall look of all the data I had collected (See Appendix E); "[c]oding is thus a method that enables you to organize and group similarly coded data into categories or "families" because they share some characteristic – the beginning of a pattern" (Saldaña, 2013, p. 9). Once the transcripts of all seven interviews had been coded and categorized, I used the information organized in the process to describe the context of the research and introduce participants, which is presented in the next chapter.

Finally, I also used the nodes (codes) and parent nodes (categories) to help organize the findings of this study into themes, which are presented and discussed in the subsequent chapter. Themes were obtained by comparing categories, or parent nodes, in light of the recurring points that stemmed from comparing the BC Curriculum, my own experience with digital technologies, and literature review (See Table 3). According to Saldaña, "when the major categories are compared with each other and consolidated in various ways, you begin to transcend the "reality" of your data and progress toward the thematic, conceptual, and theoretical" (2013, p. 12). Saldaña (2013) points out that codes and themes are sometimes used interchangeably in qualitative research but posits that that can be misleading. For the author, a "theme is an outcome of coding, categorization, or analytic reflection, not some thing that is, in itself, coded" (Saldaña, 2013, p. 14). Based on the work of Rossman and Rallis (2003), (Saldaña, 2013) explains that the explicit part of data can be captured by a word or phrase that will make up a code or category,

whereas more subtle and tacit processes can be captured by a phrases or sentence that will make up a theme (See Figure 3).

Figure 3

A streamlined codes-to-theory model for qualitative inquiry



Note. From "The Coding Manual for Qualitative Researchers" by Johnny Saldaña, 2013.

Chapter 4: Context and Participants

This chapter is descriptive in nature and is intended to provide the background information behind the research described in this document. I begin by discussing the current version of the BC Curriculum and how it came to be; I do that based on information provided on the BC curriculum overview web page (British Columbia Ministry of Education, n.d.-c) and on two studies that talk about the history of BC's new curriculum (Blades, 2019; Sanford & Hopper, 2019). Following that, I briefly describe the three schools where the participants of this study worked at the time of their interviews. I mainly used the information participants themselves provided me with when I talked to them, but I also consulted the websites of the respective school districts they belong to. I then present each of the four participants of this study in more detail, focusing on their current roles, educational and professional backgrounds, and their personal histories with ICTs.

BC's Curriculum

British Columbia publicly announced its proposal to renew the province's school curriculum on October 28, 2011, when former Education Minister George Abbott spoke at the BC Student Voice Meeting (British Columbia Ministry of Education, 2011). After five years of planning, the BC Redesigned Curriculum was officially launched and became mandatory from Kindergarten to Grade 9 in 2016 and, in 2018, to Grade 10; it was mandated to Grades 11 and 12 in 2019, which concluded its rollout (Sanford & Hopper, 2019). The rationale behind devising a new curriculum was to adapt education to a changing world and to place students in the centre of their own learning. As Blades (2019) describes:

> The key point of this document was that education based on 19th and 20th century models of learning and teaching was no longer valid in the 21st century, particularly due

> to the rapid development of digital applications. What was needed, the plan argued, was a new approach to curriculum, one in which it would be easier for teachers to use their professional knowledge to guide students in developing the skills and understanding that would help them become successful citizens. (2019, p. 24)

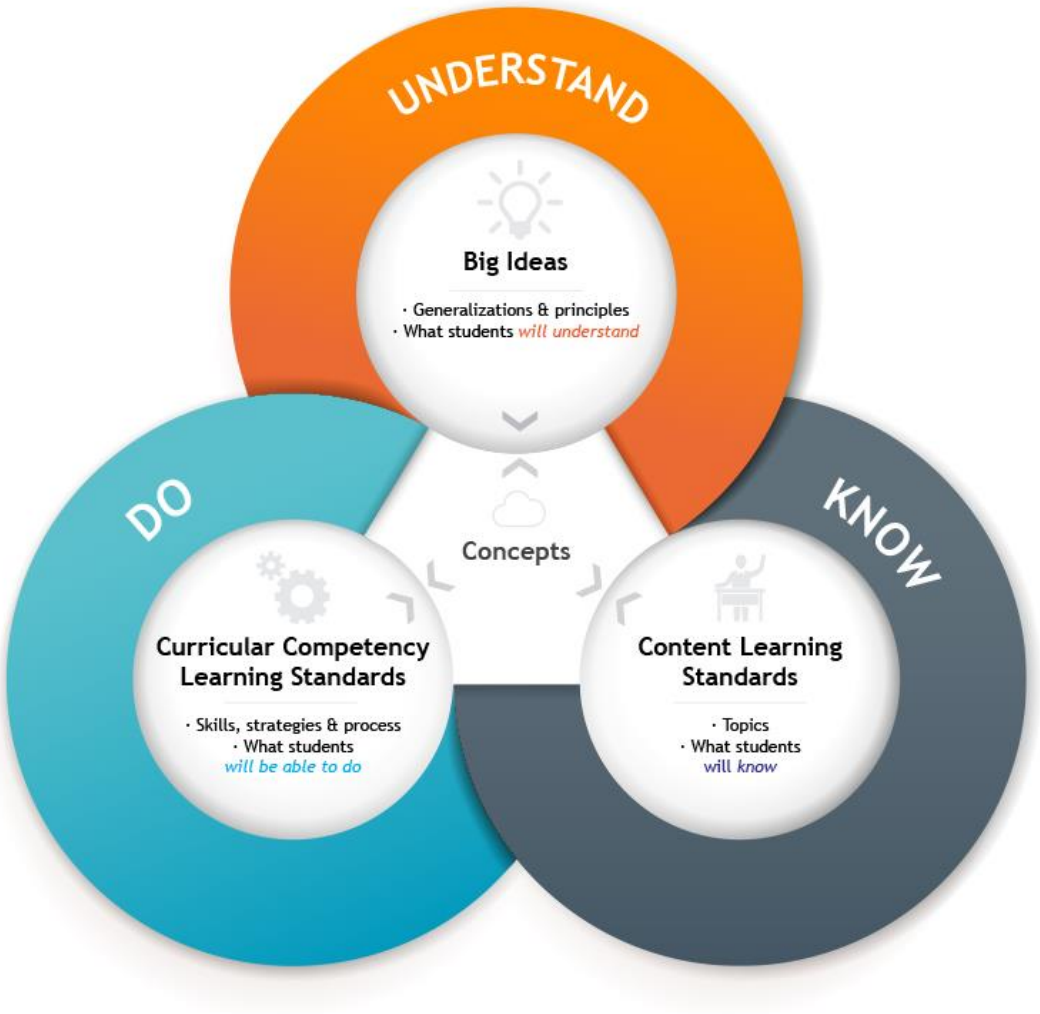
BC's Ministry of Education claims the province has one of the best education systems in the world, with skilled teachers, good infrastructure, and students who excel in international evaluations, and maintaining this status was one of the driving forces behind the plan to renew its curriculum, as described in the province's curriculum redesign website (British Columbia Ministry of Education, n.d.-a). To prepare learners for an ever-changing world, one that more and more depends on digital technologies to instantly communicate information in all sorts of formats, it was the understanding of the ministry that students should be at the centre of their own learning and that the curriculum should be flexible. "British Columbia's redesigned curriculum honours the ways in which students think, learn, and grow, and prepares them for a successful lifetime of learning where ongoing change is constant" (British Columbia Ministry of Education, n.d.-a, para. 6).

Instead of focusing solely on content, the new BC Curriculum was structured on a concept-based competency-driven framework, also known as the know-do-understand model (British Columbia Ministry of Education, n.d.-a). Key to this model are three concepts, Big Ideas (Understand), Content (Know), and Curricular Competencies (Do). Big Ideas refer to "generalizations and principles and the key concepts important in an area of learning" (British Columbia Ministry of Education, n.d.-a, para. 21) and encompass what students should understand when completing the curriculum for a specific grade. Content, in turn, includes the topics and knowledge pieces that students should know upon completing a specific grade.

Finally, Curricular Competencies connect the different areas of the curriculum and include "skills, strategies, and processes that students develop over time" (British Columbia Ministry of Education, n.d.-a, para. 23) and that will enable them to do things (See Figure 4).

Figure 4

The Know-Do-Understand Model



Note. From "BC's Curriculum: Curriculum Overview," by British Columbia Ministry of Education, n.d.

The redesigned BC Curriculum has a strong emphasis on the idea of constant change and adaptation to those changes. Since some of these shifts are caused by new technologies as they are invented and taken on by people, the curriculum seems to align with what was presented in

the literature review chapter in this document. In addition to that, the current version of the curriculum also places importance on the fact that ICTs allow people to collaborate like never before, both locally and internationally:

> Students need opportunities to develop the competencies required to use current and emerging technologies effectively in all aspects of their learning and life. Technology can facilitate collaboration between students, educators, parents, and classrooms while also providing schools with rich online resources. Today's technology enables classrooms, communities, and experts around the world to share digitally in a learning experience, wherever they may be. (British Columbia Ministry of Education, n.d.-a, para. 37)

Today, the BC Curriculum prescribes instruction from kindergarten to grade 12 (K-12) and contains 11 different main subject areas (See Table 4).

Table 4

Subject Areas in the BC Curriculum

Subject areas	Grades
Applied Design, Skills, and Technologies	K-12
Career Education	K-9
Career-Life Education	10-12
Career Life Connections	10-12
Français Langue Première	K-12
Languages	5-12
Physical and Health Education	K-12
Social Studies	K-12
Arts Education	K-12
English Language Arts	K-12
Français Langue Seconde - Immersion	K-12
Mathematics	K-12
Science	K-12

Note. Adapted from "BC's Curriculum," by British Columbia Ministry of Education, n.d.

Schools

The four participants in this study worked in three different schools distributed throughout two different school districts on Vancouver Island, BC at the time of their interviews. To guarantee their privacy and anonymity, participants were given the option to choose the name they would like to be referred to as in this study. Additionally, I decided to assign a number to each district and a letter to each school. School District 1 is represented by two different secondary schools in this study, namely School A and School B, whereas one school, School C, belongs to School District 2. I must mention that these schools were never chosen or selected by me; they, instead, were the schools in which the participants I talked to happened to work. Both schools in School District 1 are secondary schools. School A had 902 students enrolled in the 2022-2023 school year, and School B had 567. School C, located in School District 2, is a K-7 French immersion single-track elementary school and had 420 students enrolled for the same year. Single-track, in this context, means that the immersion program is the only one at that school, which offers both early and late French immersion. Heather and George taught at School A at the time of their interviews, and David taught in School B; Diane was a teacher in School C (See Table 5).

Table 5

Districts, Schools, and Teachers

District	School	Type and grades	Student enrollment (2022-23)	Teachers
1	A	Secondary (9-12)	902	Heather George
	B	Secondary (9-12)	567	David
2	C	French immersion single-track elementary (K-7)	420	Diane

Participants

This section describes each of the four teachers who participated in this study. All descriptions include details about their current role at their school at the time of their interviews and their educational and professional backgrounds. I described participants based on the data that was coded and categorized, and I drew especially on the parent node (or category) called *Participants* for that (See Appendix E). Some participants were more eloquent than others when providing information on their interviews, so their descriptions will vary slightly in length and level of detail.

David

At the time of his first interview, David had been working as an English teacher at School B for three years. He told me he taught different English courses from grade 9 to 12. He mentioned that every semester he would get a variety of courses and could never be sure of what his next semester schedule would look like. He explained to me that he was under a continuing contract with his school, which guaranteed him a minimum of three courses to teach, to a maximum of eight. Every year he had to fill out a form letting the school know what courses he would prefer to teach, and administration tried to make sure he was assigned those courses. However, decision regarding course assignment would also be based on the school needs for a certain year, so David told me that, although he usually got to teach some of his preferred courses, his appointment for a year would often contain a mix of courses. I must mention that, at the time of his first interview, late spring, David had been on paternity leave for almost a year and was getting ready to return to teaching in the fall.

David told me that he "discovered teaching as a desirable vocation" when he was in grade 12. Up to then, he hadn't had the most pleasant experience in high school, and it was in his

last school year that things changed. He had the opportunity to connect with some teachers that had a positive impact on him. They would encourage David to invest in his writing, and he was very impressed by the difference they made in his life. He realized that these teachers also seemed to have fun doing their job and decided we would like to become a teacher himself. He then went to university and received a degree in English Literature and Composition. He sought that program with the intention of applying to teaching colleges, but he soon learned that he lacked experience working with young people, which was a requirement to the different teaching programs he had applied to.

To gain the experience he was missing, David got a job as an educational liaison at an organic farm. The job entailed receiving students at the place he worked and going to schools to show them how food was grown and why that was important. Being on a farm captivated David so much that he decided to pursue a career as a farmer when his educational liaison contract was over. However, in addition to "growing vegetables, raising bees, and tapping trees for maple syrup", David continued investing in educating people. He started a field school on his farm and would run weekly workshops, which offered students the opportunity to engage in hands-on experiential learning activities. David was impressed by how students learned and grew by doing something that was authentic and meaningful to them. It was after a period of five years on the farm that he then decided to return to his home province, where he was accepted at a post-degree professional program in teaching.

David told me that his teacher education had a very positive impact on him. Not only did it align with his educational experience on the farm in the sense that it placed value on what is important to students, but it also had a strong focus on the role personal relationships play on education. Based mainly on First Peoples Principles of Learning (First Nations Education

Steering Committee (FNESC), n.d.), David learned that education at its best is relational: both students and teachers can bring what is important to them and their personalities to the table and learn and teach with and from one another. He highlighted the experience he had in his second practicum, in which he taught in a flexible studies program in a high school. The program did not follow a traditional schedule, and students from different grades studied together. Moreover, students led their own learning based on their interests, and there was a strong focus on inquiry-based learning. David saw value in helping students become aware of their learning journeys as they were given the chance to reflect about their experiences, and he understood the structure of the program worked well for students who might have had a harder time adapting, as he put it, to a more compartmentalized, traditional style of teaching.

David strove to incorporate the positive experiences he had had on his farm and during his teacher education and practicums when he got his first contract as a teacher on call (TOC) right after finishing his program. For eight months, he told me he taught practically every subject matter at every grade level in two different school districts, until he got a contract to teach English at a high school. He was able to upgrade that contract as new and bigger opportunities came up, especially because he needed the job as a teacher to offer him stability. And this was how he ended up at the school where he was working in at the time of his interview. He told me he was able to make a home for himself in that school, even though he still did not have his own classroom. He told me he appreciated the fact it was a smaller school, having a beautiful, spacious library and different spaces he could take his students to.

Diane

Diane is a teacher librarian and, at the time of her first interview, had been working in her role for over 10 years. She told me she had a Master of Library and Information Studies, which

had a strong focus on technology. Because of that, she told me she was hired very quickly by her district after graduation. She described her job in her school by saying that "one third is technology as a librarian, one third is literacy, and the other third is curiosity and supporting the school." She summarized her job at the school as a support role, for both teachers and students. She was part of the onboarding program of Chromebooks and Google Suite in her school and district, so she collected a vast experience in helping teachers and students set up their accounts and contributed to training teachers on how to use this technology. In addition to working at School C, she had also been sitting on the technology committee at School District 2 for seven years. In that role, which she described as being overarching, she had been part of discussions regarding the use of technology, such as where the district intended to go, things that were important, and what they did.

Before becoming a teacher, Diane had gotten a business degree and used to manage a retail store. She described going for a teaching degree later, when she was 29. When she set out to start building a career in education, she told me she had no idea she would end up becoming a teacher librarian. Someone that was working in her school was about to leave and asked whether she would like the job, to which she replied, "Yes, you have the best job in the building!" But then she soon learned she would have to go back to school because School District 2 required teacher librarians to have a graduate degree, and that was when she started her master's. She highlighted that her original plan when going into education was to become a classroom teacher or a school administrator, never a librarian. "But the role is just so cool, like you just get to be… you get to support all sorts of learning and literacy at all levels, adults to kids."

Heather

Heather's and Diane's stories are similar in the sense that both are teacher librarians and have a Master of Library and Information Studies. They also shared the aspect that the two used to work in different roles before becoming librarians. At the time of her first interview, Heather had been working in education for over 30 years. She started working as a teacher librarian 10 years earlier and had been a French immersion teacher for 20 years prior to that. She told me she got a teaching job right after graduating, and her practice included working in both curriculum and independent schools; she also had the experience of teaching English as a second language in South Korea. Heather described her move into teacher librarianship as a "left turn". She told me French immersion was great, but she just could not see herself doing the same thing for 35 years; she wanted to try something different.

Heather did her master's over a period of six years while she was still teaching French and told me the two experiences greatly informed one another. She went into her librarianship program with strong resource finding and curating skills, which she had been applying in her job as a language teacher:

> I think about how I've had to track down resources. And I will say this, as a teacher librarian, there is no resource I can't find. But being a French immersion teacher for 20 years taught me that you had to figure it out yourself.

She was referring to the fact that, based on her experience, schools often do not have a librarian who is French speaking. That meant that most of gathering of resources during her time as a teacher had to be done by herself, which, in the end, served her well when getting educated as a librarian to do just that.

Additionally, Heather told me that most of what she was learning about in her graduate program could be readily applied to her teaching job, especially when it came to technologies. She did her master's in the mid-2000s, a time of rapid development and release of new technologies. Heather mentioned that this chapter of her education coincided with the second stage of development of the internet, referred to as Web 2.0. This period is known for the popularization of different platforms and applications that offered users the possibility "to create, change and share information, for example through blogs and social media" (Oxford, n.d.). As part of one of her assignments for graduate school, Heather was asked to start and keep a blog, in which she had to present and discuss pedagogical uses for new technologies every week. Many of those technologies had an application in her French classroom. She learned, for example, she could play authentic content to her students and explore primary online sources with them, such as media outlet and language learning websites. She described this period as being a "turning point" for her; the popularization of Web 2.0 features and her learning about them in her master's had a direct impact on her teaching practice.

Although having been a teacher librarian for over 10 years during the time of her first interview, Heather had been working in School A for just over a year. She told me she took over a library learning commons going through a massive renovation process. Based on the work of a steering advisory committee that sought to "pull this space and this program into the 21st century", many changes were being made – and Heather joined in when two-thirds of them had already taken place. She described she felt lucky to have been part of the process, especially because she had the opportunity to give suggestions on how to modernize the learning commons, such as by "removing tall shelves and creating sight lines." She told me one of the first things she got to do when starting her role in that school was to weed older books out of the library

collection. However, the most significant transformation happening had to do with how the role of a teacher librarian was understood by the school community.

Before she joined School A, the institution had had two other teacher librarians serving there for over 20 years who did not have formal librarianship education. Heather told me that much of the work she did upon joining the school involved educating people about what she could do for them in her role. Teachers were very surprised to learn, for example, she could help them and their students with Chicago, APA, or MLA citation styles and with creating reference lists. She created a brochure to help her explain what she could do to support teachers and students. In addition to making the flyer available to people in the school, she "religiously handed out to any new staff members." When interacting with pre-service teachers, she made sure to let them know that "when you get into a school, this is what you should expect from your teacher librarian."

George

George worked at the same school as Heather at the time of his first interview and was recommended by her as a potential participant in my study. George told me he taught grades 9 to 12 in the Applied Design, Skills, and Technology (ADST) department at School A. The ADST curriculum is offered from kindergarten to grade 12 in BC schools and is described by the British Columbia Ministry of Education as:

> [A]n experiential, hands-on program of learning through design and creation that includes skills and concepts from traditional and First Peoples practice; from the existing disciplines of Business Education, Home Economics and Culinary Arts, Information and Communications Technology, and Technology Education; and from new and emerging fields. It fosters the development of the skills and knowledge that will support students in

> developing practical, creative, and innovative responses to everyday needs and challenges. (n.d.-d, para. 2)

George was the head of the department at the time and was teaching Drafting and Design, Robotics, and Design and Innovation. He is trained as a Social Studies teacher and told me he had taught a whole deal of that in the past. George said it had been difficult for School District 1 to "hold on to positions in academic areas like social studies", and he had to reinvent himself to secure a living in teaching. And that was how he landed in ADST.

George told me he had never had any formal teacher education in ADST but was pulled into it mainly because of his reputation of being "the guy that likes to use tech." He was known in his school for using technology when teaching Social Studies, and his principal came to him after the former Drafting teacher retired to ask him to fill in. He gave me details about how his principal approached him about it, "Hey, I need someone to fill in; we have nobody in the district. And so, he came and tapped me on the shoulder and said, I've seen you use a Mac before; I think you can do this." George shared that he was not sure at the time he would be able to do it, especially because there would be a lot for him to learn and prepare to teach the course, but he agreed to do it anyway.

Getting prepared to teach ASDT courses involved a great deal of self-teaching and figuring out, George told me. Since the different courses in the program included using different technologies and technical standards, he was not sure at first whether he would be able to handle them by having to learn the content on his own. George described his approach to me by saying:

> I'll take on the first two weeks and help the students get started and, to be honest, muddle my way through […] and then they posted the position again, and nobody else was applying. And I just kept holding on to it until I ended up getting the position.

George went through a similar situation when he was invited to teach yet another course in ADST, Robotics. However, at the time of the interview, after having taught the courses in ADST very successfully for many terms, George could talk about the preparation process and laugh about it. Although the first time teaching a new course could be very stressful, he told me things got more comfortable the second and further times he did it, "it's like having a child; the second child is a lot easier."

In addition to teaching the ADST courses, George is also known in School A by helping his fellow teachers with technologies. I learned this by talking to Heather, who mentioned George several times in her interviews. She told me that part of his contract at School A entailed technology integration to support both teachers and students. She highlighted the podcasting studio that they had in the learning commons in School A and how much of what went on in there depended on George's expertise. He was the one responsible for training his peers and students on how to operate the equipment in the studio and the pieces of software available for editing. She described George as being an important partner for her and colleagues in the school, "George is still our point person, because he knows the most about it. I could go to George and say, can you come into my class and teach my kids about this?"

Chapter 5: Findings

This chapter describes how and to what purposes the teachers who participated in this study used digital technologies in their pedagogical practice. It also discusses the experiences and conditions that made it possible for participants to understand and explore digital technologies and the literacies they enable. Additionally, this chapter explores how these experiences and conditions were created for these educators. I do this by presenting the findings according to the themes and subthemes that emerged from my analytic reflection of the data that was coded and categorized (Saldaña, 2013). These themes and subthemes resulted especially from three parent nodes that I used to categorize the data that was coded by using NVivo; they are, *History with ICTs*, *Teaching*, and *Context* (See Appendix E). These three parent nodes allowed me to elaborate themes and subthemes, which name the sections and subsections in this chapter (See Table 6).

In the first section, *Personal and Educational Experiences with Digital Technologies*, I describe the experiences participants indicated as being important in preparing them to do the work they did, including events of personal involvement with ICTs and the concepts they learned during their formal education. In the second section, *Working with Digital Technologies in Schools*, I explore examples of the teaching that participants did by using digital technologies, focusing on what they tried to achieve by engaging in this work. Finally, in *Incentives and Barriers*, I discuss the incentives and barriers each participant came across in the schools they worked in and how their students, peers, schools, and districts contributed to creating or hindering the conditions that allowed them to do the work they did.

Table 6

Themes and Subthemes

Themes	Subthemes
Personal and Educational Experiences with Digital Technologies	First Contact and Early Interactions Formal Education Most Important Experience
Working with Digital Technologies in Schools	Covering the Basics The Need of Operational Skills Organizing and Sharing Files Digital Citizenship Teaching and Learning Technology-Enhanced Teaching and Learning Promoting Digital Literacies Integrating Technology, Pedagogy, and Content Making and Hacking Looking Beyond the Classroom Real-Life Applicability Student Collaboration
Incentives and Barriers	Access to Technology Equipment Availability Bring Your Own Device (BYOD) Funding Strategies Ideal Conditions Human and Institutional Factors Peers Schools Districts Continuous Learning Professional Development and Mentorship Growth Mindset and Unfinishedness Enough is Enough

While discussing the findings in this study, I often refer to Chapter 2 of this dissertation, in which I describe the three theories, or systems "of assumptions, principles, and relationships posited to explain a specified set of phenomena" (Bates, 2005, p. 2), that I chose to support this study; they are Digital Literacies, TPACK, and Maker Pedagogy and Pedagogical Hacking. As a

theory, Digital Literacies postulates that people make sense of and produce information and knowledge by means of using language whose meaning is socially constructed and manifested by means of different genres, which are increasingly being enabled by digital technologies (Bazalgette & Buckingham, 2013; Coscarelli, 2009; Larson, 1996; Silveira et al., 2012). TPACK as a theory, in turn, posits that there are different types of knowledge that make up teaching, technological, pedagogical, and content, and that all of them should be considered and taught jointly when preparing teachers to teach, especially when using digital technologies (Koehler et al., 2007; Koehler & Mishra, 2005; Voithofer et al., 2019; Voogt & McKenney, 2017). Finally, Maker Pedagogy and Pedagogical Hacking presuppose that technology is ever-evolving and that teachers and students should develop an understating of it that goes beyond specific types of equipment and applications; by exploring the inner workings of technology, users can be better equipped to navigate technological inventions that are still to come and find creative and subversive uses for the technology that is available to them (Bullock, 2016; Smith et al., 2018). Additionally, I also bring in new references to support findings that were not anticipated when doing my literature review.

In sum, this chapter describes the findings of this study, which were achieved as an attempt to answer my research questions. The first and third sections in this chapter address mainly my second research question, What are the experiences and conditions that create possibilities for these teachers to understand and utilize digital technologies, and how are these experiences and conditions being created/enhanced for them? The second section, in turn, aims to answer my first question, How and to what purposes do four teachers in two local school districts on Vancouver Island, BC who have committed to working with digital technologies use these technologies in their pedagogical practice?

Personal and Educational Experiences with Digital Technologies

When planning this research, as described in Chapter 1, I considered my own experience with digital technologies as a starting point. It was due to my own trajectory with ICTs that I was drawn into this topic, and it is from my own location as a researcher that I can discuss it. Consequently, it only seemed natural that I would ask participants about their own involvement with technology to be able to trace a parallel between their stories and my own. This section will discuss exactly that, what impact participants' involvement with technologies had in enabling them to do the work they did is schools, one that was recognized by their peers and school community for contemplating diverse technologies. This section focuses mainly on personal involvement participants had with digital technologies prior to becoming student teachers, the formal training they received during their education, and the experiences they considered the most important in enabling them to do the work they did with digital technologies.

First Contact and Early Interactions

One of the assumptions I had when planning and going into the interviews with participants was that they would all have a long personal history with digital technologies and would have many details about it to share. However, I was surprised to learn that was not the case for most of them. When asked about when she was first introduced to ICTs and started using them, Diane did not give me a direct answer but said, "When I started my master's, I didn't even know what Google Docs was, so I was not very digital savvy definitely." She did not refer to any experience prior to her graduate program in either of her two interviews. George, in turn, made several references to learning about things, digital technologies included, on his own, describing himself as being curious and a risk-taker. Chronologically, the earlier mention to technology used by him was during his time as a Social Studies teacher; however, he did not

provide much detail. Much of what he learned seemed to have come from his practice as a teacher. He told me he had used technology in all previous courses he had taught and, because of that, became known in his school as being the guy that liked tech.

Heather did not share details of any experience preceding her time as a teacher either. As a matter of fact, she did not make any reference to her education to become a teacher, only to her later librarianship education. The earlier reference she made to using digital technologies was to her time as a French teacher. She mentioned she noticed an explosion in the use of digital technologies in schools, especially in the use of the internet, in the end of the 90s when she returned from a period teaching abroad. Although surprised with the rapid spread of technology, she readily adopted it in her practice. While not considering herself an early adopter of technology, she told me she "always gravitated towards it." David, on the other hand, had a detailed story to share that went back to his time as a child.

David told me the elementary school he went to in the mid-80s had a computer lab, and students were allowed to use the equipment in there from time to time. His earliest memory was of practicing typing and then printing his work. He was fascinated by the fact that they would have to insert a floppy disk containing files with fonts on it if they wanted to use a different one. The computer memory at the time was so little it could not store different font types:

> I was just so fascinated by how, you know, it was a physical piece of media. And it's really mysterious, a plastic case with a floppy, shiny circular piece of plastic inside. And I could not figure out. How does this disc have the different font on it than this one?

David attributed much of his sense of fascination and wonder to his father, who, he said, "was also a bit of a tinkerer".

By the early 90s, David told me his family got their first computer at home, and one of his favourite activities then was to play games on it. He explained how he would have to edit some of the files so that the games would work properly, and that was a source of satisfaction to him, “When I would edit those and learn what I was actually doing in those files, it was very encouraging to me; it felt like I had unlocked a secret about these computers.” He went on to tell me how in the mid-90s computers got much advanced, with better graphics and audio, and how he would keep up with new technology by buying and reading computer magazines. In the early 2000s, David had access to the internet for the first time at his house and told me he would spend a lot of time on it, especially exploring early social media platforms.

At that time, he told me technology available in schools got more advanced as well, and he had the opportunity to learn how to design websites, do some coding, and edit images. He mentioned all that learning stayed with him, and he was able to apply it when running his own farm later on. He told me he designed and built a website and organized a digital newsletter with photos to advertise the workshops they ran and the produce they sold. He ended the last chapter of his story with ICTs by telling me about how he was an early adopter of smartphones when they first came out and how he would use them to communicate with family and friends living in a different province. He had an online journal at the time that he used to keep family and friends up to date on what he was up to and to make new friends.

Although being exposed to digital technologies from an early age and exploring them in ways that resemble maker pedagogy (Bullock, 2016) were important factors for David and me in our trajectories of becoming users of ICTs as teachers, this was not the case for the other three participants in this study, at least based on what they told me during their interviews. Research shows that while early exposition to and personal experiences with digital technologies play an

important role in adopting them as pedagogical tools in the future, it is not a determining factor. As this study demonstrates, people can become fully proficient users of digital technologies and can use them as pedagogical tools in schools even if learning about them at a later stage. One of the findings in the study by Aldunate and Nussbaum (2013) focusing on "teachers' process of adopting technology, focusing on the interplay between the type of user, based on their attitude towards new technology, and the type of technology, in terms of the complexity of use" (2013, p. 524) was that indeed early adopters are more likely to embrace a new technology when teaching, independent of its level of complexity, whereas later adopters tend to abandon it if too many roadblocks appear.

On the other hand, a comprehensive study with nearly 3000 teachers by Russel et al. (2003) showed that, although early exposure to technologies will make people more confident when using them as teachers, this experience does not necessarily automatically translate as pedagogical use. "The assumption that technology use in classrooms will increase simply because a teacher grew up in a technology-rich world appears false" (Russell et al., 2003, p. 308). Rather than a long personal history with digital technologies, what seems to be more of a determining factor when it comes to teachers using technology pedagogically is rather formal training and classroom experience (Russell et al., 2003).

Formal Education

Although I asked participants about experiences prior to their time in post-secondary, most of the questions I had for them focused on the time they spent as student teachers and graduate students, and the work they did in schools. Based on the assumption that teacher education, with both courses and practicums, directly influences the work teachers will do in the classroom (Caires & Almeida, 2005; Darling-Hammond, 2000), this subsection discusses the

impact formal education had on participants in preparing them to understand digital technologies and think of them pedagogically. Except for George, the other three participants had the opportunity to share different examples about their time as students and described how those experiences created opportunities for them to think of ICTs as educational tools.

David

When talking about his time in teacher education, the first example David had to give me was about an EdTech class he took:

> It was really important for me. That course was important for me to learn what are the current educational tools and how can we use these tools as learning tools, and to assess, and to collaborate, and to express ourselves, what can technology do for us.

This excerpt highlights how David was exposed to current technologies at the time of learning to become a teacher and got to use them as learning tools. It is interesting that he referred to them as learning tools and not necessarily teaching tools, and the examples he gave, except for the example related to assessment, had to do with what students might potentially use ICT's for and not necessarily as teachers.

He went on to say that they "did an e-portfolio in that class, so that was modeled for us as a way to gather evidence of learning." He added that:

> We were making a digital portfolio for ourselves, so that, you know, that was the biggest selling point for me was that I could see that as a, you know, a portfolio as a way to track learning, and we were learning in other classes what it means to track learning and see your growth over time.

An important point here for David was the idea of modelling, or using a digital tool in a similar way students in schools might for their own learning. Although not focusing on the teaching

aspect of it per se, this experience seems to have helped David get a better sense of the effect digital applications can have on one's learning. The outcome seems to have been that it helped him think of portfolios as pedagogical tools, by trying them first as a student himself and then as a teacher as he moved forward.

This distinction between ICTs as learning and teaching tools appears in the study by Uerz et al. (2018), in which they do a comprehensive literature review about the competences of teacher educators in fostering student teachers' proficiency with technology use. The literature suggests that preparing teacher candidates to use technologies in their practice involves preparing them to use ICTs as pedagogical tools, which can aid in their work as teachers, such as by making content more engaging and organizing assessment. However, David's example and the literature also indicate that experimenting with the role of a student with digital technologies, while being educated to be a teacher, also contributed to expanding the understanding teachers have of digital tools as learning apparatuses. Understanding how ICTs can contribute to one's learning seems to be something important to be considered in an approach of digital technologies in teacher education (Hopper, 1997; Hopper et al., 2018).

Heather

In different moments throughout her two interviews, Heather reiterated the importance her master's in librarianship had in making her comfortable and prepared to used ICTs pedagogically. Similarly to David's case, using digital tools as a student in her master's program was very instructional to Heather. As mentioned in the previous chapter, Heather took most of her courses online, which required her to use different tools:

> But this is earlier days of online learning, and I was actually really impressed. So, we were Skyping with our profs, you know, in 2006, long before Zoom ever existed. So, I do

> feel like in some ways that kind of prepared me a lot to use technology, so nothing that has come up has shocked me.

The experiences David and Heather had with digital technologies as learners can be understood as meta-learning, which, according to Kidman, "relates to one's ability to have an awareness of one's self as a learner, and being able to use this ability to become a more effective learner" (2015, p. 117). The author goes on to say that being aware of oneself as a learner can have a positive impact on one's teaching, "It is important for pre-service teachers to develop this self-awareness about their own cognitive processes so that they can become more skilled in their approach to learning and therefore teaching" (Kidman, 2015, p. 117).

In addition to having to use different educational tools to complete her program as a student, Heather also had the opportunity to be exposed to different other tools and reflect about their potential uses in education, which involved "understanding the bigger picture behind it, and why do we use these and when is it appropriate, and when isn't it." She mentioned an assignment in which she was asked to keep a blog for one of her courses. Every week during that term she was tasked with blogging about a different technology. This is how she described it:

> That was a ton of work, and it was a steep learning curve. But once you've been, you know, once you've been through something like that, you're like, Well, I've done that. I can do this, you know. I've already got this foundation.

She told me of other courses she took in her master's in the area of librarianship and highlighted how important they were, but, when it came to digital technologies, she told me that "my sort of skill set probably developed the most out of those technology courses."

Throughout Heather's description of the most important experiences in her master's program, she often referred to the idea of having developed a solid foundation:

> So, I would say the actual courses that I took in information technologies for learning, the two that I had in my master's degree, really challenged me. So, taking a course and being serious about it and not just trying to learn it here and there, but have some kind of solid foundation.

She told me this idea of a firm base led her to develop her master's thesis, in which she discussed the "dispositions of a technology leader as a teacher librarian", such as "being open, you know, willing to try, problem solving, all that." Being open to try a new technology, for example, seems to have informed Heather's understanding of her role as a teacher librarian, "I always tell kids that, and that was one of the biggest things we got from our training at teacher librarianship, like there's always, there's always a solution and you just have to be open to that."

A review of literature done by Buabeng-Andoh (2012) detected different factors that may lead teachers to adopt and integrate ICTs into teaching. Two of those factors, personal and technological, seem to align with Heather's experience during her master's. The author concludes that, on a personal level:

> [t]eachers' feelings, knowledge and attitudes influence their use of ICT in teaching […] If teachers' attitudes are positive toward the use of educational technology then they can easily provide useful insight about the adoption and integration of ICT into teaching and learning processes. (2012, p. 117)

On a technological level, Buabenf-Andoh concludes that being familiar and having hands-on experience with a specific technology are factors that can determine whether teachers will adopt and implement it in their practice as opposed to only hearing or reading about them; "[m]any teachers are hesitant to change an existing program to something they only know through discussion and reading and not through observation" (2012, p. 117). It seems that Heather's

formal education gave her the opportunity to both develop a positive attitude towards technologies and to get to know many of them by means of hand-on experiences, which may explain one of the reasons why she is known in her school for working comfortably with ICTs.

Diane

Unlike David, who had had a vast experience with digital technologies before entering post-secondary, and Heather, who had been teaching for many years with technology before getting her master's, as noted earlier, Diane told me she went into her librarianship program without knowing "what Google Docs was" and considered herself at the time as "not very digital savvy definitely." Although not having much previous experience with ICTs, Diane said that she "had quite a few technology classes that were embedded and mandatory" in her program. She described that she was especially impacted by a course she took, which was similar in some respects to the blog assignment Heather did. It contained an assignment which entailed students doing different mini projects throughout the term to learn about new technologies and to present them to the class:

> And so, you know, what was really impactful to me, and I think this should be a course in every kind of teaching program, was these little mini projects. That was definitely one of my favourite courses. It was like, in 10 slides, show me this tool and then we're going to use a different tool.

Although enjoying the course that included this assignment and considering it crucial in preparing her to work with ICTs, Diane did not complete it without difficulties. In addition to presenting on new tools to the class, Diane told me students were often motivated to explore new tools to deliver their presentations. She told me this involved a double task, teaching content and teaching a new tool. This joint approach, one often seen in TPACK (Koehler et al., 2004, 2007;

Koehler & Mishra, 2005), did not seem to benefit Diane at the time, which may be related to many aspects being new to her. She expressed a feeling of being overwhelmed:

> I think one of the big things I got out of the master's was understanding that when you're teaching curriculum, a subject, plus tech tools, you're teaching two things at once, and you get kids overwhelmed and they shut down.

She was referring to a particular experience, in which she was tasked with doing a demonstration on a presentation software. In addition to sharing with her classmates what the platform was able of doing, she had to deliver the presentation itself by using the same software, which was new to her:

> I had never touched Prezi before. And so, it was like very aggravating to learn all the different buttons while trying to put my project on it at the same time. And then, of course, the person I was put into a group with at my master's, she had no idea how to use the program and then shifted the whole backslide so that every link didn't work anymore, and you just realize: group work, not everyone is at the same place, and don't teach a program and content at the same time.

Even though Diane struggled to complete her mini projects, she also shared that they helped her devise a strategy to learn new things. She said that process developed in her a growth mindset, which she made a conscious effort to impart to her students when teaching them with and about ICTs:

> I did things like all sorts of different projects. And that really kind of gave me this understanding that everything's on YouTube and to not be afraid of things. And so, kind of that like scared us, you know, the story of the Scaredy Squirrel. So, I jump from the nut tree much better now because I'm like, you know what? I don't know this program,

> and that's okay. I'm going to YouTube it. And so that definitely, you know, growth mindset is such a big piece.

Li et al. (2019) list several factors that may lead teachers to being open to learn about and use new technologies in their practice, and one of them refers to having a growth mindset. According to the authors, "people with a growth mindset (also referred to as incremental theory) tend to believe that through effort and appropriate strategies, learners can improve their ability" (Li et al., 2019, p. 514). In the program they observed, most teachers were not skilled at using ICTs to teach but concluded that "teachers who have a growth mindset may be more likely to learn how to improve their skills and take risk to try new technology and pedagogy" (Li et al., 2019, p. 514).

David, Heather, and Diane went into their programs with different levels of skills related to digital technologies. However, the three of them shared experiences that carry some similarities, especially related to getting to know new tools and reflecting about how to use them. David benefitted from experimenting with digital tools in the role of a student, which reveals a perspective of using ICTs as both learning and teaching tools. Heather and Diane, in turn, described as positive the experience they had of exploring different tools and sharing about them with their peers. While Heather described this experience as enabling her to be open to try new technologies and have a positive view towards them, Diane was able to develop a growth mindset, which entails recognizing oneself as incomplete and developing the skills to learn what you don't know. Having a personal involvement with ICTs for authentic experiences and clear purposes that point to maker pedagogy (Bullock, 2016), such as by exploring floppy disks containing different fonts and building a website to promote one's farm, did not appear as being

necessary to developing new skills, especially to Heather, but seems to have put David into a position that allowed him to give suggestions to his peers and instructor:

> There were some platforms that were introduced to me in that course that I knew better ones. I knew ones that would work better and were easier to use, and I could imagine using with students more. And it's just the instructor wasn't aware of them, which is no fault against them.

Because I conducted only one interview with George, as opposed to two interviews with the other three participants, we did not have the opportunity to talk much about his experience in post-secondary. Hence, I did not include a subsection about him under this section. However, George had a lot to share regarding the work he did with technology in his school, which is reflected in the upcoming sections in this chapter.

Most Important Experience

One of the concluding questions I had for participants in their second interview was about the experience they considered the most important in enabling them to use digital technologies in their practice as a teacher or the reason why they think ICTs should be used in education. David, once more, made a connection to his personal experience, which points to maker pedagogy (Bullock, 2016). He said:

> I'm trying to figure out how to say video games; that's my answer for this. As a pretty passionate gamer when I was younger, and it's a nice way I have to relate to students, even if I haven't kept up with modern games, it's still... I know how fulfilling and satisfying they can be and how, you know, when you problem-solve a problem in a Legend of Zelda game, it's a really hard thing you just did […] And I think part of my use of technology comes from understanding how beautiful some of those games can be; you

> can have really stirring moments while playing a game. And we can manipulate images and sounds and text now to create an emotional response from people, and I think that happens in video games, it happens in movies, and it can happen in a portfolio, you know.

Although not mentioning a personal history with ICTs and having struggled in her program to handle all the learning of new things that was happening, Diane shared a positive perspective about technologies. When asked why she thought digital technologies should be part of a curriculum, her answer was assertive, “Because it's fun! There's no other reason to do something unless it's fun!” Heather pointed out to three experiences or attitudes that she considered the most important. The first referred to the courses she took in her master’s, which she said gave her a solid foundation she was able to continually build on. The second was finding a mentor, or someone who knew more that she did. However, she said this relationship should be reciprocal to work, “build reciprocal relationships for sure, because people don't want to always only just be giving, giving, giving, you know.” The third factor Heather shared had to do with attitude, “but I would also say, you know, like push yourself, push yourself; don't get complacent.” For George, the most important experience had to do with him describing himself as an early adopter of technology and the impact technology use can have on students, especially when there is a level of novelty involved:

> Well, I guess, as an early adopter of technology in my career, I mean, I've seen it as something that lights up students and it lights me up too. I think I said before, I get charged up when something new is going on, and so that that's a key part of it.

Working with Digital Technologies in Schools

Much of what participants had to tell me in their interviews had to do with their practice as teachers, including different examples of how ICTs were used by them and their students. Thus, the theme discussed in this section focuses on the teaching practices of the participants in this study, highlighting how they used technology to teach and how they taught students how to use it. Since this is a large section, it contains three subsections that represent its subthemes, namely *Covering the Basics*, *Teaching and Learning*, and *Looking Beyond the Classroom*.

Covering the Basics

It can be argued that, before any work can be done with digital technologies, people need to be able to perform basic operational tasks, such as turning equipment on, connecting it to the internet, and copying and moving files around. Additionally, ICTs allow people to potentially have access to any type of material and be in contact with different individuals. While that has a positive aspect, such as access to a sea of information and opportunities for collaboration, it can also pose some risks, such as being exposed to age-inappropriate content and getting in touch with people that may not have good intentions. Thus, more and more there is an understanding that people should be taught how to be safe online. Moreover, technology is ever evolving, which can make it challenging to keep up with new inventions that come out. This subsection describes the strategies participants shared they used to help their students acquire the foundational skills that would allow them to advance and share their work with digital technologies. Additionally, it discusses approaches used to teach kids how to be safe online, understand their right to privacy, and develop a sense of digital citizenship. Finally, this subsection describes the strategies participants used to keep up with constant changes in technology.

The Need of Operational Skills

In their discussion about literacy and the material apparatuses needed to make it possible, Mangen and Pirhonen state that "whether it is a slate, pen and paper, or some digital device, both low and high forms of technology are always an integral part of the reading and writing processes and outcomes" (2022, p. 104). In other words, meaning-making by means of the written word, and other forms and formats such as images, audio, and video, depend on a type of technology in order to be materialized and accessed by humans. The authors define technology as "a means of using tools to enhance knowledge or skills to perform a task" (2022, p. 107). Additionally, when it comes to making sense of, producing, and sharing knowledge or information, different types of technology provide both affordances and constraints, "a printed book affords browsing and dog-earing the paper pages, whereas a digital text affords searching for specified terms" (2022, p. 107).

It can be argued that, up until very recently, literacy practices in schools involved mastering non-digital forms of technology, such as the pencil. Mastering such technology did not involve much more than learning how to hold it in an efficient position and knowing how to sharpen it when its tip became dull. When it comes to digital literacies, however, not only the number of different technologies is higher – computers, smart phones, projectors, smart boards, audio-visual equipment – the tasks they allow for are also more numerous – turning on and off, connecting to the internet, logging on and off, copying and pasting, creating a share link, to name a few. Thus, becoming literate today necessarily goes through learning how to operate more and more complex and sophisticated machines. The interviews with participants showed that developing operational skills was part of the reality in schools, for teachers and students alike.

David told me that not having basic operational skills could be an impediment for students:

> Students, a lot of times, won't have the skills to, say, move a file around or change a file format, which sometimes comes up. They want to express themselves, they're creative, but they don't have those skills.

He also mentioned that younger students tended to have more of those skills already, which David attributed to the rollout of the new BC Curriculum and its emphasis on preparing students for the 21st century (British Columbia Ministry of Education, n.d.-c). However, for older students, David told me about a project he was developing in partnership with the librarian in his school, "a one hour session that maybe students could do at the beginning of the school year to help them be more familiar with the way computers work" and "how to access menus, how the different parts of the computer work, how we can manipulate files and move them around, and basic edit... a photo editing if we want to add text to a photo."

Diane, as a teacher librarian, told me she was often tasked with helping younger students in her school get the basic operational skills they needed to do their schoolwork. However, she said this was not always an easy task:

> And then for the younger kids, I will do like, Oh my gosh! Grade three, great four, first day you handle passwords, it… that's the day where I'm always like, that day is a tough one. Because kids are so excited, but they don't have the digital understanding of how to login. So, that kind of thing.

One of the solutions she developed and shared with me was to make things as simple as possible and not to cover too much in one session, "Okay, so I'm a kid; I don't want to do too much. I want to make sure I have access to this. It's like setting it up so that, you know, the kids have the

least amount of clicks." And Diane told me she also used a similar approach with teachers, a different group under her support portfolio, "And same thing with teachers, you know, if you make things that are overly complicated or that you gotta scroll down at the bottom of the page to your right, yeah, teachers are never gonna look."

However, the biggest challenge for Diane in providing training with technologies for the teachers in her school was related to the different levels of proficiency they were at:

> And then I started to teach like Pro D days on like how to help my colleagues kind of come up in tech. They're the worst to teach. I stopped teaching them because you'll get a very advanced person and a complete technophobe. And they go like this, they go, oh, you lost me at step two. I don't even know... I don't even know.

Heather also talked about supporting teachers with technology and described the approach she took to help those not very familiar and comfortable with ICTs, "you have to step back too because, if you're working with people whose skills are not the same as yours, you have to remember what it was like; you have to remember going into this knowing nothing."

In the introduction of their book, *Cool Tech Tools for Lower Tech Teachers: 20 Tactics for Every Classroom*, Bender and Waller claim that "students learn demonstrably better when modern tech tools are used regularly and are well integrated throughout the curriculum" (2013, p. 7); however, they recognize that there are many teachers who do not feel comfortable using technology in their practice. Some of the reasons they offer for that is that some educators lack basic technology skills, which causes them to feel overwhelmed by guidebooks and manuals that use overly complicated tech language and assume that all teachers have a basic knowledge of technology. Similarly to what Diane and Heather shared, the authors suggest that teachers who are not tech savvy can benefit from an approach that recognizes all levels of proficiency with

technology and offer detailed, step-by-step instruction so that even beginners may feel comfortable exploring technology when they teach (Bender & Waller, 2013).

Organizing and Sharing Files

One of the characteristics of Web 2.0 applications is that they allow for the production, storing, and sharing of information (Virtanen & Rasi, 2017). According to Duarte (2023), the global generation of data has been increasing exponentially. The estimate in April of 2023 was that 328.77 million terabytes of data were being created daily, with videos representing over half of that figure. 'Created', in this context, refers to data that is "newly generated, captured, copied, or consumed" (Duarte, 2023, para. 5). It can be argued that an important aspect of learning in the 21st century involves understanding how files can be organized and shared.

When talking to Diane, she told me how it was not uncommon for students, and teachers alike, to get lost in the myriad of files they created and stored throughout a school year and how part of her work involved helping people develop data-organizing skills. She told me about the many files that students would often have in their online drives and described the types of skills she would teach them about:

> They have like a million of them, and then you're like, which one's your presentation? And so, we just go through the different features like, how do you use the recent, how you share with me, how do you make folders, what's a drive, how do you open it, where does it go?

Diane concluded this part of her interview by telling me how she also helped students develop skills that allowed them to share their work with others, which can be argued is a meaningful and transferrable skill (Hopper et al., 2023). She was telling me about how technology enabled

people to express themselves more authentically and then described how she got students to create quick response (QR) codes to their portfolios for a school poster presentation:

> I love having a poster that the kids make, and they put a QR code, and they record their voice. And then you go around, and you can get kids to, you know, beep with the iPad and they get a little one-minute speech from this kid. And there's just lots of different ways of just speaking your truth.

Digital Citizenship

In their paper entitled *Early Childhood Educators' Teaching of Digital Citizenship Competencies*, Lauricella et al. (2020) discuss the teaching of digital citizenship in elementary schools and reflect on how it can vary based on demographics and teacher experience. When reflecting about the important of digital citizenship education in schools, the authors state that:

> As technology access and use increases in early childhood classrooms and at home, there is an increased need to support students' understanding of how to be safe, responsible, and cooperative digital media users. While teaching media literacy in education has some historical context, it is only relatively recently that school districts have expanded their efforts to teach other digital citizenship competencies, including internet safety, media balance, and digital footprint. (2020, p. 1)

The BC Curriculum contains many mentions to digital citizenship and describes it in different places. It says, for example, that "digital citizenship implies recognizing the impact that new media has on ourselves, others, and the world", that it involves "using information and social sharing technology in a way that is respectful of self, others, and privacy laws", and that it entails "taking personal responsibility and behaving ethically and cautiously when using

technology" (British Columbia Ministry of Education, n.d.-c). Along those lines, UNESCO defines digital citizenship as:

> Being able to find, access, use and create information effectively; engage with other users and with content in an active, critical, sensitive and ethical manner; and navigate the online and ICT environment safely and responsibly, being aware of one's own rights. (2017, p. 6)

Diane gave a detailed account of how she taught a unit in the beginning of the school year on digital citizenship and how serious of a matter it was to her. She also reflected about attempts, usually without success, of trying to filter what students can do when they go online:

> I always start with a digital citizenship unit. Most important because, you know, we've gone through the debates about filters and etc., but my big thing is, it's like a whack-a-mole. You will never filter, you will never get. So, you have to start with morals and values definitely. And just looking at, that's the most important thing.

She also shared how she worked with supporting teachers on adopting a technology to use with their students. She talked about the recommendation she would often make that teachers should consider having a contract with students at the beginning of the year to help set boundaries:

> If I was a classroom teacher, I always recommend to do a digital contract. You can find lots of them online. Because, hey, if I'm going to let you go online, it means you have a responsibility to be a human. And if you break that value, then we have a problem.

Diane also shared how she worked in helping students be safe when going online and know how to respond to malicious content they may come across. One of the risks of engaging in online activities involves losing access to an account due to phishing, which Wen et al. define as "the act of deceiving people into divulging information or unintentionally installing malware on

their computers by sending the victim(s) counterfeit emails" and that this false "emails work by misleading the victim into thinking they come from a legitimate source" (2019, p. 1). Diane told me that she made sure to "always start with phishing. Phishing, making sure we understand where this came from." She also shared details of how she teaches about phishing, which involves asking students a set of questions:

> I've made a better slideshow about phishing to show, like, oh, did you notice: Dear customer. Well, if you're a... if I'm a customer, then they say my name. What do I notice about logos? What do I notice about sign ups? What do I notice about when I hover my mouse over at, what is the actual URL that pops up? What is the URL? So, there's just a lot of that kind of questions definitely.

Finally, Diane reflected about questions of anonymity and privacy. She told me she would set up the systems in the schools so that students would have to log in instead of being able to access platforms anonymously. She told me she put this in place to help students understand their responsibility when going online. She advocated for an ethical use of digital technologies in schools:

> Because when kids are allowed to be anonymous, what do they do with anonymous, right? They're checking holes in the fence; they're checking to see where they can get through. And so I just think setting up an environment that makes sense for kids and to teach them those pieces.

When reflecting about privacy, Diane emphasised how she tried to impart to students that it was an almost impossible thing to be achieved if one is using, for instance, a public computer. She described how she would teach students about what it meant to use a device that different people used:

> If you are on one of our computers, if you're on a computer at a public library, you should have zero expectation of privacy, so you need to make sure, or at a work computer when you get into the workforce. And so, making sure they understand the difference between public and private.

Heather had some input to share about the topic of digital citizenship but focused on a different aspect of it, namely how teachers in her school viewed it. What she told me permits a reflection about the BC curriculum and how teachers, in her experience, take it up. She started by telling me that there were many resources teachers could use to explore the topic of digital citizenship with students, but that that would often not necessarily be a central part of their teaching:

> Yeah, it's called control F. Excellent teaching resources, particularly centered around digital citizenship, digital literacies. I love that kind of thing, but I still feel that educators view that as a bit of sort of icing, if we have time – icing on the cake. Not... it's not meat and potatoes.

When expanding on the example, she told me that elementary and middle school teachers, in her experience, were more open to inviting her to do a unit on digital citizenship with their students than secondary teachers. Heather attributed that to the curriculum and to the reality that secondary teachers tend to stick more to it:

> Because I think it's hard to nail down those kinds of literacies in a curriculum sort of thing, and secondary teachers are much more attached to their curriculum and, well, you know, this is the content sort of thing, as opposed to, oh, you'd like to do a unit on digital citizenship? Sure, come on in. That's more... I get more reception to that at the middle level and elementary.

I then asked Heather whether the curriculum referred to the topic of digital citizenship, and she told me that reference to it was rather "embedded, you know, embedded. It's not explicit, but it is embedded in, you know, all courses, you know... digital literacies; we're talking about the core competencies and things like that."

It is important to note that the first reference the BC curriculum makes to the term digital literacy, when analysing it from kindergarten to grade 12, is in the description of the grade six Applied Design, Skills, and Technology course (British Columbia Ministry of Education, n.d.-b). It then makes more references to digital citizenship in the descriptions of different high school courses, such as Media Arts, New Media, and Computer Studies, to name a few. However, no reference is made to either digital literacy or digital citizenship in the curriculum of the earlier years. And these references, as suggested by Heather, are indeed rather embedded in the curriculum and not necessarily explicit. Most of the references I found when searching the whole BC Curriculum were found as extra information hidden inside expandable boxes and not in the body of the text. It is also noteworthy that Heather perceived elementary and middle school teachers as being more open to having units on these topics when compared to their peers in high school.

Teaching and Learning

Once basic operational and digital citizenship skills have been acquired, diverse pedagogical opportunities can arise. As argued by Raja and Nagasubramani, digital technologies can play an important role in enhancing teaching and learning practices (2018). For instance, ICTs can aid teachers in their delivery of instruction and make classes more fun, such as by creating opportunities for students to engage with learning while playing. For teachers and students who have a disability, digital technology can also serve as an aid in overcoming

potential learning barriers. Additionally, digital technologies provide the means by which many different genres and formats can be explored and produced, thus having the potential to contribute to students' digital literacy (Bazalgette & Buckingham, 2013; Coscarelli, 2009; Mangen & Pirhonen, 2022).

Moreover, there are other ways in which digital technologies can benefit teaching and learning, and different theories prescribe how teachers can incorporate technology in their practice. As discussed in Chapter 2, one of those theories is TPACK (Koehler et al., 2007; Voogt & McKenney, 2017); it suggests an integral approach to technology in education, in which content is taught alongside digital competencies, aiming at achieving a pedagogical purpose. Finally, in the absence of appropriate tools, teachers sometimes have to repurpose a technology, or pedagogically hack it, in order to achieve their pedagogical goals, which can involve subverting normative uses (Bullock, 2016; Smith et al., 2018).

Along those lines, this subsection will describe the examples participants gave me of uses of ICTs in the classroom for the purposes of teaching and learning. It discusses how participants used digital technologies to deliver instruction and make their classes more fun and engaging and to advance their students' literacies; it also includes examples of how the educators tried to adopt an integral approach to incorporating technology in their practice. It will also present examples of creative uses participants made of technology to be able to enact their pedagogy, such as by using a slide presentation software to create student portfolios and the taking apart of a 3D printer to understand its inner workings.

Technology-Enhanced Teaching and Learning

Raja and Nagasubramani state that the "role of technology in the field of education is fourfold: it is included as a part of the curriculum, as an instructional delivery system, as a means

of aiding instruction and also as a tool to enhance the entire learning process" (2018, p. 34). When reflecting on the benefits of technology for learning and teaching, they include a list of applications that can be used to enhance a class by helping students understand concepts with more ease, such as "digital cameras, projectors, mind training software, computers, Powerpoint presentations, 3D visualization tools" (2018, p. 34). They maintain that these options can also make a class more fun and create opportunities for student participation. Hence, this subsection will discuss how participants described using technology to enhance their teaching and how it positively impacted student learning.

Presenting and Interacting with Content

David had a few examples to share of how he employed technology when teaching, and the first one had to do with his using it during classes to present and interact with different types of content. He described how he creatively explored the whiteboard and used technology to include different multimedia formats to engage students with the content:

> I enjoy projecting onto the whiteboard and annotating the things I'm projecting with a whiteboard marker. I found that to be an interesting way to engage with websites or other digital media. As well as I can project games to the class that we can play together. So, that helps mix things up in the classroom a little bit. And then also playing music and videos courses as well to change things up also.

Along those lines, Heather, during one of her interviews, referred to a period in her teaching when it became possible for her to bring a myriad of authentic resources into her classes by using digital technologies and how that was a turning point for her, "All of a sudden, I'm able to, you know, play authentic content and primary sources on like the BBC, like language websites, and use that in my teaching. So, I would say that was a good turning point for sure."

Making Learning More Personalized and Fun

In a different example, David told me about how technology allowed him to materialize what he believed education to be. His philosophy around education was that it should be personalized, that it must create space for students to pursue their passions and express themselves. According to him, technology can help with that:

> Every student has their own learning journey, and so technology has such a great way of adapting to a student's personal learning journey. So, for this student, they might want to be creating videos and be using YouTube. For this person, it's Twitter. And for this person, they're recording and listening to podcasts.

David said that this approach also allowed students to take ownership of their learning. By providing students with guidance and space, David shared he was trying to make sure their education would be authentic and long-lasting. In that direction, Diane shared an example in one of her interviews that also speaks to the contribution technology can make to one's learning, making it more personalized:

> I mean, you can do these things with paper, and pen and paper, but they don't look as glitzy. You may not have learned as much; you may not be participating in a global conversation. I just get so excited about the democratization of information and the ability to access anything and to learn anything. You know, like I just learned how to crab on YouTube.

In addition to having the potential to make learning more personalized, digital technologies can also add a layer of fun to it (Raja & Nagasubramani, 2018), and Diane shared two examples that go in that direction. When teaching about technology, especially when it came to working with younger students, she expressed, at different moments during her interviews,

being cautious not to overload them with too much information. And to make her approach more fun and engaging to students, she mentioned she would focus on play:

> So, it's like, you know, first I always go in, let's play with this. How do we do... like let's say introducing Google slides, let's play. Where's the fun? Let's have fun with fonts. So, it's like using play to kind of explore a program before you dump the content, otherwise you're, you know, you know the overload.

Diane also described a project done by teachers in her school that involved students reproducing the school building and grounds in Minecraft, a popular block building game. While having fun by playing it, students got to learn about scaling and representation and developed computational abilities, especially by exploring tridimensional content creation by using a computer mouse, "but then I have other teachers who are redoing the size of the school; they're redrawing to scale like in Minecraft. So, you know, here is the thing full to scale Minecraft version of the school."

When discussing play pedagogies and how they can be intertwined with technology education, Roberts and Knaus (2023) start by listing essential elements of play. According to their literature review, play has been identified as being an activity that is meaningful, symbolic, self-directed, active, pleasurable, voluntary or self-chosen, process oriented, and adventurous and risky (2023, p. 276). Using play to teach children appears as an alternative that draws on children's interests and can help them have a more meaningful educational experience. According to Roberts and Knaus:

> When these elements of play are focused on providing learning opportunities, the positive aspects of play can be integrated with children's natural patterns of learning and development. Play is also complex in the categories of play which children progress

along as they grow and develop and can engage in more conversation and longer periods of concentration as well as develop social skills to interact with others. (2023, p. 276)

Assessment

David also talked about how he used technology for yet another purpose that is an important part of education, assessment. He told me how ICTs helped him assess his students' learning and make evaluation practices more participatory. By working with digital portfolios, for example, he told me that he would use the comment feature in the platform to start conversations with his students about the pieces they had added to their collection. He reflected on how this approach was iterative; students were able to revisit concepts and reflections as opposed to single try approaches such as quizzes and tests:

> And they'll learn that through those conversations. So, I really want to see growth from students, I want to see their thinking change by the time the course ends. And it's through those conversations and their reflections on what they're including in their portfolio that that is revealed by. So, if they tell me they're trying something for the first time, that is considered when it comes to giving them their grade. And that's a sign of growth; you're trying new things, you're thinking about it, or maybe acknowledging the things that didn't go well.

Accessibility

Diane had an accessibility perspective to share about technology and how it could help students with diverse learning abilities. Speaking from her own experience with dyslexia, she talked about some examples of assistive technology and how it could be set up:

> It's reasonable that there's text to speech; it's reasonable that there is different apps and stuff that you can download. For example, I use something called BeeLine reader. And

> BeeLine reader, I'm dyslexic as well, it just changes the font on the computer to green, to blue, red, and black. And it just does it in a certain way that I can read it much faster than if I can if it was all black. So, I, you know, take a differentiated approach, but that's what it means giving kids with difference the ability to use that same computer, have the environment setup the way they need to have it set up, and a teacher who knows what adaption accommodation looks like.

One of the issues in this approach was that the devices available for students in schools often did not include those pieces of assistive technology installed in them, and she told me that getting them approved by the district to be used in schools involved a long and complicated process. A solution she proposed was for students to bring their own technology to schools. Although simple, that did not seem to be a reality in her school yet:

> And also bring your own device, BYOD. I think there's a place for it, especially kids who have neurodiversity where they can like set up their own computer and kind of have everything that they need, their programs that they need, their little adaptions that they need. I think we need to have that a bit more normal because kids... we're not there yet, where they're bringing their own devices.

Literature highlights different benefits of the BYOD approach, especially to students with a disability. As per a study by Armstrong (2022) in a Canadian context, as technology becomes more ubiquitous and more and more students and teachers have their own device with them in class, students who historically needed assistive technology are less and less being singled out. Additionally, these students are now being able to share the expertise they have acquired along the years with their peers. In addition to contributing to the overall technology learning of the entire class, this opportunity has also been working as a motivational boost to these students.

Promoting Digital Literacies

Similarly to non-digital technologies, such as pen and paper, ICTs allow students to express themselves by means of the written word; however, digital apparatuses also provide additional opportunities for information to be represented and produced, such as by means of images, audio, and video (Bazalgette & Buckingham, 2013; Coscarelli, 2009; Ribeiro & Coscarelli, 2010). Having digital literacy proficiency can also entail being critical about what one reads, sees, and hears online, being able to detect power structures and biases. Thus, this subsection describes how participants approached digital literacies work with their students and the strategies they said they used to help their students have a more critical perspective of what they may have access to by means of using ICTs.

Expressing Oneself and One's Learning by Means of Text, Images, and Audio

Participants, David especially because he taught English, shared different stories about how they worked in developing their students' literacy. They mentioned computers and digital devices were usually part of their teaching in that area and expressed an understanding about literacy that aligns with the discussion presented in the literature review chapter in this document, more specifically in the section about digital literacies. David told me that working with digital portfolios was something that helped him develop an awareness of the process of one's learning during his time in teacher education. Because his experience with portfolios was positive, he decided to use them with his students as well. He told me in detail how that work usually started with a literacy check in the beginning of the school year:

> So, making that explicit happens towards the beginning of the semester when I collect like a baseline from them. We might do an assignment related to reading comprehension that's kind of taking in someone else's words and how do they do with that, with the

> reading and understanding the points that that person is trying to make with their words. And then I'll also collect a baseline for the students' written outputs. So, how did they express their ideas and use words to help other people understand what's happening in their minds. So, once I have that, that really guides the remainder of the course and how each student's portfolio takes shape.

David shared that his teaching involved helping students enhance reading and writing abilities, which represent more traditional forms of literacy. However, he also recognized aspects of digital literacies by working with different formats, such as images. He told me about different platforms and how he included them in his practice, "I think it's called Story Bird. And it's a way to make picture books with beautiful art and everything" or "something like Canva, which lets us make these beautiful images and infographics and things like that." He told me how positively surprised his students would get when knowing they would have the opportunity to develop their literacy skills in formats that go beyond the written language, "and certainly my visual artists, who that's their identity as well, they jump onto that. They're like, whoa, I get to do this in an English class? That's great!" The literature review chapter in this document discussed how digital technologies allow for the exploration of formats that go beyond the written word, such as audio, video, and images, and an example George gave me aligns with that understanding. This example is especially interesting in the sense that not only did he value images but seemed to prefer them over written text when asking students to submit assignments:

> I would say I'm more interested in the visual with students than the written. I've read essays like, and I can do it; it's fine. I'd much rather look at their drawings and their sketches and help them through with developing those ideas.

In addition to including the written word and images in their literacy teaching, participants also talked about audio content. The topic of podcasts, for example, was something that most interviewees talked about. David shared that podcasting is a genre that not all his students were familiar with, but that he tried to include it in his teaching to explore a popular genre, one that students might be required to produce at some point in their lives. He was glad to share how that played out:

> A popular one is students will have not experienced a podcast; they won't have listened to one. And when I show them that there are really great baseball podcasts or really, you know, there's podcast on every topic, I've had a lot of success with students adopting that into their lifestyle, when they're on the bus or whenever they're checking that out. So, that really aligns. So, that variety of platforms and activities and kind of skills that are being used to learn how to use all of those and express themselves with those.

It seemed clear to David that literacy work in the 21st century involved exploring different genres and formats with students. This aligns with what the literature suggests, that students should be exposed to different genres, digital and non-digital alike, and should learn how to make sense of the messages they can communicate and how to express themselves by using those genres (Bazalgette & Buckingham, 2013; Coscarelli, 2009; Silveira et al., 2012).

Heather also mentioned podcasts and gave me two different examples. In the first one, she described a student and the work they did in producing a podcast series about climate change for one of their classes. Heather's role involved supporting the student with access to the recording studio and helping with inviting and scheduling guests to be interviewed:

> For example, this lovely grade 12 student in our climate change class who I've been working with. For their final project she wanted to do a podcast, where teachers

> encouraged it. She wanted to interview somebody from Indigenous education from the board office. I got that all set up.

Then Heather told me how she prepared to help students with podcasts, which entailed learning how to create a podcast herself. She explained she was a listener of podcasts and would be comfortable with the writing part of it. However, it was the technical aspect of it that was new to her, such as how to use software that allowed for the recording and editing of audio. George, as one of the technical support persons in School A, played a very important role in it:

> Because this is in my space, I need to have more expertise in it. So, hopefully next year I'm going to do my own podcast series, and I've already started creating a list of who I will interview. But I need to sort of get... dig in there and really learn how to use GarageBand and experiment with it and see what I can do. I do listen to podcasts, so I know what sounds good. The writing part and the talking part, those are easy. For me, it's going to be the technology, you know, learning how to integrate my music and, you know, learning how to delete "ums and ahs", and make a tighter sort of recording.

Critical Literacy

More traditional approaches to literacy have historically focused on the cognitive acquisition of skills of reading and writing and tend to see written material as neutral, which Street (1995) defines as a characteristic of the autonomous model of literacy he proposes. When reflecting on Street's work, Larson (1996) argues that the autonomous model of literacy subjugates learners and prevents them from being able to critically analyse the social and political context behind what they read, watch, and listen to. She concludes by saying that, "if literacy is represented as a context-neutral skill, then it fulfills the political purposes of those in power to maintain a position of superiority by marginalizing other forms of literate knowledge"

(Larson, 1996, p. 440). The ideological model of literacy proposed by Street, in turn, "is conceptualized as a critical social practice that makes explicit underlying assumptions and power relations inherent in conceptions of literacy as social process" (Larson, 1996, p. 441). In other words, literacy goes beyond the acquisition of cognitive skills; it "locates reading and writing in the social and linguistic practices that give them meaning (Larson, 1996, p. 441).

The ideological model of literacy proposed by Street (1995) aligns with yet another concept of literacy, namely critical literacy. Vasquez et al. (2019) describe that critical literacy "focuses on the interplay between discursive practices and unequal power relations – and issues of social justice and equity – in support of diverse learners" (2019, p. 302). When reflecting about digital technologies and how they have caused scholars to redefine concepts of literacies, the authors argue that "young people are grappling with the traditional demands of academic literacies while simultaneously interrogating "fake news" and managing their everyday life worlds, which are increasingly crowded with dynamic digital doings" (Vasquez et al., 2019, p. 300). Although I did not ask participants about critical literacy per se, Heather had an example to share that relates to it.

She referred to using the CRAAP Method with students to help them evaluate online resources. It is a method commonly used by teacher librarians, which "encourages the user to perform an in-depth analysis of the website to determine its credibility" (Fielding, 2019, para. 2). It stands for Currency, Reliability, Authority, Accuracy, and Purpose. Heather described her experience using this method with learners:

> We even have a fun thing we teach the kids when they're evaluating resources. It's an acronym or whatever, CRAAP, and it's called the CRAAP method. And you actually say,

you know, authority, so, you know, who's the author. Accuracy, you know... what's the P? See... oh, currency, is it current? Relevant, those kinds of things.

She concluded this example by reflecting on how the number of resources available had increased exponentially due to technology and that being able to tell what was reliable or not was more and more part of her work as a teacher librarian, “there's as many resources as there has been ever. But with experience... so that's maybe how mine has evolved is, I am able to zero in more on what is crap and what isn't.”

Integrating Technology, Pedagogy, and Content

TPACK was described in the literature review chapter as a theory that advocates for an integral approach to digital technologies in education. It understands that technology, pedagogy, and content are part of a system, and that they should be taught together in teacher education programs (Koehler et al., 2007; Voogt et al., 2013). It originated as a response to an approach that would focus solely on the acquisition of static technological skills by teachers, which has several limitations (Koehler & Mishra, 2005). Although TPACK was not mentioned by participants in their interviews, indirect reference was made to it. Participants did demonstrate an understanding that technology in education was part of something bigger and that it should not be taught alone or just for the sake of teaching it.

When describing how she assisted teachers in her school select educational technology to be adopted in their courses, Heather told me that she would often use an approach that did not focus on the technology itself but rather on the pedagogical needs of the teachers. She shared some of the questions she would often ask her peers:

Well, what is the end goal here? What do we want to do? And, you know, what is the best technology for that? Not like, oh, here's this new website or this new app, let's play with

this. Well, you know, what is the best way to teach this, and what is the best tool out there?

Heather complemented that by telling me this approach also aligned with a directive that came from her district, to motivate teachers to start from the pedagogical need and then select a tool to be used and not the other way around:

> And he always has said to us, you know, don't just use technology for the sake of using technology; make sure that it is actually fulfilling the needs that you have. You know, what is it that you want kids to learn or skill to have? Okay, then what tool fits that? Not starting over with, oh, look at this new game or toy or tool and trying to integrate that.

She concluded by saying that having an integral understanding of pedagogy and technology could take time and that experience in the job could give someone the confidence to do that:

> But I think as the further a person goes along in this career, hopefully the more confident you are, the more comfortable you are in your pedagogy, so you are able to add in these new things, whether it's technology or, you know, new pedagogies.

Diane also reflected on how she adapted her approach over the years to focus not solely on the technology aspect but on what technology could be used for. She told me she used to offer workshops for teachers on different technologies, such as PowerPoint and Microsoft Outlook, and how that not always went well; it would cover too much information and content retention was very little. She told me her more recent workshop descriptions included things that could be done with the tools instead, such as creating multimedia presentations with PowerPoint. This is what Diane said, “so now I don't teach those courses anymore; I teach advanced something, or like beginner something, but I don't just teach tech.” An emphasis on what technology can be used for is something David also referred to when he described some of the topics covered in the

technology training offered to the students in his school, “some of the basic things that help students use computers in a variety of ways to help them solve problems that come up when they have a project or an assignment.”

Making and Hacking

Studies show how teachers often need to, in the absence of a specific technology, adapt software applications to be able to implement their pedagogical goals (Fu et al., 2018; Hopper et al., 2023; Sanford et al., 2023), which can be referred to as pedagogical hacking (Smith et al., 2018). Additionally, the work with technologies in schools, especially one based on maker pedagogy principles (Bullock, 2016), allows students to think creatively and overcome established restrictions and standardised uses of ICTs. The participants in this study had a few different stories about creative and disruptive uses of technology both by them and by their students to share.

David told me how he and colleagues at his school experimented with using Google Slides with students to develop electronic portfolios. In the absence of a specific tool, or because the tool that was available did not give them what they needed, they curbed a more traditional or intended use of a presentation application to enact their pedagogy, “That is software designed for presentations, but it's also a useful place for students to track their learning, to reflect and journal, and for me to keep an eye on that work and comment on it as they go.” Although doable and helpful, David told me this experiment was not simple to develop and required an advanced level of comfort with technology:

> But as soon as you start collaborating or blending software products, you run into issues where I need to get this file into a different place, or I need to have another user be able to access this file. And as soon as you start to kind of bending the rules of these software

> programs a little bit, you need that understanding of file directories and of user accounts and things like that to have it be smooth.

David attributed the feasibility of this project to his familiarity with the back end of computers, which he developed during his early experience with ICTs.

For those who lack this advanced level of skill, on the other hand, maker pedagogy appeared as an important way to get there. Diane gave an example of the use of BBC Micro:bit bots (Micro:bit Educational Foundation, n.d.) in her school. She showed me one of the bots over our Zoom call and explained how it worked, emphasizing how simple it was to operate:

> So, it plugs in and then... every kid in grade seven in England is given one of these, so that's why there's tons of code that you can download. So, I get kids... like this all lights up; their name will go across, I get them to do their name. We've also done as a step counter, we've also done blinking light. Sometimes we'll play a video game with the buttons on here. And all of these super easy are on the BBC site, and you just like download.

Diane told me the work with these bots helped students see what happened behind the scenes, which contributed to the overall understanding of digital technologies. This idea aligns with the discussion presented in the literature review chapter, that people can get a more thorough understating of technological apparatuses by engaging with pedagogy that allows them to make things (Bullock, 2016).

Along these lines, George had some examples to share. He told me about his work with a specific type of robot with his students, “So, yeah. I mean, there's something in robotics called Frankenbots or, you know, you can piece together all these different pieces of technology. And I think that kind of exploration is very useful to students.” He explained how he used that

approach to develop disruptive thinking in his students and how we would tell them that "you have two components that you could maybe bring together in a way that no one else has ever done or thought about." He went on to say that this type of conversation had allowed his students to come up with creative ideas:

> Well, you look at the application of technology, like a 3D printer, and you start to think, geez, it's pushing out this material that solidifies like, what else could you do with that sort of concept, right? And then, you know, we talk about how they're scaling that up and making houses, and they scale it down and they make chocolate that way. I had one student, group of students who thought, oh, let's use it to reprint the tire treads for a tire so you are not replacing the whole tire, you're just replacing that. Like, that is great. So, just thinking about how technology can be repurposed, for sure.

In addition to the example from his 3D printing class, George also shared an example from his robotics group:

> And same in robotics, like you could, you know, if your robot is going to pick up a ball, generally everybody thinks, oh, like the hand; just pick it up, right? Like a claw almost, right? A grabber. And I had this other group who developed a wheel pull, a system that basically the wheels pulled the ball into an area and then went and dropped the ball somewhere. And I was like, that's great! You know, that's kind of disrupting the whole claw grabbing mechanism, and it was very successful... that design.

However, George also shared that getting to this point with students is not always easy. He told me there was always a chance that things could go wrong and that students were not always prepared for a more disruptive educational approach:

> If a student thinks, hey, what if we did this with that technology in, you know, a disruptive way? Like, I would be supportive and encouraging of them exploring that, even though it could be a complete failure. You know, like, let's see what can happen here. It's speaking of risk taking, like disruptive thinking is very much that, right? And some students are shy about that or not sure, or maybe cognitively not ready for that, because it is like I say, out of the box!

George ended this sequence of examples by telling me how he got ready for those classes, which often involved taking things apart himself to learn how they work. He said this was how he often prepared to teach, "I've taken 3D printers home and taken them apart and put them back together, and, you know, you kind of need to know how to do that if you're going to run the lab."

Looking Beyond the Classroom

ICTs have been deemed an integral part of many aspects of life in the 21st century (Haleem et al., 2022), and the BC educational policy contains references to developing digital competencies in students that can enable them to fully participate in society (British Columbia Ministry of Education, n.d.-a). Digital technology can help teachers in their delivery of instruction and students in their learning trajectory, but it also applies to activities students do outside of the classroom on a personal level and tasks they may eventually perform in the future for professional purposes, such as posting comments on social media platforms and collaborating with future coworkers. Along those lines, this subsection describes strategies participants shared they used with students to prepare them to proficiently use digital technologies outside the classroom, with a focus on activities that have an explicit real-life application.

Real-Life Applicability

In their reflection about the role of digital technologies in education, Haleem et al. maintain that "technology is pervasive and intertwined in many aspects of modern life and society" (2022, p. 276) and that teachers, when teaching students about ICTs, should consider real-life applicability. The BC Curriculum also demonstrates a similar understanding. In addition to referring to the role of technology inside classrooms and how it can enhance student learning, it also contains reference to preparing students for life in the 21st century, "[s]tudents need opportunities to develop the competencies required to use current and emerging technologies effectively in all aspects of their learning and life" (British Columbia Ministry of Education, n.d.-a, para. 39).

Participants expressed an understanding about the applicability of digital technology outside the classroom and how it can prepare students to better navigate a reality that is more and more permeated by ICTs. Heather told me that was often a conversation that was had with the students in School A, "but we just explain to kids this is part of the process, this is part of the world you live in now." Diane, in turn, when reflecting about a project by a teacher she considered a clever idea, explained how they would use their work with digital portfolios to develop in students a sense of real-life applicability. One of the features Diane told me the teacher used was the comments feature to have students provide feedback to one another, which is something they might do outside the classroom when navigating social media platforms. Diane concluded by saying that:

> And again, you are preparing kids to be part of a digital world. What makes a good comment? What is a bad comment? So, it's like re-enacting these life, real-life scenarios,

like building a website, like posting and commenting. You're preparing them for a world that's current rather than not.

David, from all four participants, was the one who had more to say about this topic, especially because of a very complex project he did with his students every year, which involved students taking on real-life roles. This is how he started describing the assignment to me:

> So, my favorite way I use technology is in my New Media Class. I do a class wide collaborative inquiry project. And what I do with this is I imagine that all of the students in my class are an advertising company. So, I've given them that as kind of a prompt, and then we have to say, well, what are the jobs at an advertising company? And there's a lot. There's copywriters, there's researchers, there's people who run social media accounts, there's visual artists, and then there's like some management – there's people to coordinate all of this. So, they choose their company and they choose their role, and then we coordinate all of this is in an online collaboration tool.

David also told me how he would explore this project pedagogically and try to align his assessment with real-life evaluation practices that often took place in companies. He explained how he would make assessment feel like a conversation and intervene if he felt students were going off track or having a hard time focusing on their tasks:

> So, there are performance reviews as we go through, like at any company. I'm going to check in with them and just ask them, oh, what made you choose this or that? And, you know, that conversation is the assessment part. Or I can add structure to their job as well. I can come over and say, okay, by the end of today could we have like, you know, four sentences about this company that's really going to help sell this.

David concluded by telling me that this project was a source of pride to him as a teacher, especially because it allowed him to see his students fully engaged with a school project while taking ownership of their learning:

> And then in the online space, it's so vibrant. Like, they really take it up, take ownership of it, and they really want to create something good. And it's just so much learning that happens. And I am not doing any of it. Like, I just gave them that space and that goal, and they go for it. And it's a really.... like, I'm very proud of that, because of all of those benefits, lots of them that I didn't know would happen.

Student Collaboration

One of the many characteristics of digital technologies is that they allow users to collaborate, which often results in mutual learning opportunities (Su & Zou, 2022). And the project David did with his students, discussed in the previous subsection, also contained elements of collaboration. In addition to describing roles students took on and how assessment played out in the project, he also told me how he aimed at fostering collaboration among students:

> So, we'll use something like Slack, or a platform like that to collaborate, to... when the visual arts team is done a piece of work, they can send it over to the copywriters to put their words on top of it. And then my web developers are ready to upload that to these company websites. And so, then two of the students usually are in charge of that Slack space as so they kind of work to facilitate and say, hey, you know, these people are waiting on this piece of work, what's its status so I can update them on it?

He expanded on the pedagogical aspect of this project and shared how it impacted students positively because they were given the opportunity to collaborate. David told me he could see a

change in behaviour in his students. The project gave them inner motivation to start working and the push to make new connections with other students in the classroom:

> And the times that I've run that inquiry project, I've come into the room and they're already working, which doesn't ever happen! I've also like had almost nothing to do other than walk around and check, but the students are getting up to run over, to talk to someone else who's working on the other side of the room, maybe a person they wouldn't normally talk to. But, because they're collaborating and they're both responsible for this one thing that they, they need to do that.

David concluded by telling me that the project also contributed to students' sense of advocacy for their own learning. Not only did they get motivated to do their work from collaborating, but they also had suggestions of which platforms to use to better collaborate among themselves:

> I said, yeah, let's use Slack, and, and we'll collaborate on there. And my two "Slack administrators" came to me 40 minutes later, and they said, this is garbage! Let's use Glip instead. I said, what's Glip? What is that? And so, they showed me and said that they would rather use it. So, of course, yeah, use that then if you think it'll work better; it seems to have the same functionality. Let's try it out! What initiative for those students to advocate for themselves and say, we'd rather use this than that. That's awesome! I love that! And then they're going to have more ownership over that learning, and it'll be like something they came up with that they're getting to use. So, yeah, that's great.

Along those lines, George told me about one of his classes and how his students learned from one another because of his fostering of collaboration in his class. He said this approach not

only promoted mutual learning opportunities, but it also helped him teach a group that was not homogeneous when it came to their level of familiarity with computer languages:

> But it's very interesting in Robotics when you have students coming in with all kinds of different backgrounds. Some students have no idea how to program anything. And you have some students who know how to use three different coding languages, and you're like, oh, my gosh, how am I gonna...? So, you kind of.... you work your way through and give them as many resources and the best instruction possible, and they actually learn a lot from each other in that course as well, which I love.

Incentives and Barriers

After presenting participants' personal and educational trajectories with digital technology and discussing the work they did with it in schools, the last section in this chapter will focus on some of the conditions at their place of work. It highlights the participants' perspectives about their schools and discusses how access to technology, peers, schools, districts, and professional development affected their practice by either enabling or hindering it.

Access to Technology

The COVID-19 pandemic reignited discussions about a topic that has been addressed historically in the field of education, i.e., access to technology (Tadesse & Muluye, 2020). UNESCO reported that the global pandemic caused 87% of the schools in the world to close and, in response, launched a coalition to make sure students would continue to have remote access to education, especially those in poorer countries and in situations of vulnerability (UNESCO, 2020). Similar to more traditional literacy practices, which require pencil and paper to be materialized, digital literacies are only possible by means of apparatuses that enable them (Mangen & Pirhonen, 2022). Participants in this study talked about technology availability and

internet connection reliability in their schools and how these aspects contributed to their work when available and how they could get in the way when not available or not properly set up and used. They also talked about strategies to overcome shortage of equipment, shared considerations about funding, and described what they considered an ideal setting.

Equipment Availability

When reflecting on what teachers need to be able to teach in our day and age, Diane said, "what do you need to teach in the 21st century? You need to have a good Elmo, a good projector, a sound system. And if you don't have those pieces, it's really a struggle to teach." Along those lines, David confirmed that he had "a computer and a projector. So, a nice thing at our school is every class has a computer with a projector. And I found some creative ways to use that, but that's just from my perspective and delivering content." Although having access to those pieces of equipment as a teacher, David shared a contrasting reality when talking about access to technology by his students, "the biggest barrier is access to technology. My school has a half dozen Chromebook carts and one accessible computer lab. And it's very limiting as far as scheduling." He concluded by expanding on how the scheduling system was set up and how it did not necessarily help him:

> Having to schedule computer time a week in advance doesn't give us that flexibility and adaptability to just hop on to the computer and, you know, add something to our portfolio or write a reflection, or whatever it is we need to do. So, I try and book the library space, which has computers in it as often as I can, but sometimes you don't have access to it. And so, in that case, yeah, we're in the classroom, pen and paper.

What Heather told me about her school resonates in part with what David described. Her schools seemed to have more equipment available, but the booking system did not seem optimal:

> We have two carts of 15 each that are the library Chromebook carts that teachers can book out on a schedule, and they are also used if I have a class in here and they're doing research. So, I have to scoop those because if they're not just automatically here if a teacher has already booked them out and I'm teaching a class, then I'm out of luck. So, yeah, that's, well, that's our lab basically.

Heather expanded on this topic and explained how her school also made computers available for students to sign out. She told me those devices were in high demand and that she would spend a lot of her time signing them in and out, which, according to her, was not the best use of her hours:

> We also have another 12 Chromebooks that were purchased in December, and those are what I sign out on an hourly basis, every block. So, four blocks a day and lunch hour and after school. So, they get heavy, heavy use. And then I have a cupboard full of Chromebooks that I loan out. Like if we have an international student that's here in the building, who did not come with a laptop and their host family doesn't allow them to use a computer or they don't have a computer, they get permission from the administration to sign out one for a semester or a term or whatever. But I do spend a lot of my time signing in and signing out Chromebooks, which I think, wow! I have a master's degree and 30 years of teaching experience, and you're going to pay me to sign in and sign out Chromebooks? That's an issue.

Diane also talked about the reality of bookable equipment in her school and how the sharing of it was not always smooth. According to her description, they had a system in place that depended on each person doing their part by making sure equipment was returned to the proper location and put to charge. However, she told me that was not always the case:

> Ideally, it would be, you have number 28; make sure number 28 is plugged in whatever. But that is not what happens; classroom management will depend on the teacher. And so some teachers stand there like a hawk and then they plug in and they plug out, and it's respectful. Because when you are respectful of the device, it bleeds into everything else you do, right? And then when they aren't, you know, you got a lot more management problems on your hand.

She continued to tell me she had to intervene because the system was not working, but that that caused her to be in a difficult situation with some of the teachers in her school. The solution was to acquire more carts with computers and devise a system in which fewer teachers would share a cart instead of making them available for all teachers in the school to book:

> So, I was taking the scheduling on, but I couldn't. I mean, my heart broke; I was getting into disagreements with staff. So, it really... I had to let it go and just get enough carts where most people have one cart for two or three classes, and they have found a co-teacher where they're... they don't go crazy on.

Bring Your Own Device (BYOD)

One of the alternatives to the lack of devices for each student that participants talked about was the 'bring your own device' (BYOD) approach, which involves asking students "to bring their own devices to be used for teaching and learning purposes" (Hakami, 2020, p. 119). Although this strategy can help teachers get around access limitations due to lack of funding (Hinkel, 2014), it also brings with it its own challenges. On the one hand, it can involve an equity issue as some students may not own a device they can bring to school. On the other hand, students may be tempted to use their personal devices for purposes that do not align with class work, which can conflict with school policies. Along those lines, David told me that:

> Students have devices and the school does have Wi-Fi, but, I have done some, you know, hey, go to this website on your on your phone or let's play a game and you can use your phones to play along; and that works. I will always have maybe one or two students who their phones are out of batteries, or they don't have one, or they're using it inappropriately.

David reflected on how personal devices, such as phones, would work as an alternative for some of the things he wanted to do in has classroom. However, he also shared how some other more complex tasks could not optimally be done by using pieces of technology that have small screens and keyboards:

> I've had students on their devices collaborate on Google Docs. Say we have a project and I don't have a computer lab and the Chromebooks are all booked, I'll say, okay, well, you can get into, you know, get the slides app on your phone and you can collaborate that way. And it's so hard to do on a phone; it's not really a good environment to work. So, I think students need a bigger screen, they need a proper keyboard.

When talking about student access to schoolwork at home, which involves having to make do with devices they might have available, Diane expanded on the issue of equity of access:

> I think we need to be very cognizant as well about that one in four kids in my district live in poverty. I think we have to have that conversation that maybe some kids can't do it at home. Looking at like loan systems for those kind of inequity pieces that they get a computer. So, if you're asking to me, if you're asking for kids to do homework at home, you have to make sure that there's access for every kid. So, I feel that that is kind of a big barrier.

What Diane shared is in line with a report by Statistics Canada, which showed that, although access to digital technologies has increased nearly 5% in the country in recent years, 18.9% of the population still fell under the 'have not' side of the digital divide (Statistics Canada, 2022).

Funding Strategies

According to what participants shared with me, it all came down to funding to make sure technology was available in their schools. They did share some stories of success in securing those funds and, additionally, some alternatives when availability was scant. For George, whose work with robotics entailed having access to expensive equipment, it involved being strategic when asking for funding. He told me that making the correct move and at the right time was a strategy he employed:

> So, with robotics, it's interesting because it's getting into the obsolescence of technology. Because we have bot kits that are getting old now and we need to refurbish them, and they cost a lot of money. So, there's that piece as well. I'm mindful of that and try to navigate as department head, like, how can we purchase new kits to refresh what we have? And often, when you work in the technologies, you're sticking out your hand saying, I need more money for this. And I get support from my current administration, and I'd be careful not to overstep, you know, with the demands, keep it appropriate and clean. That's also nurturing relationships too with administration.

For Heather, in turn, it revolved around her operational budget and the limitations of it. She expressed she would like to be able to do more but that she could only do so much due to financial constraints:

> Money! Money. Yeah. You know, I mean, if I had more money, I would be perhaps getting, you know, I could pay for Curio that's not out of my budget and buy other

resources for the library. I'm still working on winning the staff over with our subscription to curio.ca, which is a CBC streaming platform, and it's $1,500 a year for a school like this, and I took it out of my budget this year because nobody else would pay for it.

However, she also shared some alternatives to securing funding, such as going to the parents advisory committee counsel and other one-time opportunities. She told me a story about a student who wrote and was awarded a grant that resulted in a reasonable funding for the school:

> And I think I told you we had a student a couple of years ago who won a grant from Staples for this school, like applied for and was granted a $10 or $20,000 grant. And you have to buy things from Staples for your school. So, that was the impetus for all of this. So, all of this recording equipment that we have, and, you know, we have tripods, and MacBook Airs, and professional quality microphones. Oh, my goodness! So, all sorts of stuff, and that was from a student.

Ideal Conditions

Finally, I asked participants about the tangible and intangible means that would create the ideal conditions for them to do their work with digital technologies. David told me that he would really appreciate it if each student could have access to their own computer whenever they needed it, without him having to schedule a room or book devices. He also pointed to the importance of having reliable internet connection:

> Ideally, students would have access every day. Because my course is structured so that we can be working on different things at different times, and students are working on all kinds of different things at the same time. Each class would have its own Chromebook cart or laptop carts that we could use that at various times, and the school would have a really great Wi-Fi to support sharing and collaboration and some heavy-duty usage. That

would help the most, I think. Just so that it's available, so that as moments arise during my class where it would be helpful for students to have those devices, they're just there. You asked about a perfect environment, so let's just have their desktops be computers as well with a screen and a keyboard right there. Wouldn't that be nice?

For Heather, it came down to limitation of space, especially in the learning commons. Of all seven interviews I did, only one was in-person, and it took place at School A. While in there, I had the chance to see the space Heather worked in, and she could show me things around a bit. While thinking of the ideal set up, she pointed to different parts of the space and told me that:

> So, if it were perfect in here, let's see, I would have all the book rooms cleaned out and a second recording studio in the back book room. And so, yeah, I mean, if money was not an object, I would have murals on these walls, I would have, you know, at least 12 good, high quality desktop computers. Well, this particular space probably needs more space. They moved a whole bunch of old desktop computers out of here because of space before I got here, and the person I replaced, he fought to keep desktop computers in here. But he lost the battle. So, partly because of space in here, partly because of space.

Human and Institutional Factors

In addition to reflecting about access to technology in their schools and how it could affect the work they did, participants also talked about other conditions that either created possibilities or added obstructions for them to enact their pedagogy by using digital technologies. This subsection describes some of those conditions, such as peers and their varied educational understandings and practices, schools and their expectation of teachers, and districts and their role in approving tools and offering support, training, and resources to teachers.

Peers

This subsection discusses the role of peers as enablers and, in some cases, inhibitors of conditions for participants to do their work. It describes examples participants gave me of their interaction with other teachers in and outside their schools, which included having to educate people about their role, especially the teacher librarians, engaging in collaborative and networking practices, and reflecting about differences in pedagogical views regarding digital technologies.

What Can a Teacher Librarian Do for You?

Heather, by being new in her school and because she was replacing someone with no librarianship training, had to put a good deal of effort into educating the teachers in her school about the things she could do for them. Overall, she shared that most teachers in her school seemed open to work with her and were impressed by the things she could help them with, which did not appear to be clear to them previously:

> I've had lots of teachers who sat in on lessons this year, because this is my first year in the building, so they want to know what you're all about, right, who have sat in and going, oh, I had no idea that we could do that. So, I would say that most colleagues, you know, who are open to working with a teacher librarian are, they're like, oh, I've learned so much. No, I'll be getting you to do this next semester too kind of thing.

Contributing to her peers' work appeared as an important factor for Heather, and she shared with me how she worked towards creating possibilities for it to happen. She made a conscious effort to demonstrate she could be an important resource, which was reflected in her attitude towards both the people and the spaces in her school:

> I'm setting up a teacher workstation, because I believe it's really important that teachers use this space. The teacher resource section is right here. I am a resource, I am right here. And so, I actually have a couple of colleagues who regularly work in here during their prep blocks, also because maybe their classroom is being used and they can't be in there, and they like the atmosphere.

However, Heather knew that not everybody would be willing to see her as a resource, and she seemed to be ok with the idea. She told me she learned that in one of her courses in her master's program. This is what she told me:

> You're either going to have people who are highly functioning educators who have already, you know, got all of their curriculum in place and are adding things and always learning and trying things out, and they don't need you; they basically don't need you. And then you have your 30% who will work with you and will want to, you now, co-create and do projects with you and not just, you know, hand off their students to be babysat; they want to be part of it. And then they told us, you'll get your 30% who'll be on the fence, and those are the ones you have to sort of win over.

Along those lines, Diane also told me that not everyone in her school was open to see her as a resource, and she gave me two reasons for that. The first reason had to do with the bigger picture of how her district and the province understood the role of teachers in schools. According to her, in the past teachers were hired as independent people and that, more recently, that expectation had shifted:

> But I also would say that not every teacher is going to have an open door. I think, you know, back 10 years ago we hired teachers so they were independent people, that they could manage a class, and that was part of the workload and why we hired teachers a

decade ago. But now we're asking those same teachers to become collaborators. And so, I don't think the culture is always there or present for a lot of people in collaboration.

The second reason Diane gave had to do with how she understood some teachers saw her, as just a librarian and not an actual teacher. She pointed that as the biggest barrier for her to do her work:

> The barrier that I have is the exact opposite – that I'm just a tech person, and I'm not a real teacher. And they're not that interested. And so, it's kind of like you can't help somebody who's not interested in being helped. And some doors stay closed; there's just nothing you can do.

Collaboration and Networking

Although not everyone in their school was open to work together and see them as a resource, which appeared as a barrier for the teacher librarians who participated in this study, participants had successful stories of collaboration and networking to share. Earlier in this chapter, I discussed how students benefitted from collaborating with one another, but I also learned that participants collaborated with their peers, and that ICTs played an important role in mediating it.

Heather shared a story of how she cooperated with a fellow teacher librarian to create a website for the library in her school and how the experience allowed her to acquire a level of proficiency she would not have achieved had she not worked together with someone else. She started telling me the story by saying:

> I had my own sort of Wix or Weebly website for a number of years, but the district asked us to use a template that they had from Wordpress, which I hate, but I still use; I still learned how to use it. And it's not user friendly.

In face of a demand by the district for teacher librarians to start using a website-building technology Heather was not comfortable with, she got together with other librarians in her district to devise a plan on how to go about the new requirement. She told me they built a template together and then shared it with their whole group. Based on that, she paired up with one of the other teachers in the group:

> And then another colleague, teacher librarian colleague, and I built my website at my last school. Then we copied it for her school, and she got the secondary school. And now we copied it again for my school when I got here. And so, yeah, we're really proud of what we have on there.

Although they got together in-person to discuss their approach as a group of teacher librarians, Heather told me that much of the work that followed took place online. She told me the two of them would collaborate over email by sending pieces of HTML code to one another to be added to their sites. In addition to making Heather proficient with a technology she never thought she would be able to master, this experience also seems to have contributed to her confidence:

> So, it's just... and I realized as I go along, I'm going... I am doing stuff that I never thought I would be able to do. I am like copying code and replacing HTML code. And I was just updating my web page today going, wow! From someone who was really... I was actually pushing back on using Wordpress because I don't think it's very user friendly to now, today, wow, I can update my website completely independently!

Learning from peers is something participants also described doing by means of building and engaging in personal/professional learning networks (PLNs). When describing PLNs in education, Carpenter et al. say that:

> Educators' PLNs often consist of people who share information (e.g., teaching strategies, resources, ideas), provide feedback, advice, and emotional support, and encourage changes in teaching practices. PLNs also consist of spaces (in-person and digital) where educators go to meet new people, discover new information, and engage in conversations or collaborative learning with others. (2022, p. 86)

David told me about his use of social media platforms and how they helped him connect to a PLN, "I also am very active on Twitter. And the educators on there will often make a post about a platform they're really enjoying using, and so then I can look into it that way." Heather shared something similar, "I look on Twitter for a lot of resources and things like that. I used to belong to some teacher librarian group." While recognizing the importance of digital platforms for accessing a PLN, Heather also pointed to some of their limitations, "but, you know, I don't know... that's a lot of stuff to sift through too I find. I'm not on Twitter all the time", and she argued that engaging with PLNs can also happen in-person. When talking about a fellow teacher librarian, Heather told me that the two of them "probably do some really valuable ProD just going for a walk around the lake talking. So, yeah, there's a lot of that, lots of informal conversations."

The Role of Pedagogy in Technology Adoption

I had the assumption going into this study that teachers' main dispositions to either adopt or not digital technologies in their classes would strictly have to do with their level of experience and comfort with using ICTs. Although that appeared to be the case in some examples that participants shared with me, it was not a determinant in some other cases. What David had to share with me shed some light into this topic. To him, the adoption or not of a technology by teachers might have to do more with how they position themselves pedagogically and how they

see technology could aid them in enacting their pedagogy, regardless of their level of comfort with digital apparatuses:

> I think the push back might not be related to the technology, but just the attitude towards education regarding it being student-led or teacher-driven. I think that's the point of tension between some teachers. There's some visions of school where the teacher has all the knowledge and, through a series of lectures and notes, and a project, then a test, delivers that knowledge to the students.

He concluded by saying that there were teachers in his school that shared his understanding of pedagogy, seeing educational technologies as a means of making learning more personalised and meaningful to students:

> Now, I will say I have a lot of allies who agree with this attitude towards education and who are very eager to see schools adopt and encourage the use of technology more and more because we see it as a way to let students learn in a variety of ways.

Diane, when reflecting about the adoption and use of digital technologies by her peers, concluded that it mostly depended on each individual teacher and that she had "been surprised on how the uptake and technologies is very varied by the teacher." She started by reflecting about the attitude of some of her peers who would not take good care of the equipment available in the school and how that directly affected students' attitudes:

> And also it's interesting, depending on the teacher, depending on the age, some Chrome carts, oh, my goodness. You go up to and they're just completely never plugged in, not taken care of, not loved, just things thrown on top. And what this does is it makes this trickle-down effect, where the next teacher, their lesson is a throwaway because nothing

> is charged, nothing's ready for them. And when the teacher models they don't care, I mean, what kind of behavior is happening in that class?

Diane also shared some examples of uses teachers made of technology in her school. Along the lines of what David said, she highlighted how this use would often reflect teachers' pedagogical understanding rather than comfort with technology per se. She had two examples of what she considered poor uses of technology, which would solely mimic practices that can be done without ICTs rather than explore what technologies can enable pedagogically, "Are you making them do something, the same thing? Like, are you doing math drills, reading math drills on the computer? Who cares, you can do them on a piece of paper!" and "Or like, you know, go look up something and put something on a slide show. And, you know, over and over and over it gets a little dull, I think." Diane also shared how technology would sometimes be used as a time filler and not necessarily have a clear pedagogical purpose behind it:

> You know, another teacher allows them to have free time on the Chromebooks. Yeah, that's one way to go. I don't necessarily do that. I think they have enough of that time at home. I'd rather them play games and work on their communication skills, that feeling of connection and belonging.

Schools

In addition to reflecting about their peers, participants also told me about their schools and how some of the policies and practices that were in effect would impact their practice. There were some contrasting stories in this aspect. David, for example, shared that there was not any direct encouragement from his school for him to use digital technologies with his students. However, the schools provided the means for it:

> My school doesn't encourage the use of any educational software, at least not to the English department. Students are given Google accounts, so I suppose that's a way of encouraging us to use Google platform, so Google Classroom. And I use that extensively, as well as other Google products.

Heather, in turn, expressed how she was supported and had clarity regarding who to go see in case she had any needs related to technology, “every principal has sort of their roles that they do, their particular jobs, and one of our vice principals is the key person that you go to regarding technology and facilities and things like that.”

George shared that he had to do a great deal of self-learning to be able to successfully shift from teaching Social Studies to teaching ADST courses, and it often involved mastering different technologies. Although this was a challenge to him, he shared that he had the support he needed from the administration in his school. He told me they trusted him to take on the task and were fair in their expectations:

> But I would say that there is support in that, if an administrator or somebody asked me to teach a course, they have confidence that I can sweat it out to figure it out how to teach it and how to understand the technologies. And then, once I do that, there's nobody getting in my way, you know, like nobody's saying, why are you doing it like that, you know? I don't get that. So, there is kind of like, we know you're going to sweat here, George, and once you get it going, we'll be there, you know, we'll help you.

Technical Support

Regarding the level of support that is available to teachers in schools when it comes troubleshooting technical issues, David had some insight to share. He did seem to recognize that there needs to be a system in place that supports teachers but that there should also be initiatives

to help teachers learn how to solve some of the most common issues they may come across on their own:

> So, when we don't know something, how do we find it? And I do recognize that that's a skill as well. So, I understand if teachers haven't solved technology problems on their own before, we are encouraged in schools, when we have a problem with our projector or laptop, to submit a ticket, and someone else will fix it. Um, that encourages us to not learn how these things work and how to solve them.

David described how he saw that, the ability to solve technical problems, as a skill that can be learned and that potentially is part of the set of skills a teacher should have to operate in the 21st century.

What Diane had to say seems to be in line with David's understanding. She first told me that, historically, there used to be people working in schools whose jobs involved solving technical issues and making sure technologies were working as they should. However, that seems to have changed in her district more recently:

> Like, there is no role in schools for that. Our school district used to have a very small piece for that, but that was taken away; I'm going to say like eight years ago. And so when things don't work or if a teacher has a question, who do they ask? Who's the expert? Who's the knowledge keeper? And there really isn't.

Diane went on to share that her peers tended to see her as an expert in technology because of her ability to solve technical issues, but she told me that was not really the case. She did not consider herself as an above average user; she instead described herself as being curious and having a mindset that directs her to find solutions. And she pointed that as something that anyone should be able to do:

> So, the first thing I would say is people think that I have this very high level of tech understanding, and I think people forget that I'm self taught. I'm looked at like I have this above ability, but I think people forget I'm just self-taught, and you can do it too.

Moreover, Diane said that being able to fix problems with technology may have to do with getting formal education, but that there does not seem to be a dedicated option for that. According to her, people can have a master's in educational technology, but if they are not curious in face of a problem, formal education might not be the solution:

> There is no course for what we're doing; there's nothing. And so, I mean, yes, you can take like a tech masters and stuff, but it's just being curious and looking at YouTube and being like, "How can I fix this problem?"

Diane also shared her perspective on why some teachers would not tackle a technological roadblock they may come across. According to her, it may be related to the fact some teacher may find it to hard or that maybe they do not have the time it requires to figure the issue out, even if it involves just a few minutes:

> But it's very interesting how a lot of teachers will be like, oh, it looks too hard! And, you know, that kind of sense of like I'm not going to spend the 20 minutes that is going to take for me to figure out how to flip this PDF.

However, Diane also recognized there is a limit to the issues a teacher who uses technology will be able to solve. Although one may be able to get a piece of software to work properly by using online tutorials, she expressed a different understanding when it comes to hardware:

> Then when it becomes beyond my scope practice, thank gosh I have a tech committee that helps me. Like, I don't know anything about hardware. Like, if the mouse breaks and if the video goes down, I have no idea how to fix that.

Districts

After having reflected about the role of peers and schools when it comes to factors that enable or hinder the work participants did with technologies, I will end this subsection by reflecting about what participants told me regarding their school districts. The first portion will focus on the intricate process of getting tools approved to be used in schools, and the later portion will cover the support options that are available to teachers at a district level.

Getting Technology Approved for Use in Schools

The government of British Columbia requires all its public bodies, which includes public schools, to complete a privacy impact assessment (PIA) whenever a project or activity involves collecting people's private information. BC's Privacy Impact Assessments website defines a PIA as "a step-by-step review process to make sure you protect the personal information you collect or use in your project. You'll work with privacy experts to identify, evaluate and manage privacy risks" (Government of British Columbia, 2023b, para. 1) and states it is a requirement described in Section 69 of FIPPA (Freedom of Information and Protection of Privacy Act, 1996). Most software, applications, and online platforms collect user data, and this is how the discussion around PIAs relates to this study.

One of the Diane's attributions in her district entailed getting digital tools approved to be used in schools, whose approval process involves completing a PIA. This is how Diane described a PIA in her own words:

> It's a special form that you have to fill out that says children's, student private data is not being collected. But it has to pass through a very rigorous thing, and then it has to be submitted to be BC privacy, and then you have to get it approved or not. So, that cog in the wheel.

Diane gave me more information about what has to be informed in a PIA and emphasised the importance of completing the whole process; however, she also highlighted that it can take a very long time to get a single tool approved:

> I don't use anything without a PIA. For example, to get an ad blocker on kids' accounts, you have to do a PIA. Who made the ad blocker? Where is that information stored? Are they collecting information? Where's the server? What protocol does it use? What is its purpose in education? So, all of these questions have to be addressed then sent to the privacy officer. If we get approved, then we can put just a simple ad blocker on. Even though we know this is good for kids, this is a gearing, grinding down procedural stuff that takes a ton of time.

Diane went on to say more about PIAs and the approval process. She told me that tools will eventually get approved, as many already have, but it may take up to three years for a simple browser extension to be permitted. Because part of Diane's job is done for her school district, she had an insider's perspective on the subject to share, including insights on lack of staff and the many levels of approval that are involved:

> I keep joking in the district role that I have, that it's been three years and all I'm looking for is easy accents as an extension. Three years! We're still not there yet, but what we had to do is... It's capacity. Our district set up a system where you apply saying, Hey, I want this extension. Hey, I want this program. It goes through the gears of the learning coordinators, but, again, is there somebody specifically dedicated from learning services or the IT department who's looking at these PIAs? They may be doing it off the side of their desk. And so it takes a while to get somebody. So, I think we've got about 20 apps that have come out, that have been approved, that have done the PIA.

Diane also shared that her district is aware that completing a PIA involves a lot of time and effort and that people may require specific training to proficiently be able to complete one. Additionally, Diane pointed to the fact that different districts in the province, by the absence of a centralized system, might be submitting duplicated PIAs for the same tool, "Because if every school district across the province is doing this, like why don't we make one for the ad blocker?" She concluded by saying that there have been recent initiatives by her district that aimed at reducing the amount of work that went into approving digital tools, by assigning centralizing the approval process and by offering a list of approved technologies teacher may use without the need of submitting a new PIA form:

> So, what the district is now trying to streamline is that we weren't doing PIAs, we're just kind of winging it. And then now it's going to a central location in our school district, then they're doing it, then it's popping out. Now we have a list of approved tools that have been PIAed.

In addition to the initiatives being implemented in Diane's district regarding making the PIA approval process more efficient, there is evidence that shows BC government is moving in the same direction. The web page, *Streamlining the Privacy Impact Assessment*, by BC's government (Government of British Columbia, 2022), describes a project carried out by the government to modernise its PIA process. The site mentions that "[t]he Privacy, Compliance and Training Branch (PCT) worked through a service design process to understand the needs and expectations of users and stakeholders and improve the PIA process" (Government of British Columbia, 2022, para. 4). The website also says that the project had final users in mind, which they offer more details about:

> The PCT staff participated in user research and workshops throughout the service design process. These activities put the user at the centre and highlighted how PCT staff can continue to look at their service from start to finish and make decisions with their users in mind. (2022, para. 11)

One of the outcomes of the project was a website, *Digital Privacy Impact Assessment (DPIA)* (Government of British Columbia, n.d.), that allows for PIAs to be submitted online. Still in a beta version, the website is described as "an integrated, guided, online tool for anyone working in a BC ministry that needs to complete a PIA. Digitizing the PIA will create a streamlined experience that enables a culture of privacy and innovation" (Government of British Columbia, n.d., para. 7).

Technology Introduction, Training, and Resources

According to what participants had to share with me in their interviews, their district played an active role in introducing digital technologies in schools and that there were expectations, especially of teacher librarians, that they would be the technology leads in their districts. I learned that when Diane told me that, "as a teacher librarian in our province, that's expected that we're innovators, that we're kind of lead teachers." I assumed coming into this study that the options to adopt a technology would be the sole decision of individual teachers, but Heather shared something that made me question my assumption; "we have some tech leaders at our district level who have been the key movers and shakers, who have brought in a lot of this new technology. And one of them has been a real huge advocate for teacher librarians." Heather added to the example by saying that her district did not simply provide the technologies and left it up for the teachers to learn how to use them; the initiative involved providing training to educators, especially to teacher librarians:

> And again, these tech leaders at our district level, they, you know, the said, Okay, we're going to get you, you know, a bunch of iPads for your school, but we're not just going to throw them out to the schools. You've got to attend some workshops and learn how to use these so you can teach teachers and students how to use them.

Heather concluded by emphasizing that these training sessions have been important and that they tended to have a hands-on approach:

> And I remember being in this workshop, this has got to be like seven years ago at least, and a teaching partner and I, a colleague and I from my then school, they basically said, Okay, here's two iPads; here's a quick demo of Adobe Spark. You have 15 minutes to make a video and show us.

Diane also shared her experience navigating support that is available to her by means of her school district. She told me a good deal of educational material was produced by learning coordinator in her district; however, she questioned the fact that those resources are usually hidden somewhere in the district's website. For her, there seemed to be a gap in communicating those resources to teachers:

> You know, for example, our learning coordinators, they produce beautiful work, beautiful lesson plans, but it is stuck in the school district website. You know, do you email every week? How do you communicate these great ideas and how do people with great ideas connect with each other?

Diane also noted that this issue of lack of communication was also permeated by technology and wondered what strategies could be used to make the resources that were being produced at the district reach teachers. She shared the solution she used was to be constantly looking at the district's website but understood that was not the optimal way to go about it:

> And technology is part of that communication. What are the access routes, you know, of those things? You know, or just like simple things like I was looking in this website, I'm doing a composting unit right now, and I'm like, oh, my gosh! The learning coordinator has done like my entire unit! Thank goodness I looked here. But unless you're in there all the time, how would you know? So, to me it's that communication piece and just making sure that access is super easy.

Continuous Learning

Teaching is a complex task, one that involves being able to juggle different types of knowledge and skills while addressing the demands of an "increasingly complex society and a rapidly changing, technology-based economy" (Darling-Hammond, 2008, p. 91). In a reflection about teacher learning to support student learning, Darling-Hammond argues that teachers continue to learn how to teach once they get into classrooms, "[t]he professional teacher is one who learns from teaching, rather than one who has finished learning how to teach" (2008, p. 95). This is an idea that is also maintained by Freire in *Pedagogy of Autonomy: Necessary Knowledge for Educational Practice* (1996), when he argues that teaching entails recognizing one's *unfinishedness*. Additionally, many studies in education have focused on teacher work and how it can contribute to educating teachers after they leave university (Ball & Forzani, 2009; Bayrakcı, 2009; Popova et al., 2016). Along those lines, the final section in this chapter will describe professional development and mentorship opportunities teachers shared they had accessed to and discuss the idea of teachers as unfinished professionals. It will also discuss participants' view about a potential limit to continue learning, especially about new technologies and digital applications.

Professional Development and Mentorship

Diane talked about a reality in her school in which different devices and pieces of equipment along with robust internet connection are available to students and teachers:

> I mean, I have like $3,000 worth of coding equipment, but the teachers don't feel comfortable, right? So, I have like BBC Micro Bits. I've got Lego Mindstorms. Here, I'll show you [moves computer and shows around the room]. So, now we're like at capacity with equipment, we're at capacity with Wi-Fi, where we have for the first time… I gotta think over 20 years that I've been around education, as a student, whatever, we had computer labs. So, it's like you've gone from a limited resource to now almost every class has access to a cart or a Chromebook.

However, although widely available, Diane told me most of these technologies were not always taken on by teachers. According to her, what seemed to be missing was innovation, and she used Maslow's Hierarchy of Needs to explain her understanding. According to Frei-Landau & Levin, "Maslow's Hierarchy of Needs (MHN) deals with the essence of human needs and motivations and provides a hierarchical scale onto which such needs can be mapped (2023, p. 02). MHN posits that "the satisfaction of basic existential needs is a preliminary condition for engaging in processes of more complex growth (such as learning)" (Frei-Landau & Levin, 2023, p. 3). In the field of education, "this level of basic need […] also includes tangible equipment and supplies as well as technology related needs" (2023, p. 3). For Diane, using technology to teach, or the innovation part, could only be fulfilled when preliminary conditions were met, such as equipment and internet connection being available and reliable:

> But I also feel like we've hit a bit of, I wouldn't say critical mass, but once you get the Wi-Fi that works, once you get the technology that's available, then it's, remember that

> last piece of the triangle, is like in the innovation part at the very top. And I think that's kind of where a lot of schools are stuck.

Diane went on and gave me more details. To her, it was not an easy answer why technology was not being taken on by more teachers in her school, and she expressed uncertainty regarding how this issue should be approached. She also hinted at what she understood by innovation, as a set of characteristics or predispositions:

> I think the bigger question that remains, difficult to answer and difficult to kind of approach, is, why aren't teachers moving forward now that they have Wi-Fi and all the gear? Like, what is it that's making collaboration and open-mindedness so difficult? We've taken care of all the other barriers of hardware and all those pieces.

One of the strategies participants shared with me regarding continuing getting educated was by means of professional development sessions. Professional development, Pro D or PD, "refers to on-the-job training activities ranging from formal, lecture-style training to mentoring and coaching" (Popova et al., 2022, p. 108). They told me details about some of the sessions they attended, including who they were usually funded by. As mentioned in the fourth chapter in this document, George had an educational background in Social Studies and needed to go through a great deal of additional learning to be able to teach the ADST courses (British Columbia Ministry of Education, n.d.-d) he had been assigned to in his school. One of the sources of learning for him were professional development sessions, which he told me were paid by the school but also by the teacher's union:

> And I think the principal at the time realized like this design thinking is going to take off, it's part of the ADST curriculum; it's a worthwhile investment. So, I was sent to for design thinking in Vancouver, and that was fully paid by admin. So, there, there has been

> support, yeah. I was just going to add that union also would have been helping to pay some of the PD costs. It wasn't entirely paid by the school. So, our union does support us and PD up to a certain amount per year, and I've tried to tap into that as much as possible.

However, George expressed that it had become harder and harder to find professional development sessions that would focus on ADST; “the issue is that sometimes there's no ADST offerings in PD sessions. It's pretty, pretty thin, especially for secondary.” Additionally, he pointed to the fact that his district did not seem able to find people who had ADST training coming out of university, “in our district, we don't have anybody really who's coming out of the teacher prep programs who are ADST ready, you know.” The solution his district seemed to have found, which is similar to what happened to George himself, was to find teachers with education in fields related to ADST and have them teach those courses; “the district's like, okay, we'll take classically trained teachers or teachers who can teach academic courses and then we'll find out which of those are techy and encourage them to get into ADST fields.”

Although containing some of the characteristics that research shows as being associated with effective professional development offerings, “such as including incentives, a specific subject focus, and lesson enactment” (Popova et al., 2022, p. 131), George expressed that this make do approach was not optimal and wondered why there was not a teacher education program with a focus on ADST in the university he graduated from:

> This is how it's working in our district. Like, why do we not have ADST training at my university? It's hard to find someone to fill in even, you know, and I'll often have to get a science teacher or an English teacher or someone. But it's fine; it is what it is.

George also shared he had recently attended a convocation ceremony at that institution and gave more details about it. He focused on the fact that there were a couple individuals with a specialization to teach ADST courses but added that it was not a degree program:

> I just sat through convocation there and just saw all these elementary teachers walk by and then all these secondary teachers who are in science, socials, English, and math and went like, okay, so is there anybody who understands the design process, you know? There was two, three specialized people, who walked by and were doing a special program; I can't remember what. I think it was a diploma; it wasn't even a degree.

David also shared his experience with professional development opportunities. He told me he was hoping to learn more about how to utilise some of the tools that were available in his school:

> I spent a lot of Pro D days trying to teach myself or googling how to use these different, you know, Google Drawing and Sheets and all these things, to use them in a learning space. So, yeah, it would be nice if that was reflected in the course during teacher training. That's I think a question educators are asking right now, but that conversation happening in an EdTech class I think could be really valuable.

David concluded his thought by hinting at teacher education and how the learning he had to do by means of professional development could have been part of his formal education instead. He described a reality in his province regarding the tools that were available to teachers, more specifically about the Google suite of tools, and went on to express how, in his view, teacher education programs could more closely align with the expectations in place in schools regarding technology use by teachers:

> I'm not sure what the state of Google products was at the time that I was in school, so I went in 2013 or 2014. I'm not sure what Google products were like back then, but certainly I would expect a more recent EdTech class to show us how to use those, especially here in BC where so many districts give students Google accounts and use Google classroom as like a preferred platform for a digital learning space.

Along these lines, Heather also talked about the role of mentorship in her learning of new things, which appears in the literature as an important aspect of teacher professional development. A study by Handrianto et al. concluded that:

> Mentoring strategy in school institutions helps teachers to promote their professional development. The essential value in mentoring is to build lifelong learning to help school community growing together. Mentoring is not limited for novice teachers as mentees but it is also applied for all teachers in all stages to be expert in their subject fields. (2022, p. 75)

Heather, who worked at the same school as George, gave me an example of how she learned from him:

> But, you know, I also do recognize my own limitations too. I mean, we have people in this building whose skills go far beyond mine. On Monday, for example, we have pro D day, and this innovation and design teacher […] is going to be putting on a pro D workshop for some staff at our school, who are interested in learning more about the recording studio and podcasting, and I'm going to be assisting because I'm still learning, you know.

Heather described mentoring as finding a peer that knew more than she did about something and establishing a working partnership with them. However, she also reflected on how this relationship should be reciprocal. When talking about a fellow teacher librarian, she said:

> She has been a mentor to me in some areas, and I to her in others. So, you know, and building reciprocal relationships for sure, because people don't want to always only just be giving, giving, giving, you know, that's kind of... she and I as teacher librarians, I know that if I share something with her, she's going to share something back with me, you know, if you're just... you're just here to get free stuff, forget it because a lot of work has gone into it.

Growth Mindset and Unfinishedness

Dweck and Yeager posit that a "growth mindset is the belief that human capacities are not fixed but can be developed over time" (2019, p. 481). When talking to participants, they demonstrated an understanding of themselves as professionals that aligns with the idea of a growth mindset. Heather, for example, said, "You don't ever arrive; you don't ever arrive knowing all of it. You... you... you just keep learning, and you just keep open to learning." When talking about changes, often brought about new technologies, what George told me adds to that:

> Yeah, I think I would say a progressive mindset, you know, like things are going to change, accept it and get ready for it, you know. And generally, the changes are beneficial to everybody; they're for a good reason, you know.

George expanded on this point by giving me an example:

> So, this happens a lot. I'll ask a student; how did you do that? [laughs], if they've done something I've never seen before. And they'll show me. And I think it's great because not only are they showing me to show how competent they are, but I'm also, Oh! Hey, I

> could use that later or, you know. So, there's a fair amount of that going on, because I work with some very, very bright students.

However, a teacher admitting they do not know the answer to something to their students is not an easy thing to do and requires teachers to hold an understanding of education that sees these professionals as unfinished beings, as proposed by Freire (1996), and lifelong learners, as proposed by Harvey and Kamvounias (2008). Also, taking this approach with students reflects a collaborative understanding of education, which a study by Martinez (2022) points as a 21st century teaching skill. What George told me goes in that direction:

> So, I kind of, in some cases, learn with students, learn from the students as well. If they're using, if they're using like the Vax V5 code program, which I don't have a lot of experience with, and I see that they've done something in a particular way, I'll be like, okay, make a note of that and, you know, remember that for when I'm working with other students.

David also told me that his students were a source of learning for him, especially because of the collaborative aspect he tried to develop in his classroom. And the learning he experienced with his students also prepared him to teach the same topic in the future:

> And because there is that collaborative atmosphere going on, I can also ask the room, hey, does anyone know how this works or how we can move this image over up to this kind of file? Or whatever it is that we might be doing. And, you know, that learning I take with me to the next time I run, run it.

Participants also shared some insights as to how they got to a point in which they were able to admit they did not know something. They seemed to share an understanding that being

ready to deal with what they did not know started with not being afraid but being willing to try. Heather told me:

> The biggest thing I think is... what it taught me is, you know, to not... and I've never been afraid of technology, but I definitely I'll get in there... and I'll just, I'll just figure it out. And you just... you have to keep trying, and that's what I tell students. I just go, you're not going to know all the answers, and neither do I. But just keep playing at it, and keep trying, and press a bunch of buttons and see what happens. So, not being afraid of it.

In addition to telling me that not being afraid is key, participants also shared what can be understood as important factors in making one willing to try something new. For Heather, having had the opportunity to build a basilar foundation was what enabled her, "And, yeah, so just going, hey, I don't know, but I'm willing to learn or I have enough kind of base knowledge that I'm willing to try." Having a knowledge base and the necessary support appeared as one of the conditions for teachers' adoption of technology in their practice. A study by Zhao and Cziko concludes that a teacher "must believe that he or she has or will have sufficient ability and resources to use technology" (2001, p. 5).

Moreover, participants told me about practical strategies they used to tackle the unknown. A shared understanding among them was that the questions they and their students had were probably questions other people also had, and that the internet was a good source for getting answers. When talking to her students, Heather told me she would often say to them, "Like, I'm sure somebody else has already asked this question; let's find out. And I say that to students all the time, you can't be the first person who has asked this question." What David told me goes in that direction:

> So, I know from experience on the farm and with technology in general that usually someone else has had the same problem, and I can just type my problem into Google and find videos or a forum that will go through a solution for me. There are many times when I will tell the students, I'm not sure how to do that; let's Google it and find out. And we'll, we'll do that together and learn about it. And I mean that's... I'm in an English new media class where we're, we're trying to teach ourselves things that just fit in, like it's not wasted time at all.

Diane's understanding about education and the use of digital technology aligns with that:

> For me, I just want to have kids really awakened and understanding their world as they move forward; because I always think if you can look something up, if you can read, and if you're curious, you're gonna be fine in school.

Enough is Enough

Although participants expressed their understanding of people as unfinished beings and shared strategies to continue learning, they also talked of the difficulty, and even the impossibility, of keeping up with everything – especially when it came to new technologies. Also, they expressed that not all technology that came out would stay, and they had to be strategic and consider the cost of investing in learning them. When talking about the phenomenon of coding classes in schools, for example, Diane told me that she had "seen coding come, ebb, and basically it's not in the schools anymore." When talking about how quickly equipment tends to become obsolete and the effort that goes into keeping up, George said:

> Yeah, 3D printing, I mean, our printers I guess are getting old. And I have to spend time looking and seeing what's fresh and new and what would be appropriate to bring into the classroom. With robotics, the issue there is that we are running multiple platforms in the

> classroom for historical reasons. And each platform has a different programming language. So, yeah, keeping up with that is has been tricky as well.

However, participants did not seem to see the challenge of keeping up as impedimental to their work. When talking about the speed at which new platforms that allowed people to create and edit images and videos came out, David told me how he filtered them and decided about them pedagogically:

> And, you know, I'm not going to keep up with all of them. But I'm going to try and fill in the blanks in my course to know what platforms can support me in different places in an easy way so that they're adding to our learning instead of just creating more obstacles, or the platform becomes the focus instead of what the students are creating, or instead of the collaboration.

When it comes to choosing what technology to adopt or replace in their classes, Zhao and Cziko state that the "teacher must believe that technology can more effectively meet a higher-level goal than what has been used" (2001, p. 5) and that the teacher "must believe that using technology will not cause disturbances to other higher-level goals that the he or she thinks are more important than the one being maintained" (2001, p. 5). David concluded, "Well, enough is enough, and my students are doing well, so I'm not going to branch out and explore those options."

Chapter 6: Discussion

After having presented the findings of this study in Chapter 5, I will discuss those findings in this chapter, with a focus on analysing what participants told me by drawing on my personal and professional experience with digital technologies and what was learned by means of my literature review. The objective of this chapter is to discus insights from the research findings in an attempt to propose answers to my research questions. Although at times overlapping, the initial section will concentrate on my first research question, How and to what purposes do four teachers in two local school districts on Vancouver Island, BC who have committed to working with digital technologies use these technologies in their pedagogical practice?, whereas the last section will focus on my second research question, What are the experiences and conditions that create possibilities for these teachers to understand and utilize digital technologies, and how are these experiences and conditions being created/enhanced for them?

Safety and Privacy

It is an understanding in educational policy and literature that it is important to teach students how to be safe online and know their rights, foster a sense of responsibility and respect for others when going online, and develop in them a critical lens when looking for sources of information, which can be referred to as digital citizenship (British Columbia Ministry of Education, n.d.-b; Lauricella et al., 2020; UNESCO, 2017). This understanding appeared in the findings, especially in what Diane and Heather told me. Diane shared how she would often start a new school year by making sure the students in her school could make informed decisions when being online, such as being able to detect phishing (Wen et al., 2019). Diane also told me how she worked in teaching the students in her school about privacy and anonymity. She shared that the systems they had in place allowed for students' privacy but that it would not allow them

to be anonymous, which she used as a segue to teach them about being responsible online and respecting others by means of their interactions. Heather, in turn, shared how she developed and taught lessons in her school on how to be able to tell whether a resource came from a valid, reliable source. Although some initiatives were in place in their schools to foster digital citizenship, participants also told me that was not always at the centre of the work they did in their schools. To Heather, mention of digital citizenship could be more explicit in the BC curriculum, rather than be embedded into different topics.

There are so many sad stories of children who have inadvertently had their personal data exposed online and who have been extorted and cyberbullied because of it. An example of that in BC is the story of Amanda Todd, who, according to a report by CBC (Proctor, 2022), ended up taking her own life as a result of being extensively cyberbullied and "sextorted" during three years. As a parent, I am constantly thinking of how I can make sure my child is safe when doing the things he enjoys doing online, such as watching videos and playing games with his friends. We often have conversations about how to tell whether information that is presented is valid and is coming from trusted sources and what is appropriate for his age, which is a standard we use for determining what he is allowed to do without any direct adult supervision. In a school context, it is encouraging to have learned that the BC curriculum includes reference to digital citizenship and that teachers are teaching about it to children, but it is also worrisome to have learned it is not always at the centre of teacher's work in the schools represented in this study. When I started using digital technologies as a child, stakes were quite low in that sense as the possibility of being online came only many years later, but children today are navigating technology and platforms that have the potential to expose them to just anything and anyone, which makes the topic of online safety paramount.

Regarding privacy, and now more specifically the right people have to it in BC, Diane told me about the intricate process that was in place in the province regarding the request for approval required to adopt digital technologies in schools. In order for any digital technology to be used with students in schools, the BC government requires that it is first approved by means of a privacy assessment impact (PIA) (Government of British Columbia, 2023b). In a sense, PIAs appeared as a barrier for Diane in that a tool as simple as a French spell checker was taking a very long time to be approved, which affected students directly. Based on what Diane told me, it seems that the barrier did not lie so much in the rationale behind a PIA itself, which she demonstrated to agree with, but in the overly complicated procedural aspect of it.

However, Diane shared that there were more recent initiatives by districts and the government itself to facilitate and streamline the submission of PIAs. One example of that is the amendments that were made to FIPPA on November 25, 2021, which removed some barriers such as the prohibition of information being stored in servers outside Canada (Government of British Columbia, 2023a) and the new platform for submitting PIAs, namely DPIA, which aims at streamlining and modernising the procedural aspect of PIAs (Government of British Columbia, n.d.). It can be argued that, although historically overly complicated, PIAs are extremely important to safeguard students' right to privacy, especially in a time when many platforms have been shown to harvest user data for misuse and exploitation. A report from Humans Right Watch demonstrated that around 90% of the online educational products they examined were infringing on children's rights by collecting extremely sensitive information (Gollom, 2022).

Teaching with and about Technology

Digital technologies can be used in many different fields and allow people to perform a myriad of tasks. In the field of education, more specifically, they can have a direct impact on how instruction is delivered (Raja & Nagasubramani, 2018). In their interviews, participants shared how they explored different digital tools when teaching their classes. David told me how he would often use the projector in his classroom to present students with multimedia content, which, to him, made his classes more engaging. He also shared how he would rely on digital technology to help him better assess his students, by means of engaging in dialogue with them about their own learning. Heather told me about her time as a language teacher and the important role technologies played in allowing her to play and show authentic content to students, which she understood was a good pedagogical approach to delivering content. Because he taught design courses, George told me how he heavily relied on different technologies to deliver content and collect student work.

Based on the findings in this study, it can be argued that the uses participants made of technology in their practice served as a means for them to enact their pedagogy when delivering instruction and collecting and assessing student work. Different types of knowledge were involved in that, namely technological, pedagogical, and content, which relates to TPACK (Koehler et al., 2007; Koehler & Mishra, 2005; Voithofer et al., 2019; Voogt & McKenney, 2017). Participants learned these different types of knowledge from distinct experiences they had, such as personal experiences, formal education, free time exploration, and collaboration with other teachers, and the classroom appeared as an important place for TPACK to be materialised. Ultimately, the participants' practice in the classroom allowed for three types of

knowledge to come together, regardless of how, where, and when participants learned each of them.

In addition to using ICTs to enact their pedagogy when delivering instruction and collecting and assessing student work, participants also demonstrated an understanding that the work they did with technologies with the students in their school should have a perspective that went beyond the classroom; in addition to using technology to complete school assignments, participants told me education should prepare students to deal with technologies for purposes they may eventually encounter outside the classroom (Haleem et al., 2022). That was demonstrated in the very detailed example of a project David shared, in which students would pretend they worked for a company and would enact different roles often present in the field. Additionally, Heather shared how the conversations she would have with students about technology would often revolve around how it played out in life outside the school. Diane, in turn, invested in teaching the students in her school, for example, how to post a comment about someone else' work, which she told me served a dual purpose; in addition to contributing to pedagogical practices in the school, she understood it also prepared students to post actual comments when, for example, navigating social media platforms outside the school. The work George did with his students had a direct connection to life outside school since it involved developing skills that are required in many different professions.

The findings in this study show that participants did not use technology for purposes confined to the direct school context only; participants demonstrated an overall understanding that the work they did with students in school should be connected to and inform real-life applications, uses students may make of technologies in their personal lives and future professional careers. This reveals yet another aspect of TPACK in the practice of participants,

that learning about technology should be associated with authentic and palpable uses rather than with simply teaching technology for the sake of technology (Koehler et al., 2007; Koehler & Mishra, 2005; Voogt et al., 2013). The findings also reveal an understanding by participants that education as a whole, not only technology education, should be connected to life, enabling students to participate in and contribute to society, which is one of the motivators behind the new BC curriculum (British Columbia Ministry of Education, n.d.-c).

Making and Hacking

Participants also shared that sometimes, especially in the absence of appropriate tools, they needed to circumvent normative uses of specific technologies to achieve their pedagogical goals, which is referred to is this document as pedagogical hacking (Fu et al., 2018; Hopper et al., 2021; Sanford et al., 2023; Smith et al., 2018). An example of pedagogical hacking was captured in David's story of how he used Google Slides, a software originally intended for presentations, as a platform for his students to create digital portfolios to demonstrate their learning. When telling me about this example, David also shared that pedagogically hacking a tool is a complex endeavor that requires an advanced level of comfort with digital technologies, which he believed he developed by getting into the heart of machines in his early interactions with technology. Along those lines, George and Diane gave me examples of the work with robotics that was done in their schools. They both shared an understanding that taking artefacts apart to understand their inner workings and finding creative uses for their parts could have a positive impact in one's overall understanding of technology.

Participants' shared understanding in the examples they gave me aligns with the theory of maker pedagogy presented in this document. Maker pedagogy posits that the taking apart of digital apparatuses to understand their inners workings and how the many pieces in them interact

with one another can help people not only develop a thorough understanding of technology but also find novel and creative uses for it (Bullock, 2016). The findings in this study demonstrate that there is a connection between maker pedagogy and pedagogical hacking, and it can be argued that the former may work as a first step in achieving the latter. Pedagogically hacking a tool is an alternative for teachers to enact their pedagogy in the absence of dedicated technology, and taking things apart can offer the advanced knowledge required to be able to engage in pedagogical hacking.

Digital Literacies

Literacies in the digital age can be expressed by means of complex genres, which can include different formats such as text, images, audio, and video (Coscarelli, 2009; Silveira et al., 2012). The theory of digital literacies presented in this dissertation posits that people make sense of the world and participate in it by means of using language, which more and more is enabled and mediated by digital technologies (Bazalgette & Buckingham, 2013). Participants in this study had different examples to share that point to this understanding of digital literacies.

David told me that he used ICTs to enhance his students' proficiency in reading and writing, but he also mentioned how he would often allow learners to express their learning and themselves by means of other formats, such as images. He also explained that he would often take on a dialogical approach in his literacy work with students by using the comments feature in the tool they used to have a conversation with students about their work (Fu et al., 2018). George shared something similar when he said that he was usually more interested in students' demonstrating their learning by means of drawing and designing in his courses than through writing. Moreover, Heather told me how she had been closely involved in working with podcasts in her schools; not only did she work towards getting her students to listen more to audio content,

but she also was involved in making sure the school had the appropriate equipment and training so that students could work on their own podcasts for school assignments and projects.

The findings in this study demonstrate that participants seemed to recognize the importance of including different genres in their instruction and giving student choice as to how they would like to express themselves and their learning. This idea reflects the new BC curriculum (British Columbia Ministry of Education, n.d.-a) and strongly relates to a 21st century reality in which people are more and more required to interact with diverse forms of information, coming to them in different formats and from multiple media channels. Being dialogical in their form of assessment, especially in the case of David, also demonstrates an understanding of learning as iterative and of pedagogy as dialogical, which points to the work of Freire (1996).

Importance of Teacher Librarianship

When inviting participants to take part in this study, recruitment conditions did not foresee what exact role they should have or subject area they should teach. The main criterion was that they needed to be teachers and known in their schools for using digital technologies in their practice. I was surprised when I realised that half of my participants ended up being teacher librarians. In addition to learning more about the overall work teacher librarians did in schools, this study allowed me to reflect about the role these professionals played in their school when it came to ICTs. The teacher librarians and other participants in this study had many examples to give that helped with that. Heather told me her work often involved helping people evaluate resources online for validity and trustworthiness, assisting teachers decide which technology they would adopt to be used with their classes, providing workshops on digital citizenship, and securing equipment and offering training for podcast production. Diane, in turn, told me how she was involved in making sure students knew their rights and knew how to be safe when going

online, submitting PIA requests to get approval to use different technologies in her school, and solving technical issues teachers had with technology.

As discussed earlier in this dissertation, doing work with digital technology requires people to have specific knowledge of how to operate it to achieve their purposes (Mangen & Pirhonen, 2022). This basic set of skills includes, but is not limited to, safely turning equipment on and off, installing and starting applications, storing and moving files, creating accounts and passwords, and creating documents and presentations. Participants told me that, often times, their students lacked the technical skills that were required to operate digital devices, and the teacher librarians in this study appeared as a vital resource in that regard. David told me that some of his students struggled with foundational digital skills, such as moving files to different locations and changing file formats, which were abilities often required in completing some of the assignments in his class. He also told me that the new BC curriculum, which was first rolled out to K-9 grades (British Columbia Ministry of Education, n.d.-c), included references to foundational digital skills, and that he could notice an impact of it in schools already, especially with younger students. For older students, however, he shared that he relied on the teacher librarian in his school to offer them the opportunity to learn the skills they lacked, which was often carried out by sessions tailored to specific student needs. Additionally, some of the other teachers in the schools where participants worked also struggled with technology, and the teacher librarians were also in charge of helping them.

Diane told me about the strategies that she used when teaching basic skills to both students and fellow teachers in her role as a teacher librarian. She told me that she would often employ a play approach when teaching young students (Roberts & Knaus, 2023), which involved motivating them to see how what they were learning could be fun. To help fellow teachers, in

turn, Diane told me she would rely on an integral approach; instead of teaching teachers how to simply perform operational skills detached from a context, Diane said she had shifted into teaching them how to use technology to achieve specific pedagogical objectives, which points to TPACK (Voithofer et al., 2019; Voogt & McKenney, 2017). Heather shared a similar approach and told me she would often start from what teachers aimed at achieving and then would suggest technologies that may help enact it. In a different example, Heather told me how she helped a student complete a podcast assignment by helping them with the genre aspect of it and with the technological part, which included hardware and software.

Overall, the findings in this study point to teacher librarians as enablers in their schools, especially when it came to digital technologies. Not only did these professionals play a vital role in making sure students were safe and knew their rights when going online, they also appeared as a robust source of support to teachers by helping in the decision making about which technologies would be used, in providing training, and in troubleshooting technical issues. Additionally, teacher librarians played an important role in helping students and teachers navigate the many resources that are available online, assisting them evaluate whether information is coming from a valid source (Fielding, 2019).

The findings also demonstrate that participants often had to educate their peers about their role as librarians and about what a library in a school could look like. This redefinition of roles and spaces seems to capture a reality in schools that points to a shift in paradigm, which could be argued was caused by the advance of digital technologies. This change is also demonstrated in both Heather's and Diane's teacher librarianship education, which had a strong focus on digital technologies. Libraries and teacher librarians in schools play different roles today than they did in the past, which was demonstrated by the characteristics of the work

participants did, their education, and, in the case of this study, the fact that half of the participants I recruited when looking for teachers who were know in their schools for using digital technologies ended up being teacher librarians. It Is Never Too Late to Learn

Coming into this research, I held the assumption that having contact with digital technology from an early age would be a determining factor in making someone comfortable and proficient in using it pedagogically. I probably believed that based on my personal experience. I was exposed to and learned how to use computers when I was very young, and the many learning opportunities I had by doing that had a direct impact in my practice as a teacher; because computers taught me so much, it only felt natural that I would employ digital technologies when teaching so that my students could have a similar experience.

However, the findings in this study demonstrate that, although having a long personal history with digital technologies can positively impact one's pedagogy, as was the case of David, it does not seem to be a determining factor. Indeed being an earlier adopter can make teachers more confident when adopting a technology to be used in the classroom (Aldunate & Nussbaum, 2013), but literature also shows that having a good level of comfort with ICTs on a personal level does not automatically translate as a pedagogical understanding and use of them (Russell et al., 2003). Diane's story, particularly, shows that one can learn about digital technologies later in life and still be proficient with them and be a vital resource to others. She told me she went into her master's in librarianship without knowing what Google Docs was and, at the time of her interview, was known in her school and district for being a reference when it came to using digital technologies for the purposes of learning and teaching.

The Contributions of Formal Education

I asked participants different questions about their educational trajectory as that was another assumption I had coming into this study, that education would be an important factor in helping participants become familiar with digital technology and prepare them to use it pedagogically. The findings corroborated my initial supposition, and participants had two main contributions from their time at university to share as being fundamental in enabling them to get where they were at the time of their interviews.

The first contribution participants pointed to that education had contributed was in giving them opportunities to explore digital technologies as learners. David gave me the example of having had the chance to develop a digital portfolio in one of the classes he took during his time in teacher education. He shared that the experience helped him at that time to develop an understanding that e-portfolios were an effective way of tracking the progress of one's learning. Literature refers to this type of experience as meta-learning (Kidman, 2015), when one becomes aware of their own learning and, consequently, is able to develop strategies to become a more effective learner. The same study also posits that such self-awareness can help pre-service teachers become more skilled in their overall approach to learning and, consequently, to teaching (Kidman, 2015). It can be argued that there is a level of implicit pedagogical learning in the experience David shared. There are not enough elements to affirm it, but it could be inferred that the professor who taught David about digital portfolios did not necessarily have the intention of causing their students to understand a portfolio as a teaching strategy after experimenting with one as a learning tool. The findings show, instead, that David made that connection himself, being able to view something he experimented as a learning tool as a potential teaching tool.

This conclusion relates to one of the findings in my master's thesis, in which student teachers shared that they developed an implicit, or accidental pedagogical understanding of digital technologies by exploring them as learning tools when completing assignments in their teacher education program (Hinkel, 2014). They did not have any courses at the time that would teach them how to use digital technology pedagogically but often had to create and submit electronic assignments in many of their courses. Exploring digital tools as means of completing assignments in the role of students caused them to start thinking of the pedagogical role of those tools and how they could potentially use them in their future practice as teachers. All in all, the findings in this study demonstrate that student teachers may develop an understanding of digital technology as a pedagogical tool even when they are not explicitly taught that in teacher education programs, especially when they have the opportunity of experimenting with ICTs in the role of a student.

In addition to having explored ICTs as learning tools, participants also shared that they had courses in their programs that invited them to become familiar with different digital technologies while trying to detect their pedagogical potential, which captures an aspect of TPACK (Koehler et al., 2007; Voithofer et al., 2019; Voogt & McKenney, 2017). Regarding this second contribution from formal education, Heather mentioned a course she took in her master's, in which the class was asked to blog about different technologies every week. She said a great deal of work was involved in completing the assignment but that it played a vital role in making her aware of the many different technologies that were available and how they could be explored in the classroom with students. Diane shared an experience with a course she had in her master's program that aligns with Heather's story. Diane told me they were asked to work on projects that involved doing many short presentations to the class about different technologies with a focus on

how they could be explored pedagogically. Not only did they have to describe each technology, but they were also required to use it to present the content whenever possible.

The examples Heather and Diane gave me about their experiences in those courses point to two important aspects. The first being that those courses seem to have given the two teacher librarians familiarity with many different technologies, which allowed them not to be afraid of using them and other technologies they came across in the future. It can be argued that the unknown may cause someone to be afraid, which can be overcome by understanding, or becoming familiar with what is causing them to fear. This aligns with the research done by Li and colleagues (2019), which concluded that teachers are more likely to use digital technology in their practice if they are not afraid. Additionally, based on my experience in having helped many people become familiar with and confident in using technology, being afraid of breaking things often appeared as a barrier. This contrasts with what maker pedagogy posits, that breaking things, or taking them apart can actually help one become familiar with them (Bullock, 2016). The second aspect has to do with the idea of having a solid technological foundation from which to continuously build on. Heather refers to this foundation as one of the most important experiences in her trajectory with ICTs, which she told me gave her the comfort level she was at when I interviewed her. She told me that, because she had had the chance to develop these technological pillars of knowledge, she felt confident about exploring new tools.

Teachers as Unfinished Professionals and Learning as Dialogue

Although being known in their schools for being proficient in using digital technologies, participants were comfortable admitting in their interviews that they did not know everything and that they always tried to be open to continue learning. One of the sources of their ongoing learning, participants told me, was their students. David said that he would often consult with his

students when he was not familiar with a specific technology. He mentioned that his students were usually more attuned than him to new platforms that came out, and that he would often ask them for suggestions, which was also expressed by George. Moreover, George told me that having the impetus to continue learning in the job was strongly related to the perception of being supported by his school, especially by administration. That can be illustrated by the example he gave me about being invited to teach ADST courses, which he had no formal preparation to do. He expressed that he felt reluctant to try something new and take risks, especially because of the amount of time and effort that went into learning a new technology and building a new course to be taught. However, he said that, if he felt supported, he would be willing to try something new. Diane and Heather told me something similar when they shared that they would have an open conversation with students when they did not know something, and that that was ok. Both teacher librarians told me that they understood it was more important to recognize they did not know something and have the mindset that allowed them to look for help or solutions than to say they knew everything.

The findings in this study demonstrate that participants were open to continue learning and benefitted from learning especially with their students. This aspect points to the work of Freire (1996), who posits that teaching involves recognizing oneself as an unfinished being, the concept of lifelong learning, discussed by Harvey and Kamvounias (2008), as well as the idea of growth mindset, as discussed by Dweck and Yeager (2019). It also speaks to the dialogical approach to education defended by Freire (1996). Because he claims people are unfinished beings, the Brazilian educator argues that both students and teachers are ultimately learners and that, in conversation, all can equally learn and improve.

It can be argued that this openness to continue learning that was captured by the findings in this study may reflect an overarching theme of evolution; technology is constantly evolving, education is constantly evolving (with the new BC curriculum being an example of that), and society is constantly evolving. Participants demonstrated to be aware of that constant movement of pieces and had an attitude towards technology and education that seems to align with it. Maybe participants were eager to continue learning as a result of expectations from society and educational policy for education to keep up with the 21st century and all the advancements brought with it. Or maybe their direct involvement with technology, which also constantly changes, has lent them that perception of having to be ever evolving. However, the main drive for participants to be open to continue learning seems to have been their pedagogical reasoning and attitude towards their students' learning. They demonstrated to want the best for their students and their learning, giving them the opportunity to express themselves and their learning in ways that were meaningful and authentic to them.

Equipment Availability and Connection Reliability

Availability of technological apparatuses in schools for both teachers and students and access to reliable internet connection are fundamental pieces for education in the 21st century (Tadesse & Muluye, 2020). Work with digital technologies necessarily involves access to functioning equipment and a solid internet connection, without which the work teachers and students can do is compromised. The findings in this study revealed different realities, in which some schools had more equipment than needed while others struggled with outdated and not sufficient equipment for all. Diane indicated that the minimum a teacher needed to have to be able to do their work in this day and age included "a good Elmo, a good projector, a sound

system" and expressed that her school had more than enough equipment availability, so much that not everything was used.

David, on the other hand, expressed that, although he had what he needed to teach regarding technology, the biggest barrier for his work with digital technologies in his school was the limited amount of equipment available to students. In addition to being scant, David also expressed limitations regarding scheduling; because there were not enough Chromebooks for each student in the school, they tended to be booked way in advance by his peers, which was impeditive of his work. Because teacher work is so dynamic, he told me, it was difficult to foresee when he would need the computers for students. Issues with scheduling and booking equipment were also something that both Heather and Diane brought up in their interviews. Heather mentioned that the booking system in her school was helpful to students in that they could almost always have access to a computer if they needed to; however, she pointed out that it was a complicated system and that it had to be administered by her, which she understood was not the best use of her time. In that direction, Diane shared how she used to be involved in organizing the booking of Chromebook carts in her school but had to stop doing it because it would often lead to conflicts with the other teachers.

One of the alternatives that participants indicated as a possible solution for the lack of available equipment for each student was the 'bring your own device' (BYOD) approach (Hakami, 2020). This approach entails students using their own devices in school to complete their work. Although sharing some success stories, such as David's students using their own phones to look up information during class, participants told me there were a few issues revolving around BYOD. For David, it had to do with some of the limitation of personal devices, such as smartphones. Because he taught English, much of what his students did with

technologies involved typing their work. Although it was possible to do that by using a small touchscreen keyboard, David shared it was not ideal. Diane, on the other hand, raised concerns around equity when it came to BYOD or when expecting students to do schoolwork at home that involved using their own pieces of technology. She pointed that not all students had the financial means to afford technology, which aligns with a recent report that says almost 20% of the population in Canada falls into the 'have not' side of the digital divide (Statistics Canada, 2022).

Regarding reliable connectivity, participants shared that it was better than it used to be. Heather told me that, for the devices that belonged to the school, the connection was overall stable and allowed students to get their work done. However, she shared that students faced some barriers when it came to them using their own devices and trying to connect to the school Wi-Fi. She said that there were too many steps to be completed, which seemed to demotivate students to go through them all in order to be able to get a connection. Data plans on personal devices were mentioned as a potential workaround, but that approach can incur similar issues as discussed in the BYOD approach, especially concerning equity.

In addition to not being available to all students, participants also shared that some of the equipment that was available was either faulty or not configured properly, and participants pointed that that had a direct impact on the work they and fellow teachers could do in schools. On top of that, participants shared that support options were not always readily available at the school level. They told me there used to be more support options, but, in some schools, it was no longer the case. In response to that, participants shared that they were able to figure out some of those issues on their own by seeking solutions online, specifically when it involved software configuration and setup errors. However, they expressed there was a limit to what they could do themselves, especially concerning hardware problems.

Ultimately the findings in this study demonstrate that equipment availability and connection reliability appeared as a barrier for teachers to be able to fully enact their pedagogy. It can be argued that the acquisition, maintenance, and support of digital technologies is a much more complex process that that of other materials traditionally utilised in education, such as school supplies. In addition to costing reasonably more money, digital technologies require constant updating and tend to become obsolete very rapidly. It seems almost an impossible task to keep up with providing all schools in a district with equipment for every student; in addition to requiring a costly level of investment, the fact that equipment might soon be collecting dust and not be used can potentially impact decision making regarding new acquisitions.

In that sense, maker pedagogy and pedagogical hacking present alternatives when they suggest the creative repurposing of existing technology and the taking apart of technological apparatuses for the purpose of learning (Bullock, 2016). Moreover, the findings indicate that investment in technology alone is not enough; if teachers do not have the proper training to use technology with students and do not feel comfortable doing it, it is not going to get used and included in their classes. Finally, the findings also showed examples in which modern technology was used in schools without fully exploring its pedagogical possibilities. All in all, it can be argued that teachers and students need access to technology to be able to fully engage with pedagogy that captures a 21st century reality, but access should be paired with training on how to take full advantage of what technology has to offer in the field of education.

Chapter 7: Implications and Conclusion

This research aimed at learning more about how and to what purposes teachers used digital technologies in their practice. Additionally, it looked at understanding some of the conditions and experiences that enabled teachers to get educated about technologies so that they would be proficient and feel comfortable using them for the purposes of teaching and learning. For that, I conducted a qualitative case study research that aimed at capturing participants' perspectives and experiences, which I then compared with my own trajectory with digital technologies, the new BC Curriculum, and literature in the field. My literature review included three theories that address the use of digital technologies in education, namely Digital Literacies, Technological Pedagogical Content Knowledge (TPACK), and Maker Pedagogy and Pedagogical Hacking. These theories, along with my philosophical assumptions, methodology, and methods made up the theoretical framework that supported this study (Collins & Stockton, 2018).

I collected data about the BC Curriculum by studying different documents in several government websites and by thoroughly analysing all mentions to the word 'digital' in the text of the new curriculum, from kindergarten to grade 12. I then carried out seven 45-minute interviews with four different participants. Recordings of the interviews were uploaded into a password protected educational video platform for the automatic generation of transcripts, which were later revisited individually for manual fine editing. Finalized transcripts were uploaded into NVivo, which allowed me to code the data and then sort it into different categories. Those categories, along with recurring points that emerged from comparing my literature review, my own experience, and the BC curriculum, allowed me to come up with themes and subthemes, which were then used to help me analyse my data and structure my findings to be presented in this

document. What follows is a summary of the key findings in this doctoral research, implications, and contributions to research in the field, and suggestions of next steps.

Summary of Key Findings in the Case Study

The findings in this study demonstrate that participants were invested in was making sure students knew how to be safe when going online, understood their rights, developed a critical lens when evaluating online resources, and had a responsible approach when interacting with others by means of ICTs, which are all characteristics of digital citizenship (British Columbia Ministry of Education, n.d.-a; Lauricella et al., 2020; UNESCO, 2017). Additionally, participants recognized the value of completing privacy impact assessments (PIAs) (Government of British Columbia, 2023b) before being able to use digital technologies with students but also pointed to the fact that submitting one often entailed going through an intricate process, which could take a long time. However, the findings show that there have been recent initiatives to streamline the PIA process by the government, who has reconsidered some of the stricter requirements, such as the need for information to be stored in servers inside Canada only (Government of British Columbia, 2023a), and making it easier for users to complete a PIA by means of the new DPIA website (Government of British Columbia, n.d.).

The findings also show that participants employed digital technologies to enhance their practice and to achieve their pedagogical objectives (Raja & Nagasubramani, 2018). Examples participants shared included using ICTs to assist in instruction delivery by making it more engaging, assess student work by having conversations about their progress, present content by including authentic materials, and teach students how to use technology to draft and design by exploring different software options. Overall, technology appeared as a means that allowed teachers to teach their subjects while enacting their pedagogy. Ultimately, the participants'

practice in their schools revealed aspects of TPACK in that different types of teaching knowledge worked together to benefit student learning (Koehler et al., 2007; Koehler & Mishra, 2005; Voogt & McKenney, 2017).

Additionally, the findings in this study demonstrate that participants had a shared understanding that it was important to use digital technologies with their students in ways that mimicked, or closely related to uses learners may do outside of school, which literature points as an important characteristic od education in the 21st century (Haleem et al., 2022). Examples of that include a school project in which students took on roles often found in an advertisement company, the discussions participants had with students about what made a good comment, and the hands-on training opportunities offered in ADST courses. This real-life application of technologies captured in the understanding of participants reflects characteristics of the new BC curriculum, such as preparing students to navigate a reality that is more and more permeated by digital technologies (British Columbia Ministry of Education, n.d.-c); it also reveals yet another characteristic of TPACK, which posits that learning about technology should be authentic, not focusing purely on technological skills, detached from solving a problem or achieving a clear objective (Koehler et al., 2007; Koehler & Mishra, 2005; Voogt & McKenney, 2017).

However, participants also expressed that there were situations in which an appropriate tool was not available to them, and that they had to curb normative uses, or hack certain tools to fully enact their pedagogical intentions (Fu et al., 2018; Hopper et al., 2021, 2023; Smith et al., 2018). An example of that includes the use of a slide presentation software a participant did with their students for the purposes of building digital portfolios. Participants recognized that what this document refers to as pedagogical hacking requires an advanced level of comfort with digital technologies and pointed to potential approaches that may help. One of the suggestions was

maker pedagogy (Bullock, 2016), which posits that the taking apart of technological apparatuses may help one learn more about them. Overall, the findings in this study demonstrate that pedagogical hacking and maker pedagogy are strongly related, and that experimenting with the latter may enable one to engage with the former.

Additionally, the findings in this study demonstrate that participants recognized digital technology as playing an important role in the learning and teaching of digital literacies. Presented in this dissertation as a theory, digital literacies understood as such posits that meaning is constructed by people when they use language to make sense of the world and participate in it, and that this practice is often materialized by means of different genres, which more and more are enabled by digital technologies (Bazalgette & Buckingham, 2013; Coscarelli, 2009; Silveira et al., 2012). Not only does technology allow students to learn from a myriad of different genres, it can also enable them to demonstrate their learning and express themselves by exploring different formats, such as text, audio, images, and video. Examples that participants gave that align with that understanding of digital literacies include presenting content from different sources and in different formats and allowing students to express themselves and their learning by means of different formats, such as text, images, and audio.

This study also found that teacher librarians played a vital role in their schools, especially when it came to supporting students and teachers with their uses of digital technologies. It is worth noting that half of the recruited participants ended up being librarians, which was not an intended outcome in the initial research design. This aspect of this study captures a reality in which teacher librarians and libraries are being associated with digital technologies, which is demonstrated by the efforts by the teacher librarians in this study in educating their peers about their role, expectations from school administration and districts, and the focus in teacher

librarianship master programs in teaching their students about digital technologies. Some of the examples of how the teacher librarians who participated in this study supported both students in teachers in their schools include the evaluation of online resources for validity and trustworthiness (Fielding, 2019), decision making regarding tools to be adopted based on TPACK (Voithofer et al., 2019; Voogt & McKenney, 2017), workshops on digital citizenship (Lauricella et al., 2020), purchasing of equipment and provision of training on foundational digital abilities (Mangen & Pirhonen, 2022), such as by means of a play approach in the case of younger students (Roberts & Knaus, 2023), initiatives on privacy awareness (UNESCO, 2017), PIA submissions (Government of British Columbia, 2023b), and the troubleshooting of technical issues.

Differently from what I had assumed based on my own experience, the findings in this case study show that a long history with digital technologies is not a prerequisite in becoming proficient in them and being able to use them pedagogically. Participants had different personal and educational stories with ICTs to share but were equally recognized in their schools for their use of technology. While one of the participants came into their teacher education program with vast personal experiences with technology, another participant shared it was no until they joined their master's program that they became proficient with technology and felt comfortable helping others with it. The findings in this study demonstrate that, although being an earlier adopter of technologies can make someone more comfortable in adopting them in education (Aldunate & Nussbaum, 2013), being familiar with technology for personal uses does not necessarily automatically translate as being proficient in using it pedagogically (Russell et al., 2003).

What the findings show as a more determining factor as to whether teachers will use technology to teach is the contribution of their formal education. Participants shared that teacher

education and master program in librarianship played an important role in developing in them an awareness of how technology could enhance their own learning, which, as a result, informed their pedagogy (Hinkel, 2014; Kidman, 2015); in exposing them to different examples of technology while having to explain them to classmates and having to come up with pedagogical uses for them, which relates to TPACK (Koehler & Mishra, 2005; Voithofer et al., 2019; Voogt & McKenney, 2017); in helping them not be afraid of technology by having appositive attitude towards it (Li et al., 2019); and in providing them with a strong foundation, which they could continually build on when learning about new technologies in their practice.

The findings also demonstrate that participants were open to continue learning, which captures the idea of teachers as unfinished professionals (Freire, 1996) and lifelong learners (Harvey & Kamvounias, 2008); the different strategies they had in place to continue learning in the job also point to an understanding of growth mindset (Dweck & Yeager, 2019). One of the most important examples of a source for continuous learning participants indicated was their students, who appeared as contributors to the understanding of participants about new technology; in addition to contributing to their own learning, participants shared that this openness to learning from their students also contributed to their pedagogy as they applied what they learned with one class when teaching subsequent classes. This openness to learning from students also points to the work of Freire (1996), who posits teachers and students are both learners and can contribute to each other's trajectories by means of engaging in dialogue.

Finally, the findings in this study show that equipment availability and connection reliability are fundamental elements for any work that might be done with digital technology in schools (Tadesse & Muluye, 2020). Data collected depicts different realities in the schools that were represented; while some had more equipment than was actually needed and used, others did

not have equipment available for everyone. Overall, technology appeared to be more readily available to teachers than to students. Additionally, findings show that the lack of appropriate equipment and complex scheduling systems acted as a barrier in allowing participants to fully explore digital technologies in their practice. The 'bring your own device' (BYOD) approach (Hakami, 2020) appeared as an alternative but also posed some complications, such as equity issues (Statistics Canada, 2022) and difficulties regarding students not being able to connect to the school Wi-Fi while using their own devices. Maker pedagogy and pedagogical hacking (Bullock, 2016; Sanford et al., 2023; Smith et al., 2018) appeared as alternative to repurposing older and obsolete technological apparatuses and finding novel, creative uses for them. Additionally, the findings show that equipment availability in schools does not necessarily transfer to teacher taking it on; without proper training, teachers will not likely enhance their pedagogy with the use of technology, which will remain in storage collecting dust.

Implications and Contributions

This study investigated the stories of four teachers and looked at their personal and educational experiences with digital technologies, their use of technology in schools, and some of the incentives and barriers that either allowed them to do or hindered them from doing their work. Along those lines, the following subsections reflect on the implications and contributions of the findings in this study to research in the field of education, to teacher education, and the teaching practice.

Research in Education

This research has implications for research in the field of education because of how it combined three different theories to interpret the innovative practices of four teachers and their capacity to be leaders in their schools when it came to their understanding and use of digital

technologies. Each of the three theories that were selected, namely Digital Literacies, TPACK, and Maker Pedagogy and Pedagogical Hacking permitted to understand a particular aspect of the data that was collected. And, when combined, these theories allowed for a comprehensive picture to be painted. They helped understand that the participants in this study were highly motivated to meet their student needs while having to overcome different barriers, such as insufficiency of equipment in schools, having to use free time to be able to prepare to teach new courses, lack of foundational digital skills of some students, and intricate processes of getting technology approved for use, to name a few. Despite all these barriers, participants were able to use the means they had to provide students with effective technology enhanced learning. The combination of these three theories allowed for elements of different aspects of education to be explored and discussed, such as teacher education, teacher work, and student learning, which can potentially contribute to a growing, and, because of the rapid development of new technologies, a more and more relevant field of study.

Along with the three theories that were selected, the methodology and methods that were employed in this study present a solid theoretical framework for qualitative studies in the field of education. On one hand, the methodology and methods that were used allowed for the valuing of personal experiences of individuals, regarding them as valid sources of knowledge. And that included both my own experience with and perspective on digital technologies in education, from which I approached this study as a researcher, and the lived perceptions of participants of the phenomenon I chose to investigate. Moreover, the techniques and technologies for data collection, transcription, and analysis that were employed are free and available to any graduate student associated with a higher education institution, which may work as an incentive for people pursuing a similar path to research. A case study methodology associated with snowball

sampling were especially useful to me in the sense that I had been living for a short period in the location where I conducted my research. By allowing me to construct a thick description (Stake, 2005), case studies was an effective approach in giving me a comprehensive understanding of a phenomenon that had many new elements to me. Additionally, case study has the potential to create a sense of naturalistic generalization in readers, who may recognize elements of their own experience in the findings, thus intuitively generalizing from the case to their own reality (Chadderton & Torrance, 2011).

Teacher Education

Because I asked participants about their experience in higher education and they had a lot to say about it, this study has some contributions to make to the field of teacher education. Participants expressed they highly valued the courses about technology they took, especially those that allowed them to become familiar with and explore different technologies, and those that intentionally taught them how think pedagogically about ICTs. Although personal experiences appeared as a contributor to the level of comfort some of the participants shared that they had, formal education was pivotal in making them select and used digital technologies in their work.

Overall, participants seemed to have really appreciated the opportunity to have hands-on and integrated experiences with technology, pedagogy, and content during their time as students, which points to the validity of considering maker pedagogy and TPACK when planning and delivering instruction in teacher education programs. The findings also pointed to the importance of comfort with different genres when learning and expressing learning, which points to the relevance of considering the theory of digital literacies in teacher education. The participants were able to be the leaders they became in their schools because they had a solid education. Not

only did it give them the opportunity to learn their subject areas, but it also allowed them to be familiar and comfortable with technology, which they proficiently used in schools to help them enact their pedagogy.

Teaching Practice

Much of what participants in this study had to share referred to their pedagogical practice, and the findings in this research have some valid contributions to the work of teachers. First, this study points to the importance of teachers recognizing themselves as unfinished beings (Freire, 1996) and lifelong learners (Harvey & Kamvounias, 2008), and as having a growth mindset (Dweck & Yeager, 2019). Particularly regarding digital technologies, which are ever evolving, the findings show that being open to continue learning can play a vital role in one being able to use technology for educational purposes. Teachers who are not as open to change may have a harder time adapting to new technological requirements and tools that come about. One of the key aspects that participants indicated as being vital in keeping up to date was learning from their students, which reflects the dialogical approach to education proposed by Freire (1996).

Additionally, this study shed some light into the reality in schools when it comes to minimum technology requirements that need to be met in order for teachers to be able to do their work. Without proper equipment and reliable connection, the work with digital technologies in schools can be negatively impacted. Although technology was often available to teachers and most students, the reality still seemed to be far from ideal. However, the findings in this study also show that providing technology itself is not enough; without proper training and right motivators, teachers will not adopt technology, and investment solely in equipment may end up being a waste of resources. Also, participants indicated that being supported by their peers and

administration played an important role in their practice, and partnership and collaboration with peers appeared as a source of learning, enabling teachers to enact and advance their pedagogy.

Conclusion

I started my journey to pursue a doctoral degree in education more than six years ago now, and, as I sit here in the university library to write the final portion of this dissertation, I realize how much I have grown in many different areas.

First, I recognize I have a more thorough understanding of qualitative research methodologies by having had the chance to learn more about ontology and epistemology and philosophical assumptions that are involved in research. Although I chose to use case studies, I studied different approaches to qualitative research, which gave me ideas and foundations for future research. Additionally, I had the opportunity to deepen my understanding of Digital Literacies, a theory I had explored in my master's in education, and to add a couple more to my repertoire, namely TPACK and Maker Pedagogy and Pedagogical Hacking. I am today also more knowledgeable regarding the many steps involved in qualitative research, such as data collection, transcription, and analysis. Writing this document has also given me advanced writing skills and confidence. Writing a dissertation in a language that is not my first posed some challenges but also made me a better writer. I feel I was able to find my voice and be less critical of my own writing, which were pivotal points in allowing me to conclude this work (Narayan, 2012).

In practical terms, I feel I have a much more informed understanding of education in Canada, especially in BC. I can explain today how education is structured in this province and what the documents and policies that regulate it are. I also have a more thorough understanding of different aspects of teacher practice, with a focus on both barriers that impede it and

motivators that enable it. I also feel confident I can proficiently participate in discussions about technology in education, indicating some approaches that may help schools, teachers, and students. Next steps for me include continuing my trajectory in education, by means of both research and teaching. I interviewed fellow teachers for this research and was able to see how future iterations of this work may involve talking to students, their families, school administrators, and policy makers.

References

Aldunate, R., & Nussbaum, M. (2013). Teacher adoption of technology. *Computers in Human Behavior*, *29*(3), 519–524. https://doi.org/10.1016/j.chb.2012.10.017

Alelaimat, A. M., Ihmeideh, F. M., & Alkhawaldeh, M. F. (2020). Preparing preservice teachers for technology and digital media integration: Implications for early childhood teacher education programs. *International Journal of Early Childhood*, *52*, 299–317.

Andema, S., Kendrick, M., & Norton, B. (2013). Digital literacy in Ugandan teacher education: Insights from a case study. *Reading & Writing*, *4*(1). https://doi.org/10.4102/rw.v4i1.27

Araújo, M. de S. (2018). Ensino-aprendizagem com tecnologias digitais na formação inicial de professores de inglês. *Trabalhos Em Linguística Aplicada*, *57*(3), 1590–1614. https://doi.org/10.1590/01031813865259039647 1

Armstrong, A. (2022). Technological Practices of Middle Years Students with Mathematics Learning Disabilities. *Canadian Journal of Science, Mathematics and Technology Education*, *22*(2), 376–391. https://doi.org/10.1007/s42330-022-00208-3

Arya, P., Christ, T., Chiu, M. M., & Li, P. (2024). Literacy teacher preparation for technology integration: A design experiment. *Journal of Digital Learning in Teacher Education*, *40*(1), 21–40. https://doi.org/10.1080/21532974.2023.2275781

Ball, D. L., & Forzani, F. M. (2009). The Work of Teaching and the Challenge for Teacher Education. *Journal of Teacher Education*, *60*(5), 497–511. https://doi.org/10.1177/0022487109348479

Bates, M. (2005). An introduction to metatheories, theories, and models. In K. E. Fisher, S. Erdelez, & L. McKechnie (Eds.), *Theories of Information Behavior*. American Society for Information Science and Technology.

Bawden, D. & others. (2008). Origins and concepts of digital literacy. *Digital Literacies: Concepts, Policies and Practices*, *30*(2008), 17–32.

Baxa, J., & Christ, T. (2018). The digilit framework. *The Reading Teacher*, *71*(6), 703–714.

Bayrakcı, M. (2009). In-service teacher training in Japan and Turkey: A comparative analysis of institutions and practices. *Australian Journal of Teacher Education (Online)*, *34*(1), 10–22.

Bazalgette, C., & Buckingham, D. (2013). Literacy, media and multimodality: A critical response: Literacy, media and multimodality. *Literacy*, *47*(2), 95–102. https://doi.org/10.1111/j.1741-4369.2012.00666.x

Bender, W. N., & Waller, L. (2013). Cool tech tools for lower tech teachers: 20 tactics for every classroom. In *Cool tech tools for lower tech teachers: 20 tactics for every classroom*. Corwin.

Biernacki, P., & Waldorf, D. (1981). Snowball sampling: Problems and techniques of chain referral sampling. *Sociological Methods & Research*, *10*(2), 141–163.

Blades, D. (2019). Science Education in British Columbia: A New Curriculum for the 21st Century. In C. D. Tippett & T. M. Milford (Eds.), *Science Education in Canada: Consistencies, Commonalities, and Distinctions* (pp. 13–36). Springer International Publishing. https://doi.org/10.1007/978-3-030-06191-3_2

Borthwick, A. C., & Hansen, R. (2017). Digital Literacy in Teacher Education: Are Teacher Educators Competent? *Journal of Digital Learning in Teacher Education*, *33*(2), 46–48. https://doi.org/10.1080/21532974.2017.1291249

Botturi, L. (2019). Digital and media literacy in pre-service teachereducation: A case study from Switzerland. *Nordic Journal of Digital Literacy*, *14*(3–4), 147–163. https://doi.org/10.18261/issn.1891-943x-2019-03-04-05

Botzakis, S., Burns, L. D., & Hall, L. A. (2014). Literacy reform and common core state standards: Recycling the autonomous model. *Language Arts*, *91*(4), 223–235.

British Columbia Ministry of Education. (n.d.-a). *BC's Curriculum: Curriculum Overview*. Retrieved June 19, 2023, from https://curriculum.gov.bc.ca/curriculum/overview

British Columbia Ministry of Education. (n.d.-b). *BC's Curriculum: Explore Curriculum*. Retrieved May 15, 2022, from https://curriculum.gov.bc.ca/curriculum/search

British Columbia Ministry of Education. (n.d.-c). *Curriculum Redesign*. Retrieved January 11, 2024, from https://curriculum.gov.bc.ca/rethinking-curriculum

British Columbia Ministry of Education. (n.d.-d). *Introduction to Applied Design, Skills, and Technologies*. Retrieved February 29, 2024, from https://curriculum.gov.bc.ca/content/applied-design-skills-and-technologiesintroduction

British Columbia Ministry of Education. (2011, October 28). *Province unveils plan for education excellence*. BC Government News. https://news.gov.bc.ca/releases/2011EDUC0089-001372

British Columbia Ministry of Education. (2021). *District/Authority Scholarship Allocations School Year 2020/21*. https://www2.gov.bc.ca/assets/gov/education/administration/kindergarten-to-grade-12/scholarships/district-authority-allocation.pdf

Buabeng-Andoh, C. (2012). Factors influencing teachers' adoption and integration of information and communication technology into teaching: A review of the literature.

International Journal of Education and Development Using ICT, *8*(1). https://www.learntechlib.org/p/188018

Bullock, S. (2016). Digital technologies in teacher education: From mythologies to making. *Building Bridges: Rethinking Literacy Teacher Education in a Digital Era*, 3–16.

Cahill, M., & McGill-Franzen, A. (2013). Selecting "app" ealing and "app" ropriate book apps for beginning readers. *The Reading Teacher*, *67*(1), 30–39.

Caires, S., & Almeida, L. S. (2005). Teaching practice in Initial Teacher Education: Its impact on student teachers' professional skills and development. *Journal of Education for Teaching*, *31*(2), 111–120. https://doi.org/10.1080/02607470500127236

Cambridge. (n.d.). Zoombombing. In *Cambridge Dictionary*. Retrieved May 15, 2023, from https://dictionary.cambridge.org/dictionary/english/zoombombing

Carpenter, J. P., Krutka, D. G., & Trust, T. (2022). Continuity and change in educators' professional learning networks. *Journal of Educational Change*, *23*(1), 85–113. https://doi.org/10.1007/s10833-020-09411-1

Chadderton, C., & Torrance, H. (2011). Case Study. In B. Somekh & C. Lewin (Eds.), *Theory and methods in social research* (2nd ed, pp. 53–60). SAGE.

Chaka, C. (2019). Re-imagining literacies and literacies pedagogy in the context of semio-technologies. *Nordic Journal of Digital Literacy*, *14*(1–2), 54–69. https://doi.org/10.18261/issn.1891-943x-2019-01-02-05

Collins. (n.d.). Zoom fatigue. In *Collins Dictionary*. Retrieved May 15, 2023, from https://www.collinsdictionary.com/submission/22949/Zoom+fatigue

Collins, C. S., & Stockton, C. M. (2018). The Central Role of Theory in Qualitative Research. *International Journal of Qualitative Methods*, *17*(1), 160940691879747. https://doi.org/10.1177/1609406918797475

Corcoran, P. B., Walker*, K. E., & Wals, A. E. (2004). Case studies, make-your-case studies, and case stories: A critique of case-study methodology in sustainability in higher education. *Environmental Education Research*, *10*(1), 7–21.

Coscarelli, C. V. (2009). Textos e hipertextos: Procurando o equilíbrio. *Linguagem Em (Dis) Curso*, *9*, 549–564.

Creswell, J. W., & Creswell Báez, J. (2021). *30 essential skills for the qualitative researcher* (Second edition). SAGE Publications, Inc.

Curcic, S., Yurita, M., Young, K., Wolff, L., Ziazi, Z., & Garcia Ansani, E. (2015). Teachers' needs and preparation to use technology in the US and Japan K-12: Learning from teachers. *Journal of Contemporary Research in Education*, *3*(3), 3.

Daigle, T. (2020, May 27). "Zoom fatigue" is setting in: What it is and how to prevent it. *CBC News*. https://www.cbc.ca/news/science/zoom-fatigue-is-setting-in-1.5585933

Darling-Hammond, L. (2000). How Teacher Education Matters. *Journal of Teacher Education*, *51*(3), 166–173. https://doi.org/10.1177/0022487100051003002

Darling-Hammond, L. (2006). Constructing 21st-century teacher education. *Journal of Teacher Education*, *57*(3), 300–314.

Darling-Hammond, L. (2008). Teacher learning that supports student learning. *Teaching for Intelligence*, *2*(1), 91–100.

Denzin, N. K., Lincoln, Y. S., & Stake, R. (1994). *Case studies*.

Dhakal, K. (2022). NVivo. *Journal of the Medical Library Association: JMLA*, *110*(2), 270–272.

Dragulanescu, N.-G. (2002). Website quality evaluations: Criteria and tools. *The International Information & Library Review*, *34*(3), 247–254.

Duarte, F. (2023, April 3). Amount of Data Created Daily. *Exploding Topics*. https://explodingtopics.com/blog/data-generated-per-day

Dweck, C. S., & Yeager, D. S. (2019). Mindsets: A View From Two Eras. *Perspectives on Psychological Science*, *14*(3), 481–496. https://doi.org/10.1177/1745691618804166

Eady, M., Buchanan, S., & Dean, B. (2023). Supporting Remote and Rural Pre-service Teachers on WIL Placement Using Video Technology: Relationships, Confidence, Self-efficacy. In M. Winslade, T. Loughland, & M. J. Eady (Eds.), *Work-integrated learning case studies in teacher education: Epistemic reflexivity*. Springer.

Fielding, J. A. (2019). Rethinking CRAAP: Getting students thinking like fact-checkers in evaluating web sources. *College & Research Libraries News*, *80*(11), 620.

First Nations Education Steering Committee (FNESC). (n.d.). *First Peoples Principles of Learning*. Retrieved February 23, 2024, from https://www.fnesc.ca/first-peoples-principles-of-learning/

Foulger, T. S., Burke, D., Williams, M. K., Waker, M. L., Hansen, R., & Slykhuis, D. A. (2013). Innovators in teacher education: Diffusing mobile technologies in teacher preparation curriculum. *Journal of Digital Learning in Teacher Education*, *30*(1).

Freedom of Information and Protection of Privacy Act (1996). https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/96165_00_multi

Frei-Landau, R., & Levin, O. (2023). Simulation-based learning in teacher education: Using Maslow's Hierarchy of needs to conceptualize instructors' needs. *Frontiers in Psychology*, *14*, 1149576–1149576.

Freire, F., Cavalcanti, M., Kleiman, A., & Possenti, S. (2007). Leitura e escrita via internet: Formação de professores nas áreas de alfabetização e linguagem. *Trabalhos Em Linguística Aplicada*, *46*, 93–111.

Freire, P. (1996). *Pedagogy of Autonomy: Necessary Knowledge for Educational Practice*. Paz e Terra.

Front-End Applications. (n.d.). Hewlett Packward Enterprise. Retrieved January 12, 2024, from https://www.hpe.com/us/en/what-is/front-end-applications.html

Fu, H., Hopper, T., & Sanford, K. (2018). New BC curriculum and communicating student learning in an age of assessment for learning. *Alberta Journal of Educational Research*, *64*(3), 264–286.

García-Martín, J., Merchant, G., & García-Sánchez, J.-N. (2016). Preparing to teach 21st century literacies. In C. Kosnik, S. White, C. Beck, B. Marshall, A. L. Goodwin, & J. Murray (Eds.), *Building Bridges* (pp. 43–55). SensePublishers. https://doi.org/10.1007/978-94-6300-491-6

Geertz, C. (1973). *The interpretation of cultures: Selected essays*. Basic Books.

Gollom, M. (2022, May 25). *Educational tech, including CBC Kids, harvested personal data from children, new report claims*. CBC. https://www.cbc.ca/news/canada/cbc-kids-personal-data-educational-technology-1.6465739

Goodwin, T. (2016, June 23). The Three Ages of Digital. *TechCrunch+*. https://techcrunch.com/2016/06/23/the-three-ages-of-digital/

Government of British Columbia. (n.d.). *Digital Privacy Impact Assessment (DPIA)*. Retrieved January 18, 2024, from https://pia.gov.bc.ca/

Government of British Columbia. (2022, May 19). *Streamlining the Privacy Impact Assessment*. https://www2.gov.bc.ca/gov/content/governments/services-for-government/service-experience-digital-delivery/service-content-design/case-studies/privacy-as-process

Government of British Columbia. (2023a, January 13). *Guidance on Disclosures Outside of Canada*. https://www2.gov.bc.ca/gov/content/governments/services-for-government/information-management-technology/privacy/privacy-impact-assessments/guidance-on-disclosures-outside-of-canada

Government of British Columbia. (2023b, October 5). *Privacy Impact Assessments*. https://www2.gov.bc.ca/gov/content/governments/services-for-government/information-management-technology/privacy/privacy-impact-assessments

Gruszczynska, A., & Pountney, R. (2013). Developing the Concept of Digital Literacy in the Context of Schools and Teacher Education. *Enhancing Learning in the Social Sciences*, *5*(1), 25–36. https://doi.org/10.11120/elss.2013.05010025

Hakami, M. (2020). Using Nearpod as a tool to promote active learning in higher education in a BYOD learning environment. *Journal of Education and Learning*, *9*(1), 119–126.

Haleem, A., Javaid, M., Qadri, M. A., & Suman, R. (2022). Understanding the role of digital technologies in education: A review. *Sustainable Operations and Computers*, *3*, 275–285.

Handrianto, C., Jusoh, A. J., Syuraini, S., Rouzi, K. S., & Alghazo, A. (2022). The implementation of a mentoring strategy for teachersprofessional development in elementary school. *Elementary: Islamic Teacher Journal*, *10*(1), 65–80.

Harvey, A., & Kamvounias, P. (2008). Bridging the implementation gap: A teacher-as-learner approach to teaching and learning policy. *Higher Education Research & Development*, *27*(1), 31–41. https://doi.org/10.1080/07294360701658716

Hinkel, T. A. (2010). *The Learning of English by Players of Online Games*. Universidade do Vale do Rio dos Sinos.

Hinkel, T. A. (2014). *Trajetórias de letramento digital de professores de língua portuguesa: Da formação inicial à ação docente. 2014. 121f* [PhD Thesis, Dissertação (Mestrado em Educação)-Universidade da Região de Joinville–UNIVILLE]. https://www.univille.edu.br//pt-br/institucional/proreitorias/prppg/setores/pos-graduacao/mestradosdoutorado/mestradoeducacao/dissertacoes/dissertacoes2014/625069

Hockly, N. (2021). Digital Literacies. In H. Mohebbi & C. Coombe (Eds.), *Research Questions in Language Education and Applied Linguistics: A Reference Guide* (pp. 633–637). Springer International Publishing. https://doi.org/10.1007/978-3-030-79143-8_110

Hopper, T. (1997). Learning to Respond: Supervising Novice Physical Educators in an Action Research Project. *Sport, Education and Society*, *2*(2), 163–180. https://doi.org/10.1080/1357332970020202

Hopper, T., Fu, H., Sanford, K., & Hinkel, T. A. (2021). YouTube for transcribing and Google Drive for collaborative coding: Cost-effective tools for collecting and analyzing interview data. *The Qualitative Report*, *26*(3), 861–873.

Hopper, T., Fu, H., Sanford, K., & Monk, D. (2018). What Is a Digital Electronic Portfolio in Teacher Education? A Case Study of Instructors' and Students' Enabling Insights on the Electronic Portfolio Process | Qu'est-ce qu'un portfolio numérique dans la formation des enseignants? Étude de cas sur les perspectives d'enseignants et d'étudiants concernant le processus du portfolio numérique. *Canadian Journal of Learning and Technology / La Revue Canadienne de l'apprentissage et de La Technologie*, *44*(2). https://doi.org/10.21432/cjlt27634

Hopper, T., Sanford, Kathy, Spray, T., Fu, H., & Hinkel, T. (2023, May 28). *Teacher Pedagogical Hack Entangling Competencies with Content: Mathematics 12 as a Site for Transferrable Skills*. CSSE Congress, Toronto, ON, Canada.

Israelson, M. H. (2015). The app map: A tool for systematic evaluation of apps for early literacy learning. *The Reading Teacher*, *69*(3), 339–349.

Johnston, R. R. (2010). *Imagi Nations and Deep Literacy: Ideas, Dreams and Visions for Australian Futures* (1st ed). University of Technology, Sydney - Centre for Child & Youth: Culture & Wellbeing.

Kidman, G. (2015). Facilitating Meta-learning in Pre-service Teachers: Using Integration and Slowmation Animation. *Procedia - Social and Behavioral Sciences*, *167*, 117–123. https://doi.org/10.1016/j.sbspro.2014.12.652

King, N., & Horrocks, C. (2010). *Interviews in qualitative research*. SAGE.

Koehler, M. J., & Mishra, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. *Journal of Educational Computing Research*, *32*(2), 131–152.

Koehler, M. J., Mishra, P., Hershey, K., & Peruski, L. (2004). With a little help from your students: A new model for faculty development and online course design. *Journal of Technology and Teacher Education*, *12*(1), 25–55.

Koehler, M. J., Mishra, P., & Yahya, K. (2007). Tracing the development of teacher knowledge in a design seminar: Integrating content, pedagogy and technology. *Computers & Education*, *49*(3), 740–762.

Larson, J. (1996). Challenging autonomous models of literacy: Street's call to action. *Linguistics and Education*, *8*(4), 439–445.

Lauricella, A. R., Herdzina, J., & Robb, M. (2020). Early childhood educators' teaching of digital citizenship competencies. *Computers & Education*, *158*, 103989.

Li, D. (2022). The Shift to Online Classes during the COVID-19 Pandemic: Benefits, Challenges, and Required Improvements from the Students' Perspective. *Electronic Journal of E-Learning*, *20*(1), 1–18.

Li, Y., Garza, V., Keicher, A., & Popov, V. (2019). Predicting high school teacher use of technology: Pedagogical beliefs, technological beliefs and attitudes, and teacher training. *Technology, Knowledge and Learning*, *24*, 501–518.

Logo. (n.d.). In *Wikipedia*. Retrieved May 17, 2021, from https://en.wikipedia.org/w/index.php?title=Logo_(programming_language)&oldid=1023615784

Lohnes Watulak, S. (2016). Reflection in action: Using inquiry groups to explore critical digital literacy with pre-service teachers. *Educational Action Research*, *24*(4), 503–518. https://doi.org/10.1080/09650792.2015.1106957

Mackenzie, D. (2020, September 16). The covid-19 pandemic was predicted – here's how to stop the next one. *New Scientist*. https://www.newscientist.com/article/mg24733001-000-the-covid-19-pandemic-was-predicted-heres-how-to-stop-the-next-one/

Mangen, A., & Pirhonen, A. (2022). Reading, Writing, Technology, and Embodiment. *Movement Matters: How Embodied Cognition Informs Teaching and Learning*.

Martinez, C. (2022). Developing 21st century teaching skills: A case study of teaching and learning through project-based curriculum. *Cogent Education*, *9*(1), 2024936. https://doi.org/10.1080/2331186X.2021.2024936

McDonald, L. (2005). The Meaning of "e-": Neologisms as Markers of Culture and Technology. *eTopia*. https://doi.org/10.25071/1718-4657.36746

Mendoza, A. (2018). Preparing Preservice Educators to Teach Critical, Place-Based Literacies. *Journal of Adolescent & Adult Literacy*, *61*(4), 413–420. https://doi.org/10.1002/jaal.708

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation* (2. ed). Jossey-Bass.

Micro:bit Educational Foundation. (n.d.). *Micro:bit*. Micro:Bit. Retrieved July 30, 2023, from https://microbit.org/

Moita Lopes, L. P. (2012). O novo ethos dos letramentos digitais: Modos de construir sentido, revolução das relações e performances identitárias fluidas. *Ensino de Línguas: Das Reformas, Das Inquietações e Dos Desafios. Belo Horizonte: Editora UFMG*, 204–229.

Murphy, M., Beene, S., Greer, K., Schumacher, S., & Statton Thompson, D. (2024). Collaborative Approaches to Teaching and Building Visual Literacies. In *Unframing the visual: Visual literacy pedagogy in academic libraries and information spaces*. Association of College and Research Libraries.

Narayan, K. (2012). *Alive in the writing: Crafting ethnography in the company of Chekhov*. University of Chicago Press.

Nelson, R. (2020). *Examining preservice teacher technology development during the COVID-19 pandemic* [PhD Thesis]. The University of Texas at San Antonio.

Oxford. (n.d.). Web 2.0. In *Oxford Learner's Dictionaries*. Retrieved July 10, 2023, from https://www.oxfordlearnersdictionaries.com/definition/english/web-2-0

Ozkaya, E. (n.d.). History of Windows from MS Dos to Windows 11. *EO*. Retrieved May 15, 2023, from https://www.erdalozkaya.com/history-of-windows/

Popova, A., Evans, D. K., & Arancibia, V. (2016). *Training teachers on the job*.

Popova, A., Evans, D. K., Breeding, M. E., & Arancibia, V. (2022). Teacher Professional Development around the World: The Gap between Evidence and Practice. *The World Bank Research Observer*, *37*(1), 107–136.

Proctor, J. (2022, June 11). *Parents, Dutch police investigator testify in trial of man accused of cyberbullying Amanda Todd*. CBC. https://www.cbc.ca/news/canada/british-columbia/amanda-todd-week-one-1.6485200

Raja, R., & Nagasubramani, P. (2018). Impact of modern technology in education. *Journal of Applied and Advanced Research*, *3*(1), 33–35.

Reimer, J. (2005, May 4). *A History of the GUI*. ARS Technica. https://arstechnica.com/features/2005/05/gui/

Ribeiro, A. E., & Coscarelli, C. V. (2010). O que dizem as matrizes de habilidades sobre a leitura em ambientes digitais. *Educação Em Revista*, *26*(3), 317–334. https://doi.org/10.1590/S0102-46982010000300016

Roberts, P., & Knaus, M. (2023). *Play-based learning: Play pedagogies for technology education*. 274–287.

Rojo, R. (2007). Letramentos digitais: A leitura como réplica ativa. *Trabalhos Em Linguística Aplicada*, *46*, 63–78.

Rossman, G., & Rallis, S. (2003). *Learning in the Field: An Introduction to Qualitative Research*. https://doi.org/10.4135/9781071802694

Roulston, S., Cowan, P., Brown, M., Austin, R., & O'Hara, J. (2019). All aboard or still at check-in? Teacher educators' use of digital technologies: Lessons from a small island.

Education and Information Technologies, *24*(6), 3785–3802. https://doi.org/10.1007/s10639-019-09951-x

Russell, M., Bebell, D., O'Dwyer, L., & O'Connor, K. (2003). Examining Teacher Technology Use: Implications for Preservice and Inservice Teacher Preparation. *Journal of Teacher Education*, *54*(4), 297–310. https://doi.org/10.1177/0022487103255985

Saldaña, J. (2013). *The coding manual for qualitative researchers* (2nd ed). SAGE.

Sanford, K., Fu, H., Hopper, T., & Hinkel, T. (2023). Pedagogically Hacking the System. In P. Seitz & S. L. Hill, *Assessment of Online Learners* (1st ed., pp. 187–205). Routledge. https://doi.org/10.4324/9781003347972-14

Sanford, K., & Hopper, T. (2019). *Educational Transformation: The BC Story*. Houlihan Publishers.

Segura, M. (2014, August 5). Eu, Steve Wozniak e meu TK85. *Meio e Mensagem*. https://www.meioemensagem.com.br/marketing/ponto-de-vista/eu-steve-wozniak-e-meu-tk85

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, *15*(2), 4–14.

Silveira, A. P. K. da, Rohling, N., & Rodrigues, R. H. (2012). A análise dialógica dos gêneros do discurso e os estudos do letramento: Glossário para leitores iniciantes. *Florianópolis: Dioesc*.

Smith, B., Ng-A-Fook, N., Radford, L., & Pratt, S. S. (2018). *Hacking Education in a Digital Age: Teacher Education, Curriculum, and Literacies*. IAP.

Soares, M. (2017). Alfabetização e letramento: Caminhos e descaminhos. *Anos Iniciais Do Ensino Fundamental*, 197–204.

Somekh, B., & Lewin, C. (Eds.). (2011). *Theory and methods in social research* (2nd ed). SAGE.

Sparkes, A. C., & Smith, B. (2014). *Qualitative research methods in sport, exercise and health: From process to product*. Routledge.

Stake, R. E. (2005). Qualitative Case Studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative research* (pp. 443–466). Sage Publications Ltd.

Statistics Canada. (2022). *Study: Canadians' use of the Internet and digital technologies before and during COVID-19 pandemic* (The Daily, p. 2) [Study]. https://www150.statcan.gc.ca/n1/daily-quotidien/220428/dq220428b-eng.htm

Street, B. (1984). *Literacy in theory and practice*. Cambridge University Press.

Street, B. (2006). Autonomous and ideological models of literacy: Approaches from New Literacy Studies. *Media Anthropology Network*, *17*, 1–15.

Su, F., & Zou, D. (2022). Technology-enhanced collaborative language learning: Theoretical foundations, technologies, and implications. *Computer Assisted Language Learning*, *35*(8), 1754–1788. https://doi.org/10.1080/09588221.2020.1831545

Tadesse, S., & Muluye, W. (2020). The impact of COVID-19 pandemic on education system in developing countries: A review. *Open Journal of Social Sciences*, *8*(10), 159–170.

Tang, M. (2020, October 27). The History of Email. *Exabytes Enterprise*. https://www.exabytes.cloud/blog/history-of-email/

Tennyson, R. D., & Volk, A. (2015). Learning Theories and Educational Paradigms. In J. D. Wright (Ed.), *International Encyclopedia of the Social & Behavioral Sciences (Second Edition)* (Second Edition, pp. 699–711). Elsevier. https://doi.org/10.1016/B978-0-08-097086-8.92036-1

Terra, M. R. (2013). Letramento & letramentos: Uma perspectiva sócio-cultural dos usos da escrita. *DELTA: Documentação de Estudos Em Lingüística Teórica e Aplicada*, *29*(1), 29–58. https://doi.org/10.1590/S0102-44502013000100002

Thompson, A. D., & Mishra, P. (2007). Editors' Remarks. *Journal of Computing in Teacher Education*, *24*(2), 38–64. https://doi.org/10.1080/10402454.2007.10784583

Tomczyk, Ł., & Fedeli, L. (2022). *Digital Literacy for Teachers* (1st ed.). Springer.

Uerz, D., Volman, M., & Kral, M. (2018). Teacher educators' competences in fostering student teachers' proficiency in teaching and learning with technology: An overview of relevant research literature. *Teaching and Teacher Education*, *70*, 12–23. https://doi.org/10.1016/j.tate.2017.11.005

UNESCO. (2017). *Outcome document of the Conference on Digital Citizenship Education in Asia Pacific*. UNESCO. https://en.unesco.org/sites/default/files/dkap-conference-outcome-mar2017.pdf

UNESCO. (2020, March 26). *UNESCO rallies international organizations, civil society and private sector partners in a broad Coalition to ensure #LearningNeverStops*. Unesco.Org. https://en.unesco.org/news/unesco-rallies-international-organizations-civil-society-and-private-sector-partners-broad

Vasquez, V. M., Janks, H., & Comber, B. (2019). Critical Literacy as a Way of Being and Doing. *Language Arts*, *96*(5), 300–311.

Virtanen, J., & Rasi, P. (2017). Integrating Web 2.0 Technologies into Face-to-Face PBL to Support Producing, Storing, and Sharing Content in a Higher Education Course. *Interdisciplinary Journal of Problem-Based Learning*, *11*(1). https://doi.org/10.7771/1541-5015.1613

Voithofer, R., Nelson, M. J., Han, G., & Caines, A. (2019). Factors that influence TPACK adoption by teacher educators in the US. *Educational Technology Research and Development*, *67*(6), 1427–1453. https://doi.org/10.1007/s11423-019-09652-9

Voogt, J., Fisser, P., Pareja Roblin, N., Tondeur, J., & van Braak, J. (2013). Technological pedagogical content knowledge–a review of the literature. *Journal of Computer Assisted Learning*, *29*(2), 109–121.

Voogt, J., & McKenney, S. (2017). TPACK in teacher education: Are we preparing teachers to use technology for early literacy? *Technology, Pedagogy and Education*, *26*(1), 69–83.

Web 101: A History of the GUI. (1997, December 19). Wired. https://www.wired.com/1997/12/web-101-a-history-of-the-gui/

Wells, M., & Lyons, D. (2016). Navigating 21st century multimodal textual environments: A case study of digital literacy. In *Handbook of research on global issues in next-generation teacher education* (pp. 43–61). IGI Global.

Wen, Z. A., Lin, Z., Chen, R., & Andersen, E. (2019). What. Hack: Engaging anti-phishing training through a role-playing phishing simulation game. *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, 1–12.

Wetzel, K., Buss, R., Foulger, T. S., & Lindsey, L. (2014). Infusing educational technology in teaching methods courses: Successes and dilemmas. *Journal of Digital Learning in Teacher Education*, *30*(3), 89–103.

Wilson, M. L., Ritzhaupt, A. D., & Cheng, L. (2020). The impact of teacher education courses for technology integration on pre-service teacher knowledge: A meta-analysis study. *Computers & Education*, *156*, 103941.

Zhao, Y., & Cziko, G. A. (2001). Teacher Adoption of Technology: A Perceptual Control Theory Perspective. *Journal of Technology and Teacher Education*, *9*(1), 5–30.

ZX81. (n.d.). In *Wikipedia*. Retrieved April 30, 2021, from https://en.wikipedia.org/w/index.php?title=ZX81&oldid=1020649578

Appendices

Appendix A: Recruitment Emails

First Contact – Insiders

Dear _____,

I hope this email will find you well.

I don't know if you'll remember me. My name is Thiago Hinkel, and we met in _____. I'm reaching out because I am recruiting for my doctoral research at UVic and thought of asking you for suggestions of people I might eventually interview.

I'll be happy to share more details if you think this is something you might be able to help me with, but, in a nutshell, I'm looking to talk to teachers who are well known in their communities for the work they do with technologies in schools. My research is titled "Experiences that Create Possibilities for Teachers to Understand and Utilize Digital Technologies and Digital Literacies in Their Pedagogical Practice". I have always tried to incorporate digital technologies in my work as a teacher and believe that has been possible due to many factors, such as having learned about computers since very young and because of the many things I myself have learned through my involvement with digital tools. Based on my experience and on what the literature says, I am looking to learn about the trajectories of other teachers and put together a case study that describes the trajectories of teachers with digital technologies. I'm planning to conduct two 45-minute interviews with them sometime before the summer.

Any help you are able to provide or direction you can point me to will be much appreciated. Please let me know!

Kind regards,

Thiago Hinkel, PhD Candidate
Department of Curriculum and Instruction
Faculty of Education
University of Victoria

First Contact – Participants Known to the Researcher

Dear _____,

I hope this email will find you well.

As you know, I am currently doing my PhD at UVic. I have now gone through the initial parts or my program and have recently had my research proposal approved. The next chapter involves talking to teachers who are known for using digital technologies in their work. I am looking to learn more about the experiences these teachers have had and that potentially led them to do the work they do.

My research is titled "The Experiences that Create Possibilities for Teachers to Understand and Utilize Digital Technologies and Digital Literacies in Their Pedagogical Practice". I have always tried to incorporate digital technologies in my work as a teacher and believe that has been possible due to many factors, such as having learned about computers since very young and because of the many things I myself have learned through my involvement with digital tools. Based on my experience and on what the literature says, I am looking to learn about the trajectories of other teachers and put together a case study.

I write to you today because you meet the criteria of my study, and I wonder whether you might be interested in participating. Participation is voluntary and anonymous and would involve being available for two 45-minute interviews via Zoom in the next 6 months or so. It would be great to talk to you about your trajectory as a teacher.

Please let me know if you have interest. I will be happy to share more details with you and answer any questions you might have.

Kind regards,

Thiago Hinkel, PhD Candidate
Department of Curriculum and Instruction
Faculty of Education
University of Victoria

First Contact – Participants Referred to the Researcher (Snowball)

Dear _____,

I hope this email will find you well.

My name is Thiago Hinkel, and I am currently doing my PhD at UVic. I have now gone through the initial parts or my program and have recently had my research proposal approved. The next chapter involves talking to teachers who are known for using digital technologies in their work. I am looking to learn more about the experiences these teachers have had and that potentially led them to do the work they do.

My research is titled "The Experiences that Create Possibilities for Teachers to Understand and Utilize Digital Technologies and Digital Literacies in Their Pedagogical Practice". I have always tried to incorporate digital technologies in my work as a teacher and believe that has been possible due to many factors, such as having learned about computers since very young and because of the many things I myself have learned through my involvement with digital tools. Based on my experience and on what the literature says, I am looking to learn about the trajectories of other teachers and put together a case study.

I have obtained your contact information with _____, who is a participant in my research. I write to you today because you also meet the criteria of my study, and I wonder whether you might be interested in participating. Participation is voluntary and anonymous and would involve being available for two 45-minute interviews via Zoom in the next 6 months or so. It would be great to talk to you about your trajectory as a teacher.

Please let me know if you have interest. I will be happy to share more details with you and answer any questions you might have.

Kind regards,

Thiago Hinkel, PhD Candidate
Department of Curriculum and Instruction
Faculty of Education
University of Victoria

Second Email – Invitation for an Interview

Dear _____,

Thank you so much for your interest in participating in my research. I truly appreciate it.

As mentioned in my previous email, I am looking to connect with you for two 45-minute interviews via Zoom. I have added below a few suggestions of dates and times for our first talk.

List of dates and times

Please let me know if none of them works. I am flexible to meeting at a different time as needed. I can send you the Zoom link and a calendar invite once we have decided on a date.

Also, I have attached a copy of the Consent Form I am using in my research to this email. I ask you to please read it before we meet. When we do meet, I would like to go over it with you and make sure all parts are clear. I will need you to sign a copy before we do the interview. If you have any question or concern in the meantime, please let me know.

I am looking forward to talking to you.

All my best,

Thiago Hinkel

Third Email – Check-in and Confirmation of Second Interview

Dear _____,

Thank you again for taking the time to talk to me on *date* (and for suggesting *AAA* as a potential participant).

I am reaching out today to schedule our second and last interview. I just revisited our first interview and can't wait to talk to you one more time. Do any of the dates and times below work for you?

List of dates and times

Like the first time, I will send you a Zoom link and a calendar invite once we have a date.

I hope all is well. Looking forward to talking to you.

Best,

Thiago

Fourth Email – Member Checking

Dear _____,

It was great talking to you on *date*. I am glad to have had the opportunity to learn more about your trajectory as a teacher and the work you do.

I have now processed the content of the two interviews we had and would like to share it with you. I have attached the transcripts to this email in case you want to review them before I use them in my work. Please let me know whether I can use the transcripts in their entirety or whether you would anything to be removed.

I will be great to hear what you have to say about it. I am available for an additional conversation if you would like that. If I don't hear back from you, can I assume you are ok with the transcripts the way they are?

Thank you again for all your time. You have contributed immensely to my work.

All my best,

Thiago Hinkel

Appendix B: Curriculum Search

Entry	Description	Subject Area	Grade	Core Competency	Elaboration	# Occ.
digital environments (60)	Use materials, tools, and technologies in a safe manner in both physical and digital environments	Applied Design, Skills, and Technologies	K, 1, 2, 3	Applied Skills	-	4
	Use materials, tools, and technologies in a safe manner, and with an awareness of the safety of others, in both physical and digital environments	Applied Design, Skills, and Technologies	4, 5	Applied Skills	Things That Extend Human Capabilities	2
	Demonstrate an awareness of precautionary and emergency safety procedures in both physical and digital environments	Applied Design, Skills, and Technologies	6, 7, 8, 9	Applied Skills	-	4
	Demonstrate an awareness of precautionary and emergency safety procedures in both physical and digital environments	Computer Studies, Media Design, Entrepreneurship and Marketing, Textiles, Web Development	10	Applied Skills	-	5
	Apply safety procedures for themselves, co-workers, and consumers in both physical and digital environments	Food Studies	11, 12	Applied Skills	Including Food Safety And Sanitation, Health, Digital Literacy	2
	Apply safety procedures for themselves, co-workers, and consumers in both physical and digital environments	Specialized Studies in Food	12	Applied Skills	Including Food Safety And Sanitation, Health, Digital Literacy	1
	Apply safety procedures for themselves, co-workers, and users in both physical and digital environments	Marketing and Promotion, Tourism, Graphic Production, Digital Communications	11	Applied Skills	-	4

	Apply safety procedures for themselves, co-workers, and users in both physical and digital environments	Industrial Coding and Design, Mechatronics, Remotely Operated Vehicles and Drones, Furniture and Cabinetry, Fashion Industry, Digital Media Development, Machining and Welding, Art Metal and Jewellery, Engine and Drivetrain, Automotive Technology	12	Applied Skills	-	10
	Apply safety procedures for themselves, co-workers, and users in both physical and digital environments	Woodwork, Robotics, Metalwork, Drafting, Media Design, Electronics, Textiles, Engineering, Computer Information Systems, Computer Programming	11, 12	Applied Skills	-	20
	Demonstrate an awareness of safety issues for themselves, co-workers, and users in both physical and digital environments	Accounting	11	Applied Skills	For Example, Viruses, Phishing, Privacy (Digital); Ergonomics, Lifting, Repetitive Stress Injuries (Physical)	1
	Evaluate safety issues for themselves, co-workers, and users in both physical and digital environment	Entrepreneurship, Business Computer Applications, Economics, Financial Accounting, Accounting, E-Commerce	12	Applied Skills	For Example, Viruses, Phishing, Privacy (Digital); Ergonomics, Lifting, Repetitive Stress Injuries (Physical)	6

	Evaluate and apply safety procedures for themselves, co-workers, and consumers in both physical and digital environment	Tourism	12	Applied Skills	-	1
digital technology(ies) (32)	Safely use appropriate tools to make observations and measurements, using formal measurements and digital technology as appropriate	Science	3, 4	Planning and Conducting	-	2
	Represent and communicate ideas and findings in a variety of ways, such as diagrams and simple reports, using digital technologies as appropriate	Science	3, 4	Communicating	-	2
	Observe, measure, and record data, using appropriate tools, including digital technologies	Science	5, 6	Planning and Conducting	-	2
	Observe, measure, and record data (qualitative and quantitative), using equipment, including digital technologies, with accuracy and precision	Science	7,8	Planning and Conducting	1. Evidence Expressed Through Words, Descriptions, Interviews, Narratives / 2. Evidence Expressed Through Numbers And Measurement / 3. How Close A Measured Value Is To The Actual Value / 4. How Close Measurements Of The Same Type Are To Each Other	2
	Construct and use a variety of methods, including tables, graphs, and digital technologies, as appropriate, to represent patterns or relationships in data	Science	5, 6	Processing and analyzing data and information	-	2
	Construct and use a range of methods to represent patterns or relationships in data, including tables, graphs, keys, models, and digital technologies as appropriate	Science	7, 8	Processing and analyzing data and information	-	2

	Communicate ideas, findings, and solutions to problems, using scientific language, representations, and digital technologies as appropriate	Science	7, 8	Communicating	-	2
	Select and use appropriate equipment, including digital technologies, to systematically and accurately collect and record data	Science	9, 10	Planning and conducting	-	2
	Use appropriate SI units and appropriate equipment, including digital technologies, to systematically and accurately collect and record data	Science for Citizens, Life Sciences, Physics, Automotive Technology, Earth Sciences	11	Planning and Conducting	-	5
	Use appropriate SI units and appropriate equipment, including digital technologies, to systematically and accurately collect and record data	Geology, Specialized Science, Environmental Science, Anatomy and Physiology	12	Planning and Conducting	-	4
	Use appropriate SI units and appropriate equipment, including digital technologies, to systematically and accurately collect and record data	Physics, Chemistry	11, 12	Planning and Conducting	-	4
	Use digital technologies to generate results and support facts and findings	Accounting	11, 12	Applied Technologies	-	2
	Use digital technologies to generate results and support facts and findings	Financial Accounting	11	Applied Technologies	-	1
digital tools (2)	computer troubleshooting, including the incorporation of digital tools to aid and assist with research and diagnostics	Computer Information Systems	11	-	For Example, Help And Discussion Forums, Tutorial Videos, Online Help Databases, Lists Of Frequently Asked Questions (FAQs)	1

	digital tools to communicate and solicit information	Digital Communications	11	-	1. For Example, Spreadsheet, Databases, Word Processors, Social Media, Blogs, Infographics, Polls And Surveys, As Well As Graphic Design And Photo Tools, Such As Photoshop And InDesign / 2. For Example, Polls, Surveys, Crowdsourcing Ideas	1
evolution of digital technology	evolution of digital technology and the impact on traditional models of computing	Computer Studies	10	-	For Example, Introduction Of Mobile Devices, Smartphones, Tablets, Internet Of Things	1
digital identities	Recognize the intersection of their personal and public digital identities and the potential for both positive and negative consequences	Career Education	4, 5	-	Digital Presence/Footprint, Modes Of Dress, Diction, Body Language, Representing Self And Communities	2
digital identity	Our personal digital identity forms part of our public identity	Career Education	6, 7	-	-	2
digital literacy *	Internet safety	Applied Design, Skills, and Technologies	6, 7	-	Including Privacy And Security (Secured Connections, Passwords, Personal Information), Digital Footprint And Dossier, Cyberbullying, Online Scams, And Cybercrimes	2
	digital self-image, citizenship, relationships, and communication	Applied Design, Skills, and Technologies	6, 7	-	-	2
	legal and ethical considerations, including creative credit and copyright, and cyberbullying	Applied Design, Skills, and Technologies	6, 7	-	-	2
	methods for personal media management	Applied Design, Skills, and Technologies	6, 7	-	For Example, Personalization And Organization, Bookmarks, Content Management	2
	search techniques, how search results are selected and ranked, and criteria for evaluating search results	Applied Design, Skills, and Technologies	6, 7, 8	-	Accuracy, Timeliness, Appropriateness, Credibility, And Bias	3

	strategies to identify personal learning networks	Applied Design, Skills, and Technologies	6, 7	-	Personalized Digital Instructional Tools To Enhance Learning And Engagement (Apps, Websites, Videos, Tutorials, Games)	2
	elements of digital citizenship	Applied Design, Skills, and Technologies	8	-	For Example, Digital Self-Image, Creative Credit And Copyright, Relationships And Communication, Cyberbullying, Legal And Ethical Issues	1
	ethical and legal implications of current and future technologies	Applied Design, Skills, and Technologies	8	-	For Example, Hacking (White Hat And Black Hat), P2P Sharing, Torrents, VPNs, Tracking, Data Collection, Anonymity; Automation, Artificial Intelligence, Mobile Devices, Data Collection, Robotics, Digital Currencies (E.G., Bitcoin)	1
	strategies for curating personal digital content, including management, personalization, organization, and maintenance of digital content; e-mail management; and workflow	Applied Design, Skills, and Technologies	8	-	-	1
	strategies to engage with personal learning networks	Applied Design, Skills, and Technologies	8	-	Personalized Digital Instructional Tools To Support Learning (Web Forums, Tutorials, Videos, Digital Resources, Global Communities, Group Communication And Etiquette, Online Learning)	1
media arts *	digital and non-digital media, and their distinguishing characteristics and uses	Applied Design, Skills, and Technologies	6, 7, 9	-	For Example, Video Production, Layout And Design, Graphics And Images, Photography (Digital And Traditional), Emerging Media Processes (Performance Art, Collaborative Work, Sound Art, Network Art)	3

	digital and non-digital media technologies, their distinguishing characteristics, and their uses, including layout and design, graphics and images, and video production techniques for using images, sounds, and text to represent characterizations and points of view of people, including themselves, as well as settings and ideas		8	-	For Example, Video Production, Layout And Design, Graphics And Images, Photography (Digital And Traditional), Emerging Media Processes (Performance Art, Collaborative Work, Sound Art, Network Art, Kinetic Art, Biotechnical Art, Robotic Art, Space Art)	1
	techniques for using images, sounds, and text to communicate information, settings, ideas, and story structure		6, 7	-	For Example, Crop, Print, Record/Capture, Sequence	2
	story principles and genre conventions		8	-	1. Electing And Organizing The Elements Of Structure, Intent, Characters, Settings, And Points Of View Within The Conventions Of A Genre / 2. Traditional Or Culturally Accepted Ways Of Doing Things Based On Audience Expectations	1
	techniques for organizing ideas to structure information and story through media conventions		9	-	Traditional Or Culturally Accepted Ways Of Doing Things Based On Audience Expectations. Each Media Form Has Hundreds Of Conventions That Have Been Built Up Over Time And Are Widely Accepted By Audiences	1
	technical and symbolic elements that can be used in storytelling		9	-	-	1
	media technologies and techniques to capture, edit, and manipulate images, sounds, and text for specific purposes		6, 7	-	-	2

	media technologies and techniques to shape space, time, movement, and lighting within images, sounds, and text for specific purposes		8	-	For Example, Preparing Rough Lumber, Choosing Appropriate Tool Sizes, Cutting, Drilling, Painting, Using Simple Hardware And Fasteners *	1
	media production skills		9	-	Editing And Publishing To Shape The Technical And Symbolic Elements Of Images, Sounds, And Text	1
	influences of digital media for the purpose of communication and self-expression		6, 7, 8	-	-	3
	processes for manipulating and testing digital media data		8	-	-	1
	standards-compliant technology		9	-	Layout Conventions, Mark-Up Language, Current Web Standards, Or Other Digital Media Compliance Requirements Ethical, Moral, Legal Considerations And Regulatory Issues: For Example, In Relation To Duplication, Copyright, Appropriation, And Ownership Of Rights	1
	issues in ethical media practices, including cultural appropriation, moral copyright, reproduction, and privacy		8	-	-	1
	ethical, moral, legal considerations and regulatory issues		9	-	In Relation To Duplication, Copyright, Appropriation, And Ownership Of Rights	1
	elements of media arts used to communicate meaning		8	-	Composition, Time, Space, Sound, Movement, Lighting	1
	specific features and purposes of media artworks from the present and the past to explore viewpoints, including those of First People		9	-	-	1

	specific purposes of media use in the social advocacy of First Peoples in Canada		9	-	-	1
	influences of digital media in society		9	-	-	1
digital media (5)	influences of digital and non-digital media in documentation, communication, reporting, and self-expression	Media Design	10	-	-	1
	Use digital media to collaborate and communicate both within the classroom and beyond its walls	New Media	10	Create and communicate (writing, speaking, representing)	-	1
	Use digital media to collaborate and communicate, both within the learning environment and larger communities	EFP: Literary Studies + New Media	11	Create and communicate (writing, speaking, representing)	-	1
	Select and use a variety of digital media appropriate to purpose, audience, and context	EFP: Literary Studies + New Media	11	Create and communicate (writing, speaking, representing)	-	1
	2D, 3D, audio, and video digital media editing tools, including paid, freeware, open source, and cloud-based solutions	Digital Media Development	12	-	1. Raster And Vector Image Creation And Editing Software / 2. Animation Software That Supports Modelling, Animation, And Rendering / 3. For Example, Sound Editing Software That Supports Import, Export, And Editing Multiple Types Of Audio Formats / 4. Multi-Format Video Editing Software Capable Of Developing Basic Editing, Transitions, And Titling	1
computers and communication devices * (3)	design and function of digital infrastructures, from personal communication systems to wide area networks and the Internet of Things	Applied Design, Skills, and Technologies	8	-	For Example, Global, Satellite	1
	social, cultural, and economic impact of mobile devices		8	-	-	1

	systems for information transfer and communication, including videos, blogs, podcasts, and social media		8	-	-	1
	keyboarding techniques		8	-	For Example, Physical Hand And Foot Placement, Posture, Development Of Touch Typing Skills, Use Of “Home Row” ASDFJKL Techniques	1
drafting *	drafting technique, including dimensioning and standards	Applied Design, Skills, and Technologies	9	-	-	1
	drafting styles, including perspective, mechanical, and architectural		9	-	-	1
	CADD/CAM, CNC and 3D printing		9	-	1. Computer-Aided Drafting And Design / 2. Computer-Aided Manufacturing / 3. Computer Numerical Control	1
	function of models		9	-	-	1
	basic code		9	-	For Example, For The Purpose Of Editing To Send To Output Devices	1
	digital output devices		9	-	For Example, Plotters, Vinyl Cutters, And 3D Printers; CNC Machines	1
	virtual creation using CAD/CAM		9	-	For Example, Layout And Planning Of A Project, Creating Plans For A Model	1
information and communication technologies *	text-based coding	Applied Design, Skills, and Technologies	9	-	HTML, CSS, JavaScript	1
	binary representation of various data types, including text, sound, pictures, video		9	-	-	1
	drag-and-drop mobile development		9	-	For Example, Vizwik	1
	programming modular components		9	-	For Example, Arduino, Raspberry Pi, LEGO Mindstorms	1
	development and collaboration in a cloud-based environment		9	-	For Example, Cloud 9, GitHub	1

	design and function of networking hardware and topology, including wired and wireless network router types, switches, hubs, wireless transfer systems, and client-server relationships		9	-	For Example, NFID, Bluetooth, Mobile Payments	1
	functions of operating systems, including mobile, open source, and proprietary systems		9	-	-	1
	current and future impacts of evolving web standards and cloud-based technologies		9	-	Potential To Support Collaboration, Sharing, And Communication; Data Storage And Privacy	1
	design for the web		9	-	Digital Creation And Manipulation Of Videos And Images For A Web-Based Purpose	1
	strategies for curating and managing personal digital content, including management, personalization, organization, maintenance, contribution, creation, and publishing of digital content		9	-	-	1
	relationships between technology and social change		9	-	For Example, Local And Global Impacts Of Evolving Communication And Mobile Devices, Socio-Economic Digital Divide, Technology And Gender, Social Media And Social Movements, Social Media And Politics, Inequality Of Access, Technology And Democracy, Information As A Commodity	1

	strategies to manage and maintain personal learning networks, including content consumption and creation		9	-	1. Personalized Digital Instructional Tools To Share And Authenticate Learning / 2. Web Forums, Tutorials, Videos, Digital Resources, Listservs, Global Communities, Group Communication And Etiquette, Online Learning, MOOCS, Open Courseware, Broadcasting	1
	keyboarding techniques *		9	-	For Example, Physical Hand And Foot Placement, Posture, Development Of Touch Typing Skills, Use Of "Home Row" ASDFJKL Techniques	1
digital citizenship (18)	Identify and put into practice the principles of digital citizenship	Études littéraires et artistiques + nouveaux médias	10	Exploring and reflecting	-	1
	Identify and put into practice the principles of digital citizenship	Médias et communication numérique	11	Explore and Reflect	-	1
	Digital citizenship implies recognizing the impact that new media has on ourselves, others, and the world	Études littéraires et artistiques + nouveaux médias	10, 11	-	Global By Nature, It Evolves In A Virtual World. It Is Free Of Physical Borders And Offers New Opportunities And New Responsibilities, Such As The Responsible And Ethical Use Of The Internet And Other Digital Technologies To Contribute To Civil And Social Communities	1
	Digital citizenship implies recognizing the impact that new media has on ourselves, others, and the world	Médias et communication numérique	11, 12	-	Responsible And Ethical Use Of The Internet And Other Digital Technologies To Contribute To Civil And Social Communities	2
	Engage in digital citizenship throughout the creative processes	Media Arts	10	Connect and expand	Using Information And Technology In A Way That Is Respectful Of Self, Others, And Privacy Laws, And Mindful Of Cultural Values And Beliefs	1
	Engage in digital citizenship throughout the creative processes	Media Arts, Photography	11, 12	Connect and expand	Understanding Human, Cultural, And Societal Issues Related To Technology, And Engaging In Legal And Ethical Behaviours	4

	Engage in digital citizenship throughout the creative processes	Photography	10	Connect and expand	Using Information And Social Sharing Technology In A Way That Is Respectful Of Self, Others, And Privacy Laws	1
	Recognize the complexities of digital citizenship	New Media	10	Comprehend and connect (reading, listening, viewing)	Self-Monitored Habits And Actions Of Participation And Membership In Digital Communities	1
	Recognize the complexities of digital citizenship	New Media	11, 12	Comprehend and connect (reading, listening, viewing)	Taking Personal Responsibility And Behaving Ethically And Cautiously When Using Technology	2
	Recognize the complexities of digital citizenship	Études littéraires et artistiques + nouveaux médias	11	Exploring and reflecting	-	1
	Digital citizenship requires both knowledge of digital technology and awareness of its impact on individuals and society	New Media	11	-	Taking Personal Responsibility And Behaving Ethically And Cautiously When Using Technology	1
	Analyze and put into practice the principles of digital citizenship	Médias et communication numérique	12	Explore and Reflect	-	1
	Understand and appreciate the complexities of digital citizenship	New Media	12	Comprehend and connect (reading, listening, viewing)	-	1
digital citizen (5)	Digital citizens have rights and responsibilities in an increasingly globalized society	New Media	10	-	People Who Use Information Technology (IT) To Engage In Society, Politics, And Government Participationpeople Who Use The Internet Regularly And Effectively To Interact With Private And Public Organizations	1
	Digital citizens have rights and responsibilities in an increasingly globalized society	New Media	10, 12	-	Takes Personal Responsibility And Behaves Ethically And Cautiously When Using Technology	2
	Explore the rights and responsibilities of being a digital citizen	New Media	10	Comprehend and connect (reading, listening, viewing)	-	1

	Recognize the complexities of being a digital citizen	EFP: Literary Studies + New Media	11	Comprehend and connect (reading, listening, viewing)	Someone Who Uses Information Technology (IT) To Engage In Society, Politics, And Government Participationsomeone Who Uses The Internet Regularly And Effectively To Interact With Private And Public Organizations	1
digital literacy and digital citizenship	digital literacy and digital citizenship	Computer Studies	10	-	Curating A Positive Online Portfolio, Digital Footprints/Dossier, Safe Online Information Sharing, Cyberbullying, Online Empathy, Reporting Online Hate/Bullying, Support And Resources, Appropriate And Professional Ways To Engage In Online Forums/Communication Spaces	1
digital citizenship, etiquette, and literacy (11)	digital citizenship, etiquette, and literacy	Media Design	10	-	Appropriate And Responsible Technology Use	1
	appropriate use of technology, including digital citizenship, etiquette, and literacy	Digital Communications	11	-	-	1
	appropriate use of technology, including digital citizenship, etiquette, and literacy	Digital Media Development	12	-	-	1
	appropriate use of technology, including digital citizenship, etiquette, and literacy	Media Design, Graphic Production, Computer Information Systems, Computer Programing	11, 12	-	-	8
language elements *	digital language	Études littéraires et artistiques + nouveaux médias	10, 11	-	Interactivity Between Words And Images, Elliptical Expressions, Jargon, Slang, Digital Abbreviations	2
	digital language	Médias et communication numérique	11, 12	-	Interactivity Between Words And Images, Elliptical Expressions, Jargon, Slang, Digital Abbreviations	2

elements to enrich a text *	the digital footprint	Études littéraires et artistiques + nouveaux médias	10	-	-	1
image-making technologies *	materials, processes, techniques, and image-making technologies, used in one or more types of photography	Photography	10, 11	-	In Photography, Any Image-Making Technology, Such As Cameras, Lenses, Lighting Equipment, Enlargers, Computers, Scanners, Digital Imaging Software, Accessories, And Other Pieces Of Equipment; Could Also Include Improvisational Use Of Miscellaneous Items	2
	photographic materials, techniques, processes, and image-making technologies, used in one or more types of photography	Photography	12	-	In Photography, Any Image-Making Technology, Such As Cameras, Lenses, Lighting Equipment, Enlargers, Computers, Scanners, Digital Imaging Software, Accessories, And Other Pieces Of Equipment; Could Also Include Improvisational Use Of Miscellaneous Items	1
	digital photography		10, 11, 12	-	Uploading, Formatting, Editing	3
digital (4)	Demonstrate an awareness of precautionary, safe, and supportive interpersonal strategies and communications, both face-to-face and digital	Family and Society	10	Applied Skills	-	1
	Apply precautionary, safe, and supportive interpersonal strategies and communications, both face-to-face and digital	Interpersonal and Family Relationships, Child Development and Caregiving, Housing and Living Environments	11	Applied Skills	-	3

digital and multimedia writing and design processes	Use digital and multimedia writing and design processes to plan, develop, and create engaging and meaningful literary, imaginative, and informational texts for a variety of purposes and audiences	New Media	11, 12	Create and communicate (writing, speaking, representing)	1. Such As Prewriting, Planning, Drafting, Storyboarding; Revising, Editing, And Publishing; Using Sketch, Shade, And Colour; And Selecting Appropriate Format And Layout / 2. Writers Write For Authentic Purposes And Real-World Audiences, Based On Their Strengths And Passions	2
cryptography	modern uses of cryptography in war and digital applications	History of Mathematics	11	-	-	1
digital communication	career opportunities in digital communications	Digital Communications	11	-	For Example, Copywriting, Internet Marketing, UX, SEO, Communications Officers, Social Media Managers	1
	ethics and legalities in digital communication, including ethics of cultural appropriation	Digital Communications	11	-	For Example, Fair Use Rights, Image Use, Copyrights, Trademarks, Creative Commons Licensing, Anonymous Authorship	1
digital communication tools	sociological impacts of digital communication tools	Digital Communications	11	-	For Example, Self-Image, Social Connections (Real Versus Imagined), Mental Health, Self-Esteem	1
digital dossier	strategies for developing a digital dossier	Digital Communications	11	-	Maintaining A Positive Public Profile That Highlights Career Objectives And Showcases Work And Experience	1
digital marketing	influences of digital marketing in online content creation and curation	Digital Communications	11	-	For Example, Email, Newsletters, Mobile Media Marketing, Social Media Marketing, Videos, Graphics, Digital Ad Campaign Strategies, Measurement In Clicks, Analytics And Metrics, Audience Reach, Virality, Generational Targeting	1
digital security risks	awareness and understanding of digital security risks	Computer Information Systems	12	-	For Example, Digital Footprints, Hacking, Piracy, Identity Theft, Phishing Scams, Ransomware	1

digital animation	methods for digital animation	Digital Media Development	12	-	Squash And Stretch (Exaggerating Body Formations For A Comedic Effect), Anticipation (E.G., Guiding The Audience's Eyes Toward Upcoming Action), Staging (E.G., Using The Characters' Poses To Set The Mood Of A Scene), Straight-Ahead Action Or Pose-To-Pose Action (Two Techniques For Moving The Action Forward), Follow-Through And Overlapping Action (E.G., Showing Detail By Giving Characters' Reactions), Slow-In And Slow-Out (Acceleration And Retardation Of A Scene For Effect), Arcs (Moving Characters In Curved Paths For A More Realistic Look), Secondary Action (E.G., Using Smaller Motions To Complement The Main Action, Using Layers), Timing (The Precise Amount Of Time Spent On An Action), Exaggeration (E.G., Squash And Stretch), Solid Modelling And Rigging (Originally Called Solid Drawing, This Emphasizes A Clear Representation Of The Shapes), Character Personality (Creating A Personality That Will Connect With The Audience)	1
digital sound	digital sound and audio data compression	Digital Media Development	12	-	1. For Example, Sampling, Sampling Rates, Aliasing, Bit Depth, Bit Rate, Microphones / 2. For Example, MP3, WAVE Format (WAV), Advanced Audio Codec (AAC), Ogg Vorbis, Free Lossless Audio Codec (FLAC), Loss Versus Lossless, Binary Format, Analog-To-Digital Conversion	1
digital copyright	creative and digital copyright for composers, publishers, and producers of music	Instrumental Music	12	-	-	1

digital systems	circuits for digital systems	Electronics	12	-	For Example, Digital Alarm Clock, Multi-Segmented Light-Emitting Diode (LED) Chasers	1
digital retail environment	digital retail environment	E-Commerce	12	-	For Example, Websites And Mobile Apps	1
digital businesses	distribution channels for digital businesses	E-Commerce	12	-	-	1
digitally procured goods and services	digitally procured goods and services	E-Commerce	12	-	-	1
digital and cloud-based technologies	digital and cloud-based technologies	E-Commerce	12	-	-	1
digital sector	emerging career options and opportunities in the digital sector and for young entrepreneurs	E-Commerce	12	-	-	1

Total	**237**

Appendix C: Participant Consent Form

University of Victoria

Participant Consent Form

Experiences and Conditions that Create Possibilities for Teachers to Understand and Utilize Digital Technologies in their Pedagogical Practice: A Case Study

You are invited to participate in a study entitled The Experiences that Create Possibilities for Teachers to Understand and Utilize Digital Technologies and Digital Literacies in Their Pedagogical Practice that is being conducted by Thiago Hinkel.

My name is Thiago Hinkel, and I am a PhD Candidate in the department of Curriculum and Instruction at the University of Victoria. You may contact me if you have further questions at thiagohinkel@uvic.ca.

As a graduate student, I am required to conduct research as part of the requirements for a degree in Education. It is being conducted under the supervision of Dr. Kathy Sanford. You may contact my supervisor at 250-721-7804 or ksanford@uvic.ca.

Purpose and Objectives
The purpose of this research project is to identify experiences in the life trajectories of teachers that enable them to understand and use digital technologies in their work. My research questions are: What are the experiences and conditions that create possibilities for BC teachers to understand and utilize digital technologies and digital literacies in their pedagogical practice? How are these experiences and conditions being created/enhanced for educators?

Importance of this Research
Research of this type is important because it will allow me to have a thorough look at experiences of teachers with digital technologies in education, which can help pinpoint elements that can contribute to teacher education. It can contribute to teacher education in the sense that the significant experiences that led to pedagogical use of information and communication technologies (ICTs) by the participant teachers might offer important insight to those designing or updating teacher education curricula. Consequently, good practices can reverberate with other teachers and might be taken on by them when research findings are shared.

Participants Selection
You are being asked to participate in this study because you are currently a teacher on Vancouver Island and because your name has been associated as someone who used digital technologies in their educational practice to enhance student learning.

What is involved?
If you consent to voluntarily participate in this research, your participation will include receiving and replying to email communications and/or phone calls, participating in an initial meeting that should last around 30 minutes, and being interviewed twice for 45 minutes in an interval of a few months.

Audio and/or video recordings of the interviews will be made, and the recordings will be uploaded to an online platform for the generation of transcripts.

Inconvenience
Participation in this study may cause some inconvenience to you, including the amount of time that is being asked of you, especially considering that the week of a teacher can be a very busy one.

Risks
There are no potential risks to you by participating in this research.

Benefits
The potential benefits of your participation in this research include having the opportunity to talk about yourself and revisit experiences you consider meaningful to your practice. This may cause you to see relations that you did not see before and, thus, you may have new ideas for your practice or see new ways to carry on current practices. Being sought as a research participant may also help boost your morale; you are being contacted because you are known for including practices in your work that are acknowledged by your students, peers, and/or school community.

Voluntary Participation
Your participation in this research must be completely voluntary. If you do decide to participate, you may withdraw at any time without any consequences or any explanation. If you do withdraw from the study your data will be used if you permit so. Otherwise, all data collected from you will be destroyed and no longer used in the study.

On-going Consent
To make sure that you continue to consent to participate in this research, I will check with you every time we meet whether you want to continue participating in the study. You can withdraw from the study at any point with no consequences to you.

Anonymity
In terms of protecting your anonymity, I will make sure the interview transcripts do not contain your name; a pseudonym will be used instead. They key that connects your real name to your assigned pseudonym will be kept on a physical document and never uploaded to an electronic device. Any other information that may potentially give away your identity will be removed from the transcripts. If the information is crucial and cannot be removed, descriptors or paraphrasing will be utilized.

Confidentiality
Your confidentiality and the confidentiality of the data will be protected by employing online services that utilize secure login options and that store information in servers located inside Canada. Offline electronic files containing data will be store on a password-protected device. All internet connection involved will happen by means of a private connection. Physical records and documents will be kept at the researcher's residence.

Dissemination of Results
It is anticipated that the results of this study will be shared with others in the following ways: doctoral dissertation, published articles, book chapters, and poster presentations.

Disposal of Data
Data from this study will be disposed of after the research is completed or eventual use of data has been made for future endeavors. Regardless of future uses, primary data will be deleted within four years of the conclusion of the study.

Contacts
Individuals that may be contacted regarding this study include Thiago Hinkel, researcher, and Dr. Kathy Sanford, supervisor.
In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca).

Your signature below indicates that you understand the above conditions of participation in this study, that you have had the opportunity to have your questions answered by the researchers, and that you consent to participate in this research project.

_____	_____	_____
Name of Participant	*Signature*	*Date*

Future Use of Data

I consent to the use of my data in future research: _____ (Participant to provide initials)

I **do not** consent to the use of my data in future research: _____ (Participant to provide initials)

I consent to be contacted in the event my data is requested for future research: _____ (Participant to provide initials)

A copy of this consent will be left with you, and a copy will be taken by the researcher.

Appendix D: Interview Guide

First Interview

1. Can you talk a little about your school/class and the work you do?
2. Could you describe your professional trajectory until here? How did you start teaching?
3. What are some of the things that led you to seek a career in education?
4. Could you speak a little about how you were first introduced to digital technologies and what your involvement with them has been throughout the years?
5. We are having this conversation today mainly because you are known for using digital technologies in your work. Could you give some examples of how you use them in class and to what objective?
6. What previous experiences do you consider pivotal in enabling you to do the work you do today with digital technologies? I am looking for examples from any context, and these may include personal experience, formal education, or experience in the job.
7. Has the work you do with digital technologies changed throughout the years? If so, how has it changed and what do you believe has caused it to change?
8. I am looking to talk to more people about the work they do in schools but don't know many people. I was wondering whether there is anyone you know that uses digital technologies in their work as teachers that you think would be willing to talk to me? If so, could you please check in with them and let me know the next time we talk?

Second Interview

1. Is there anything that came to mind since our last interview that you would like to say today? Did you think of any details that may add to what you said before?
2. When we last talked, you gave me an example of the work you do with digital technologies. Can you tell me a little more about how that has developed or is developing?
3. Could you talk about the options you have for support and how you usually proceed regarding experimenting with a new technology or feature?
4. Although there are many technologies out there, not always what they have to offer fits perfectly with the pedagogical objectives teachers have in mind. Do you somehow relate to that statement? Have you ever felt you had to work around a specific technology or use it creatively to achieve your pedagogical objectives? If so, could you talk about it?
5. Do you experience any barriers or incentives to using or not using digital technologies in your work? What would the perfect work environment look like regarding the use of digital technologies?
6. Could you describe how the work you do with technologies in your school today is perceived by your peers and administration?
7. Ultimately, what do you consider the most important experience(s) or factor(s) to have motivated you to use digital technologies in your pedagogical practice? Suggestions to teacher education?
8. Last time we talked I had asked you to think of someone you could possibly refer as a participant to my research. Do you have any suggestion to give?
9. Would you like to choose a name to be used in the transcripts to refer to you?

Appendix E: NVivo

Node Coding (Codes)

Name	Files	References
Who they are and what they do	6	95
School context	3	73
Using tech pedagogically	7	68
Barriers	6	48
Educational background	7	45
Keeping up-to-date	6	42
Experiences with digital technologies	6	34
What is education (emerging)	5	30
Professional background	5	23
Ever evolving	4	22
Support options	2	16
Most important experience	4	12
BC Curriculum (emerging)	4	11
Hacking	2	10
Ideal setting	3	10
Gaps (emerging)	2	9
Perception by others	3	8
Literacies (emerging)	4	7
First introduced	2	6
New technology but old pedagogy (emerging)	2	6
Incentives	2	5
Digital citizenship (emerging)	2	4
Teacher education (emerging)	2	3
Why education	2	2

Parent Node Coding (Categories)

Name	Files	References
Context	7	189
Barriers	6	48
BC Curriculum (emerging)	4	11
Gaps (emerging)	2	9
Ideal setting	3	10
Incentives	2	5
New technology but old pedagogy (emerging)	2	6
Perception by others	3	8
School context	3	73
Support options	2	16
Teacher education (emerging)	2	3
History with ICTs	7	52
Experiences with digital technologies	6	34
First introduced	2	6
Most important experience	4	12
Participants	7	165
Educational background	7	45
Professional background	5	23
Who they are and what they do	6	95
Why education	2	2
Teaching	7	183
Digital citizenship (emerging)	2	4
Ever evolving	4	22
Hacking	2	10
Keeping up-to-date	6	42
Literacies (emerging)	4	7
Using tech pedagogically	7	68
What is education (emerging)	5	30