EXAMINING GOOGLE CLASSROOM CAPABILITIES TO HELP TO PROVIDE PRINCIPLES OF UNIVERSAL DESIGN FOR LEARNING

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A thesis summitted to the school of Graduate Studies in partial fulfillment required for the degree Master of Education

Faculty of Education

Memorial University of Newfoundland

DATE

June 2019

Abstract

Inclusive education allows every student to participate in learning activities and teachers to exercise new approaches to ensure students' means to communicate their knowledge. Universal Design for Learning's mandate is to ensure that all students in a classroom can access and learn from the curriculum. Assistive technology, when employed through a Universal Design for Learning (UDL) framework, can play a key role in connecting all students to curriculum and Google Classroom meets the guidelines recommended by the Center for Applied Special Technology (CAST). These guidelines include: multiple means of representation to give learners various ways of acquiring information and knowledge, multiple means of expression to provide learners alternatives for demonstrating what they know, and multiple means of engagement to tap into learners' interests, challenge them appropriately, and motivate them to learn. The current study focuses on Google Classroom as assistive technology in inclusive classrooms through data collected in formal and informal interviews with teachers and a focus group with students. This study is designed to better understand the benefits and challenges associated with the use of Google Classroom within the framework of UDL. While Google Classroom is still new and its use in the inclusive classroom is not perfect, it was perceived by both teachers and students as an effective classroom technology to meet the needs of each learner in the classroom. Data collected from the current study could help educational stakeholders make appropriate decisions regarding educational technology in the future.

Keywords: Google Classroom, Assistive technology, Universal Design for Learning, Inclusive Education

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Introduction

Inclusive education is a mandate in the Department of Education and Early Childhood Development, Newfoundland and Labrador (Newfoundland and Labrador Department of Education, n.d.). This directive promotes the right for students to attend school and receive the same programming as their peers; respect every student while providing supports to assist; and a welcoming, safe and caring environment that celebrates diversity among students (Newfoundland and Labrador Department of Education, 2017). In an inclusive classroom, teachers are required to apply their instructional approaches to all students to engage them in educational activities and allow them to demonstrate their learning. To implement inclusive education requires "significant reforms and changes to school practices" (Poon-McBrayer & Wong, 2013, p. 1520), namely in values to promote inclusive education, systems and programs that reach each learner, and teaching practices that are designed to reach and communicate to the diverse student body. These authors further discuss the internal implementation issues such as stakeholders involved, namely parents, students, teachers and the school itself as well as the external implementation issues such as deciding what resources would be best, allocation of funds, and creating new policies to match new reforms.

Today's teachers and "school leaders are confronted with many challenges in their attempt to implement reforms and bring changes" (Poon-McBrayer & Wong, 2013, p. 1520). Teachers may often arrive in a classroom where there are language barriers, learning and behavioral exceptionalities, as well as students who require gifted programming. To meet the needs of a diverse student body, teachers need flexible teaching methods, and materials and tools that will help maximize student learning and achievement (Rose, Hasselbring, Stahl, & Zabala, 2005).

Rose and Meyer (2002) proposed Universal Design for Learning (UDL) as a solution to classroom barriers and recommend teachers adapt their environments and their teaching styles to accommodate individual learning needs. UDL recognizes that individuals have differing learning strengths and needs and invites educational institutions to offer outcomes that provide:

> *Multiple means of representation* to give learners various ways of acquiring information and knowledge, *Multiple means of expression* to provide learners alternatives for demonstrating what they know, and *Multiple means of engagement* to tap into learners' interests, challenge them appropriately, and motivate them to learn. (CAST, 2011)

Through the provision of multiple means of representation, expression, and engagement, UDL may reduce barriers to learning.

In a Universally Designed classroom, assistive technology can be used to support students' learning needs (Edyburn, 2010). It becomes obvious that students have exceptionalities when they are the only students using assistive technology in the classroom and they "carry stigma and/or unwanted attention" (Faucett, 2017, p. 14). To relieve the stigma, UDL provides a set of guidelines that outlines how instructional materials, methods, goals and assessments can be used to allow *all* students to access learning curriculum outcomes (Rose & Meyer, 2002). The goal of UDL is to recognize that every student can learn and demonstrate their acquisition using several different means addressed in the three principles that are the foundation of Universal Design for Learning: multiple means of representation, multiple means of expression, and multiple means of engagement (Rose & Meyer, 2002).

Being a newer educational initiative, there are not many published works on Google Classroom in North America. One article was published in Australia, and the two countries were deemed similar enough to draw comparison. Through ERIC (Education Resource Information

Center), SAGE, and ProQuest databases from Memorial University of Newfoundland's library, I was given 527 results, five of which were deemed useful for my study. I included search results that were created after 2014, the year Google Classroom was created, search results related to education, and any article that discussed how teachers would incorporate Google Classroom in their practice. I excluded search results that included the words 'Google' and 'Classroom' that were not linked together and any results that were not linked to education.

Google Classroom was launched in 2014, with a goal to bring together both students and teachers (Government of Australia, 2015). Through Google Classroom, teachers can post announcements, assignments, resources, and due dates for students to access to stay connected with their course material (Government of Australia, 2015). Students can stay organized with their coursework as each course is divided into folders, and whenever there is activity in a certain class, for example an announcement from the instructor, students receive an email with a notification saying so. Furthermore, when typing up assignments or giving presentations, teachers and students can present and customize course material in Google Slides, and when completing written work, Google Docs students can avail of the different inputs, such as speech-to-text or spell check or word-prediction when organizing ideas to a word document. Finally, because Google Classroom is cloud-based and completed work saves automatically, students are less prone to misplacing completed work or having to restart an assignment because of a broken computer. Students simply need an internet connection and browser (Government of Australia, 2015).

The Educator's Role

> All children deserve to learn and grow in peaceful schools and communities. Ensuring our young people have the opportunity to be successful in school - and ultimately, in life

- requires safe and caring schools where teachers, students, parents and the broader community work together to respect and support each other. (Department of Education, Safe & Caring Schools Policy, 2006)

Inclusive education is now a reality for educators in Newfoundland and Labrador and educators, novice and expert, must discover and implement strategies to connect with and support every student in their classroom. An inclusive classroom is comprised of diverse learning needs and teachers are required to accommodate students with physical, behavioral, mental health, and language barriers. Google Classroom as a form of assistive technology can help students of varying ability levels. Struggling writers can use Google docs to quickly access content and use that information to complete a task, as well as respond to any constructive criticism in their writing and make the appropriate changes (Martin & Lambert, 2015). Moreover, students with language barriers can quickly use online or offline versions of Google Translate which proves to be vital when breaking down language barriers (Von Ahn, 2013). Google Classroom allows students to share their content with teachers and peers, and the students who are less interested in curriculum may find collaborating, sharing, and publishing for an audience motivating (MacArthur, 2009), therefore increasing classroom participation and success.

Educators who familiarize themselves with Google Classroom and its functions, and use it as a form of assistive technology, are stepping away from the *one size fits all* approach of the past and are setting their classrooms up to meet UDL standards by providing the ability to create and manipulate course materials and objectives to meet the needs of every student (Lopes-Murphy, 2012).

Rationale for the Research

Research indicates that the integration of technology in a classroom allows for increased motivation and more collaboration among students (MacArthur, 2009). While there is little research investigating assistive technology in an inclusive classroom (Watson, Ito, Smith, & Anderson, 2010), because Google Classroom launched in 2014 (Government of Australia, 2015), there is even less research investigating how Google Classroom can be used as a valuable tool and form of assistive technology when delivering course content and presenting course materials that support inclusion initiatives and UDL. As an intermediate/secondary teacher at Springfield Junior High, I was always interested in incorporating technology into my lessons. I enjoyed interacting with technology, familiarized myself with its capabilities, and I found students were more excited and engaged when technology was introduced to the curriculum. I was curious to see how teachers incorporate Google Classroom into their curriculum, the benefits they see when using it, challenges they encounter, and whether or not they see Google Classroom and associated applications being a viable intervention in the inclusive classroom.

From experience, and in practice, Google Classroom provided an enthusiastic learning environment by way of co-led projects. The assignment, outline, due dates, and class discussion was all attached to Google Classroom where students could access their work, and the work was completed using Google Docs. The students were in groups of two and could share the document with each other and work individually, alongside each other, anywhere in the world, at their own convenience, instead of having to be together in the same space on the same computer to complete the assignment.

This exploratory study used case study methodology to examine how teachers and students use and are impacted by Google Classroom at one school and how it functions as a form of assistive technology in an inclusive classroom that is universally designed.

The goal of the current study is to answer the following research questions:

1. What benefits and challenges do teachers who use Google Classroom encounter when implementing it in the classroom?
2. Do teachers who use Google Classroom find it meets the needs of each student in an inclusive environment? Why or why not?
3. What are students' perception of Google Classroom and how it is used in the context of learning?

Literature Review

This literature review provides and overview of inclusive education, UDL, assistive technology, and research on Google Classroom and its functions. This study applies the framework of UDL to study Google Classroom as a form of assistive technology in an inclusive classroom. It also engages both students and teachers as research participants and examines the data received using a lens of appreciative inquiry. Additional investigation of these topics will be explored in the methodology and analysis of the study.

As a student of Memorial University, I had access to articles in ERIC (Education Resource Information Center), SAGE, and ProQuest Databases. When searching previous studies dealing with assistive technology, UDL, Inclusive Education, and Google Classroom through the Memorial University of Newfoundland's library, many results were found when searching for assistive technology and UDL, but not as many with Google Classroom. For example, when searching "assistive technology" through the above databases, 64,237 results were produced. Searching "assistive technology education" produced 27,782. Given the number of articles produced through these searches, with the exception of a few, I was able to retrieve information from research that was conducted in the past two years. When searching "Universal Design for Learning", 206,918 results were produced. This allowed me to specify UDL as it pertains to assistive technology. Therefore, when I searched "Universal Design for Learning + assistive technology" I was given 4,669 results and could browse through the descriptions and find articles that were relevant to my study. I was also able to seek out the most recent research in these fields. "Inclusive Education" yielded 352,593 results which indicates there was ample research in the field. When I searched "Universal Design for Learning + assistive technology + Inclusive Education" I was given 1,477 results. While this still seemed like many results, I was

able to retrieve articles from the most recent research while only citing few prior to 2010. The Search "Google Classroom" produced 527 results, but many of the results had nothing to do with Google Classroom, or were not able to be linked with my research. "Google Classroom + assistive technology" gave five results. Given the limited number of search results found from these scholarly databases, and lack of empirical research conducted on the use of Google Classroom as means of assistive technology, I used grey literature as a resource to find examples of how Google Classroom is used by teachers that may be considered assistive technology. A Google search gave many results from teachers who have used the technology but limiting the search to "Google Classroom" and "assistive technology" from 2014 to now gave 133 results, some of which were deemed useful. Most of these search results dealt with adults and their interaction with Google Classroom as a form of assistive technology.

Inclusion

In practice, inclusion in education means "teaching students with disabilities in the same environment as their age peers who don't have disabilities" (Hallahan, Kauffman, & Pullen, 2019, p. 33). Accommodations are strategies that are put in place that help students who have different abilities and have their needs met with interventions that accommodate where they are not as strong in the classroom (Government of Newfoundland and Labrador, 2017). These accommodations mean that teachers can modify their instruction, materials, assignments, and curriculum for their learners (Hallahan, et al., 2019). Adaptations in an inclusive classroom means student with learning difficulties, in reading, writing, or math, all participate in the same classroom. Regardless of their learning needs, the inclusion model accommodates students with significant intellectual disabilities who may require an assortment of accommodations. In order for the inclusion model to be successful, educational outcomes may be modified, but

expectations for every student must be preserved (Hollingshead, Carnahan, Lowrey, & Snyder, 2017).

Universal Design for Learning in an Inclusive Classroom

Universal Design was initially created by Ronald Mace with the idea that products and environments should be designed to meet the needs of every person without modifications. The concept of universal design was initially linked to the disabilities rights movement to limit barriers to infrastructure (Silva, 2011). For example, instead of stairs leading up to a building which is only accessible to people who have function in their legs, a ramp leading up to a building is useful to both people in wheelchairs, as well as people who have function of their legs. Rose and Meyer (2002) took this concept and applied it to education with the belief that curriculum should be developed with every type of learner in mind. UDL deals with "instructional practices used for students with and without disabilities" (King-Sears, 2009, p. 199), and addresses several issues that put constraints, such as learning impairments, on learners. Most curriculum outcomes are designed to meet the needs of students who are achieving at grade level. Those who are academically inclined to perform extremely well do not learn as much, while students who have learning disabilities are left unaccommodated (King-Sears, 2009).

UDL "helps meet the challenges of diversity by suggesting flexible instructional materials, techniques and strategies" (McMillan, 2012, p.443), that benefit both students and teachers alike. Teaching flexibility aside, UDL offers students adaptability in the way they "respond or demonstrate knowledge and skills, and in the ways students are engaged" (Edyburn, 2010, p. 34), while allowing students the appropriate supporting accommodations, challenges, expectations in educational accomplishments whether students are working with a disability or not (Edyburn, 2010). UDL is in the best interest of every student. It is not just for students with

disabilities. It is intended to help "increase students' engaged behavior, particularly active engagement, and promoted social engagement through increased peer interactions, student autonomy, and inclusivity" (Katz, 2013, p. 153). Katz's research examined UDL interventions on students' academic and social engagement in the inclusive classroom. The participants in this study were kindergarten to Grade 12 students and teachers drawn from five school divisions in both rural and urban Manitoba, Canada. The three-block UDL model was implemented in teaching practices with their curriculum. It required teachers to collaborate with grade level peers, determine the critical learning outcomes of each unit, and develop projects and activities that allowed for differentiated evaluations. In a given unit of study, the science teacher would teach the science of the unit, the social studies would teach the social studies, and so on. To assess the implementation of the intervention, the author made personal visits to the schools, recorded observation notes and asked teachers to provide feedback after the intervention. The study found that the students in the intervention groups were both academically and socially engaged, with test scores increasing and more time spent on task during instructional time.

Anne Meyer, David Rose, Grace Meo, Skip Stahl, and Linda Mensing created the Center for Applied Special Technology (CAST) in 1984 with the idea to bring universal design's theory to education (CAST, 2011). CAST based the principles of UDL on neuroscience research that suggests the affective network in the brain enables the learner to make an emotional connection to the information and patterns, the recognition network of the brain enables learners to identify and make sense of information and patterns, and the strategic network enables the learner to act according to the information and patterns presented (CAST, 2011). CAST suggests that providing multiple means of representation, expression, and engagements will minimize barriers to learning for students with disabilities and improve learning opportunities for every student

(Rose & Meyer, 2002). UDL is based around three principles that guide curriculum to ensure effectiveness for all learners:

1. To support affective learning, provide multiple means of engagement by offering potions for generating and sustaining motivation, the *why* of learning
2. To support recognition learning, provide multiple means of representation by offering flexible ways to present *what* we teach and learn
3. To support strategic learning, provide multiple means of action and expression by offering flexible options for *how* we learn and express what we know

(Glass, Meyer, & Rose, 2013)

These principles, when implemented in an inclusive classroom, are intended to help teachers when preparing course materials that best communicate with each learner and allow students to demonstrate their learning through a means that best suits their abilities. Lopes-Murphy (2012), states that, "teachers will need to steer away from the one-size-fits-all presentation approach if they are to create flexible ways to present the content" (p. 227), and therefore teachers need to create "flexible and varied approaches to instructional design and assessment" (p. 229), when communicating to a classroom. Taking this concept a step further, UDL recommends that the curriculum itself is developed to anticipate and accommodate the various learners rather than the other way around (Rose & Meyer, 2012). Gordon, Meyer, and Rose (2010), express that learning problems are caused by a rigid curriculum, rather than a student's ability, and therefore stress the need to adapt the curriculum to accommodate students rather than the other way around. Traditionally, educational institutions would categorize students as being gifted or disabled and would subsequently modify curriculum to meet individual needs (Rose & Meyer, 2012). Students who require special services in the classroom

were allowed accommodations to assist students with disabilities to learn in the regular classroom with their grade level peers (Minke, Bear, Deemer, & Griffin, 1996).

Today's diverse student body poses challenges to teachers who are planning curriculum. Traditionally, educational institutions would separate students into different groups based on cognitive or physical ability. However, according to Ralabate, Dodd, Vue, Karger, Smith, Carlisle, and Eidelman (2012), in today's classrooms, there is a "desire to provide services for students with disabilities in the general education classroom" (p. 42), rather than separating them. Edyburn (2010), suggests that those who develop curriculum change the design to include diversity plans to be inclusive and considerate of the primary needs of various student populations. Students with and without exceptionalities can struggle with a rigid curriculum; however, UDL's framework shows promise to benefit every student and their learning style.

Research on Universal Design for Learning

Currently, research on UDL and its impact on student achievement is limited. When searching the Memorial University of Newfoundland (MUN) library database, "Universal Design for Learning" produced 701 results. Many of the articles discussed student engagement, however, when matching "Universal Design for Learning" with "Student Achievement" only six results were produced. Rappolt-Schlichtmann, Daley, Lim, Lapinski, Robinson and Johnson (2013) describe research on UDL as being "still in its infancy" (p. 1222). Vitelli (2015), explains that, "There are no previous studies that have broadly examined the incorporation of UDL into preservice general education" (p. 176). Furthermore, Bastedo and Vargas (2014), explain that while UDL has existed for many years, it is only now gaining momentum. When searching for a definition of UDL, Campbell, Selkirk, and Gaines (2016), state that "Universal Design for Learning (UDL) is a set of principles for curriculum development that gives all individuals equal

opportunities to learn" (p. 1). However, we are yet to find valid tools or instruments to measure what would be deemed universal instruction (Kennedy, Thomas, Meyer, Alves, & Lloyd, 2014), nor is there a concise platform where which we can say an intervention is universally designed. Finally, because we are still in early stage of implementation, educational stakeholders have yet to figure out how principles of Universal Design should be implemented in today's curriculum.

Rappolt-Schlichtmann and colleagues (2013), compared a web-based science notebook aligned with the UDL framework with traditional pencil and paper notebooks, believing that the online science notebook would have a positive impact on student performance, reading and writing proficiency, and motivation to learn science. The Universally Designed for Learning Science Notebook (UDSN) was designed to reduce barriers of learning and followed accessibility guidelines from the *World Wide Web Consortium, Rehabilitation Act,* and *the National Center for Accessible Media,* which aligned with UDL framework (Rappolt-Schlichtmann et al., 2013). The UDSN reduced literature barriers by including accessibility options such as text-to-speech technology, word-by-word English to Spanish Translator, alternate text, image descriptions, and multimedia vocabulary support (Rappolt-Schlichtmann et al., 2013). Furthermore, there are built-in accessibility features for those who have "sensory or motoric limitations" (Rappolt-Schlichtmann et al., 2013, p. 1211). The book also provided students different means to communicate their knowledge, thus allowing multiple means of expression - one of the three principles of UDL. Using both qualitative and quantitative methods, Rappolt-Schlichtmann and colleagues determined that students found the associated supports in the UDSN to be beneficial to enhance their learning experience. Moreover, students were not only more motivated to learn when using the UDSN, when compared to pencil and paper learning, but excited when they had the opportunity. When students were using the UDSN, they

felt as though they were taking ownership of their learning and were competent to show what they knew (Rappolt-Schlichtmann et al., 2013). The authors indicated that there is a need for more qualitative research that explores both students' and teachers' experience with UDL. They also suggest implementation of design-based research on UDL environments (Rappolt-Schlichtmann et al., 2013).

In the past, research has been conducted to determine whether the use of videos games aligned with Universal Design guidelines, as a supplement with traditional curricular materials, heightened the engagement of 57 students with learning disabilities (LD), (Marino, Gotch, Israel, Vasquez, Basham, & Becht, 2014). Engagement from this study was based on time on task when interacting with the learning device, as well as through interviews with participants discussing their level of engagement. Findings showed that the intervention, video games, and supplemental text, were effective at providing students with multiple means of representation and expression, two of the three principles of UDL.

Campbell, Selkirk, and Gaines (2016), conducted a study which highlighted speech-language pathologists' role in a school that implements UDL. The team surveyed participants from 91 different schools to determine if these speech-language pathologists were familiar with UDL, if they were equipped to implement it, and the level of difficulty attached to implementing UDL in their current position. The authors found that many participants in their survey were familiar with the term *UDL,* but did not feel competent as to how they would implement UDL in a classroom, citing "time, opportunities to collaborate with school personnel, and administrative support as key barriers to implementing UDL" (Campbell, Selkirk, & Gaines, 2016, p. 121). The survey results suggest the need for professional development in implementing UDL, as well as

systemic change within the education system to support speech-language pathologists' involvement in planning.

Jennifer Katz developed a Three-Block Model of UDL that includes Systems and Structures, Instructional Practices, and Social and Emotional Learning. Systems and Structures involves an inclusive policy that sees no exceptions, an administration that have expertise in the field of UDL and have a vision for the school's direction for implementation, staff that put in time and effort to collaborate and plan for inclusivity, and a funding for assistive technology and multi-leveled resources. Instructional Practices involve integrating curriculum and offering choice for assessment, peer learning, differentiated instruction and assessment, integration of technology, and social and academic inclusivity of students with exceptionalities. Social and Emotional Learning aims to develop a students' self-concept which provides a sense of belonging, planning, and goal setting. It also values diversity which provides an awareness of strengths and challenges of others, empathy, perspective, compassion and democratic classroom management which promotes rights, responsibilities, independent learning, student choice and empowerment (Katz, 2012). Sokal and Katz (2015), applied Katz's Three-Block Model of UDL to the engagement of early and late middle school students. They believed that their study would demonstrate self reported improvements in academic, social and intellectual engagement, this engagement would carry out through middle school, and would impact traditionally under-performing populations while validating a need for more multi-method studies in this area (Sokal & Katz, 2015). Participants included 183 students, from 10 schools in a midsized city in central Canada. The participants included students from Aboriginal (First Nations, Metis, or Innuit) heritage. The study found that the three-block model of the UDL does have a "a positive impact on students' perceived intellectual engagement in their learning as well as on their observed

active learning and peer interaction" (Sokal & Katz, 2015, p. 78). Further to this study, Sokal and Katz (2015), helped contribute to methods of measuring engagement theories.

Assistive technology

According to DaCosta and Seck (2014), assistive technology is "a combination of […] devices and services that are intended to enhance the skills of people with disabilities in a variety of contexts of interaction, for example, at school, in the home, at the workplace, and in recreation" (p. 13). Assistive technology is used to "to improve the performance of a range of skills including reading, writing, remembering, walking, seeing, hearing, sitting, and communicating" (Maich, van Rhijn, Woods, & Brochu, 2017, p. 2), and comes in low, medium and high-tech selections. Low-tech devices often require little if any training at all and are not electronic (e.g., visuals, pencil grips, adaptive furniture), medium-tech devices are electronic and also do not require much training (e.g., adaptive keyboards, digital dictionaries and recorders), and high tech devices are electronic, require training, but are very adaptive to meet individual student needs (e.g., word prediction software, listening devices) (Maich, van Rhijn, Woods, & Brochu, 2017).

Assistive technology is designed to support the access, participation, and development of students with exceptionalities in our schools (Messinger-Willman & Marino, 2010), and can be adapted to meet specific needs of each student in the classroom. Assistive technology is used to enable students with disabilities to access to information that may have once been inaccessible and help students with learning disabilities meet academic challenges (Bryant, Rao, & Ok, 2014), and can enhance a learning experience where students are strong and assists where students find weakness (Gordon, Meyer, & Rose, 2010).

Research on Assistive technology

Research validates the effectiveness of assistive technology for students with disabilities. "AT [assistive technology] devices, such as electronic dictionaries, audio books, reading pens, talking calculators, or word prediction software, benefit students with disabilities by improving accessibility to the general education curriculum through cognitive, social, and emotional scaffolds (Messinger-Willman & Marino, 2010, p. 9). The literature surrounding assistive technology identifies low-tech and high-tech supports for students who have disabilities in reading, writing, and mathematics. Computer-adapted textbooks, computer assisted reading, CAI (Computer-Aided Instruction), word prediction software, and text-to-speech software are general devices used to support students in mathematics, reading, and writing (Bryant, Rao, & Ok, 2014). Messinger-Willman and Marino (2010) believe that when taking into account students' strengths and weaknesses, and utilizing individualized technology-enhanced plans, students can overcome their limitations. Liu, Wu, and Chen (2013) conducted a review of 85 studies regarding the use of technology learning and special education. After including several different methodologies in their study, the researchers found there to be a positive impact from technologies being used to enhance students' academic performance. Moreover, this review suggested that, "teachers and students in the field of special education expressed positive attitudes towards the use of Computer-based instruction (CBI) in the classroom" (p. 3625). CBI is great for demonstrations, however, not all applications of CBI meet the criteria to be deemed assistive technology.

Bryant, Rao, and Ok (2014) researched the function of assistive technology for students with specific learning disabilities in a UDL framework in reading, mathematics, and writing. For reading and literacy, the authors discuss their interaction with a teacher who uses UDL

BookBuilder (CAST, 2013). BookBuilder is a writing technology that allows teachers to "upload digital photos, type in text, and add audio files" (Bryant, Rao, & Ok, 2014, p. 17). Further, the software has assistive technology built-in tools to meet the needs of certain students who have specific learning disorders. For example, the technology provides a speech-to-text option, where after text is typed, it is read aloud by the computer. As the words are being read, there is a visual associated with it that highlights the words being read. This proves to be useful for students' word recognition skills. The UDL BookBuilder provides "Text Help" that allows support features for text such as translators and playback, as well as literacy support to assist in reading comprehension. The UDL BookBuilder also provides students with "coaches" in the form of animated characters that can be modified to ask questions related to the book that support new vocabulary and enhance classroom concepts. For students who require assistance in organization, Bryant, Rao, and Ok (2014), studied technologically enhanced graphic organizers as a means to structure ideas, and also to begin early stages of the writing process. Traditionally, teachers would put pictures on a screen and students would discuss what they see and its significance. The research team found that *Kidspiration* proved to be a technology-enhanced graphic organizer that allowed teachers to complete several processes with the students, including "Brainstorming, categorizing and organizing information, using visuals as prompts for writing, and practicing oral expression as a part of the writing process" (Bryant, Rao, & Ok, 2014, p. 21). From here, with the help of the software, students can transform their ideas into an outline for a written piece. Bryant et al. (2014) found that students with and without exceptionalities showed significant engagement and representation when assisted with the software. The research team also observed a Grade 9 math class where traditionally, the teacher would introduce a topic, write notes on the white board, then give a few examples of equations, solve them, have a class discussion about

what is and is not understood, and then students would do examples of their own either in a booklet or textbook independently (Bryant, Rao, & Ok 2014). Many students in this class were often disengaged when a new concept was introduced and therefore the teacher came up with alternatives to the traditional way of teaching his math class. Through three different interactive white board apps, students were able to "draw or write on the screen, narrate, and capture the action in video format" (Bryant, Rao, & Ok 2014, p. 22). The teacher used a function from one of the software applications to create tutorial videos where the handwritten step-by-step math processes were shown and narrated to show visually the steps, as well and narrate them, so students can hear it as well. As an evaluation, students then have to create a video themselves in the same format, explaining the same step, and have to share it with peers. Bryant, Rao, and Ok (2014), noted that students reported enjoyment in the technologically enhanced lesson, and evaluation. The activity is structured but offers choice and self-direction, thus, helping every student in the class, not just those with exceptionalities. Furthermore, Kortering, McClannon, and Braziel (2008), mentioned that increased engagement with classroom activities could potentially lead to academic success in the more challenging high school curriculum. Students also noted that when teachers participated in UDL training, the results gave improvements in instruction.

Messinger-Willman and Marino (2010) suggest that today's classrooms have an increased number of students with learning disabilities and that the framework of UDL paired with assistive technology may be the solution to this complex classroom challenge. The team also discussed preventative barriers that inhibit teachers from "effectively selecting, adopting, implementing, and assessing assistive technology devices" (Messinger-Willman & Marino, 2010, p. 5), and gave recommendations for implementation. Students with learning disabilities in

elementary school have their problem amplified once they enter secondary school. Additionally, students who experience difficulty in reading will often struggle with science, social studies and mathematics when learning from a textbook (Messinger-Willman & Marino, 2010). When students in secondary school with learning disabilities, particularly in reading, are required to follow rudimentary learning strategies for reading comprehension, they often find this task demoralizing, they are less motivated and expect to fail when performing an academic task. As a result, these students have high dropout rates, unemployment, and are more likely to be incarcerated compared to students without a learning exceptionality (Messinger-Willman & Marino, 2010). The proposed solution by this research team comes from assistive technology tools such as "electronic dictionaries, audio books, reading pens, talking calculators, or word prediction software" (Messinger-Willman & Marino, 2010, p. 9). This will prove valuable to students with specific learning difficulties by increasing accessibility to the curriculum outcomes through "cognitive, social, and emotional scaffolds" (p. 9). Barriers to implementation mostly derive from users lack knowledge and understanding of assistive technology and therefore users find it challenging when selecting a suitable form of assistive technology. Furthermore, once a technology is deemed suitable to meet the needs of a certain school, there is often a lack of professional development provided for teachers who would benefit from this intervention (Messinger-Willman & Marino, 2010). To overcome these barriers, Messinger-Willman and Marino turn to Edyburn's four-phase process individualized educational planning teams can avail of when choosing assistive technology for students with learning exceptionalities: selection, acquisition, implementation, and integration (Messinger-Willman & Marino, 2010, p. 10). In the selection phase, a list of the most effective products is created that support teaching and learning. For example, what type of products are out there that meet the needs of the school. The

acquisition phase receives and reviews assistive technology products to determine whether or not the product will meet the needs of the team. The implementation phase seeks out the best way to integrate the setting where it will be used, including teacher training and student use. Finally, the integration stage is centered on the use of assistive technology to improve teaching and learning (Haines & Sanche, 2000). They believe that students who struggle academically can overcome this challenge through the integration of assistive technology used by teachers to enhance lessons in their teaching practices.

Liu, Wu, and Chen (2013) conducted a review of 28 studies that were published between 2008 and 2013 that aimed to answer the following questions:

> (a) What are the major research aims, methodologies, and outcomes in these studies of implementing LT [Learning Technologies] in the field of special education?
>
> (b) What types of LT are mainly used with special education students, and for what kinds of students? (Liu, Wu, & Chen, 2013, p. 3618)

Liu et al., answered their first question by classifying their studies with participants, methodologies, learning technologies and whether or not the outcomes was positive, negative or neutral (Liu, Wu, & Chen, 2013). Methodologies consisted of observations, action research, experimental studies and interviews, case studies, other literature reviews, descriptive studies and interviews and questionnaires. The learning technology varied from cloud computing, voice-to-text applications, reading support software, virtual worlds, computer-based learning programs, computer-assisted learning programs, distance learning applications, assistive technology that aids in oral and written communication, computer software, computers for collaborative work, and computer assisted UDL (Liu, Wu, & Chen, 2013). The researchers found that 23 of the 28 studies yielded positive results, 3 reported neutral results and 4 reported negative results.

Moreover, interviews with teachers as well as participating students showed that technology "was a powerful tool that enhanced teaching and learning, and that they observed improvements in the performance of the participating students" (Liu, Wu, & Chen, 2013, p. 3626), once technology was integrated into the classroom. Much of this motivation comes from the notion that technology is perceived as fun when used as a learning intervention. While negative results were noted, they stemmed from teachers lack of knowledge with the device, and students with very high needs.

Barriers to Assistive technology in the Inclusive Classroom

Implementation of assistive technology in a classroom has more challenges than expected. While both students and teachers are often capable of using technology that pertains to their lifestyle, there is a still a steep learning curve when using technology that is specific to achieving academic goals. Walker, Walker, and Bean-Kampwerth (2012) published a study that outlined the major barriers to implementing technology. The research team estimated that in the United States 12 percent of the population live with a disability, which translates to about 36.3 million people. Of these people, over eight million require assistive technology to perform everyday functions. While assistive technology is essential for people with disabilities, financial limitations often inhibit the acquisition of assistive technology in the first place. The solution provided by Walker and colleagues is that assistive technology reutilization to helped to provide "many benefits to consumers, the community, and our environment" (Walker, Walker, & Bean-Kampwerth, 2012, p. 1). Where Google Classroom is web-based and not resource heavy, refurbished computers that would ordinarily be set to be destroyed often support the Google Classroom platform with minor modification (Gooch, 2018). Moreover, this reutilization has "increased access to AT devices and services for individuals with disabilities, promoted

independent living through AT acquisition, and established a model reutilization program for other ILCs [Individual Learning Centers]" (Walker, Walker, & Bean-Kampwerth, 2012, p. 2). Furthermore, tablets, such as iPads, and Microsoft Surface, have made technology-implemented classrooms possible as they can be purchased at a relatively low cost, and they are portable and functional (Maich & Hall, 2016). However, while some technologies can be reutilized, schools must make sure both hardware and software are compatible with speech-to-text, word prediction, and other assistive tech programs (Information Resources Management Association, 2013). While financial constraints often pose as a barrier to technology, there are ways to overcome. Croasdaile, Jones, Ligon, Oggel, and Pruett (2014), published a chapter in Information Resources Management Association identifying that the lack of technology leadership in educational technology is a barrier itself. This problem can stem from an administration that does not have much experience in educational technology, explaining that if they are not equipped to educate their staff, it is often up to the staff to implement technology themselves (Information Resources Management Association, 2013). Moreover, the authors explain that even if administrators believe in the implementation of technology in the classroom, unless there is a clear vision in the technology and path of implementation, the lack of clarity in the technology plan can itself be a barrier to implementation and educational technology is often abandoned when meaningful training is not provided (Information Resources Management Association, 2013).

Google Classroom

Google Suite's software Google Classroom "is a cloud-based system offering online productivity tools for classroom collaboration" (Government of Australia, 2015, p.4). These tools include Google Docs as a word processor, Google Slides as a presentation tool, along with

translation software among many other applications. Google Classroom is designed to enable better communication between student and teacher and help students stay on task with course work in an inclusive environment, by "assisting students in researching, organizing and collaborating for assignment, as well as turning in work through the apps' built-in sharing features" (Sweeney, 2013, p. 34). Colleagues at Springfield Junior High, which is the focus school in this case study, have been using Google Classroom with the courses they teach for the past two years and believe the embedded tools have helped in increasing student achievement, student responsibility, and communication among teachers and students. Parents can also join the Google Classroom subjects as another means of communication. Google Classroom provides teachers with an organized platform for creating, organizing, and having students submit work and allows teachers to post "class resources, assignments, announcements and due dates" (Government of Australia, 2015, p. 5). Additionally, Google Classroom stores all the teacher's class resources in *Google Drive,* which allows teachers to, "automatically create and manage folders for each of their classes" (Government of Australia, 2015, p.5), and allows students to access assignments anywhere with an internet connection.

For students, Google Classroom provides a platform to read, write, present with visuals, submit work, keep track of assignments, and communicate back and forth with the instructor and peers. Spoken language can populate in the document and students can highlight the text and have the computer read it back to them. Students who have exceptionalities, which impact their ability to type and spell, can also benefit from Google Docs. If there is a spelling mistake Google Docs, like Microsoft Word, will either correct it or underline it to let the writer know there is something needing to be addressed.

Google Classroom and Universal Design for Learning in an Inclusive Classroom

Representation is the "what" of learning, expression is the "how" of learning, and engagement is the "why" of learning (Rose et al., 2011). Several of my colleagues at Springfield Junior High, including myself, believe Google Classroom can support the three principles of UDL, and perceive that Google Classroom applications can scaffold the learning of students with and without exceptionalities. For instance, a student's exceptionality may not necessarily be connected with learning, but with the visuals presented in class. Students may have difficulty seeing smaller fonts, the text colour clashing with the background colour, and other visual elements associated with the learning materials. CAST (2011) recommends flexibility in the design of digital materials so as to allow customization in the information pertinent to students' success. Customizations include manipulating text size and colours, graphics, tables or any visual and listening component required in communicating course content CAST (2011). When presenting material to a classroom, both teachers and students can use Google Slides, as a means to communicate to the classroom. The many functions of Google Slides allow the user to change the text size, font, and colour, while at the same time providing the ability to change the background colours, and to create merit to more students and to gain interest, users can also embed video streams where they can manipulate the size of the video as well as the level of volume during play (In Pictures, 2014). CAST (2011) recommends that content be monolingual to avoid confusion but cross-lingual for the students who may not speak the dominant classroom language. Furthermore, along with embedding visual aids for the students who do not speak the dominant language in the class, CAST (2011) recommends electronic translation tools to help students with language comprehension. Google Translate is a software application that is accessible on any computer with an internet connection. It helps assist teachers, students, and

any individual who has a language barrier. With over 70 languages available, Google Translate "allows users to type, write or speak a word or phrase and it will instantly translate it into their chosen language" (Daly, 2014, p. 33). In a diverse school where many students do not speak the same language as the instructor, Google Translate is not only helpful, but becomes vital when students from one country arrive in a school where they do not speak any of the serviceable languages in their new community. Jaganathan, Hamzah, and Subramaniam (2014), found that more than three quarters of English as a foreign language learners (EFL) university students from the Universiti Sains Malaysia not only use, but depend on Google Translate, when completing classroom tasks. CAST (2011) recommends multiple tools and or devices to help construct and compose language. Interventions for this could be text-to-speech or speech-to-text software recordings, spelling and grammar checkers, as well as word prediction software. Google Docs features provide the ability to record text, read text within a document, check grammar and spelling and provide word prediction (Read Write for Google, 2018).

CAST (2011) recommends facilitating and managing information and resources, by providing all students with graphic organizers to enhance the writing process. Google Drawings is an application that provides students with a blank canvas to add text, drawings, shapes, and lines (Docs Drawings, 2017). CAST (2011) stresses the importance of scaffolds and organizational aids for students who may struggle in this area. Google Classroom can be set up for each individual course in which a student is enrolled, and within each class, the teacher can organize information through announcements and assignments students are required to complete. Information for these courses gets stored in a students' Google Drive, helping students who often lose course material to never lose another piece of work (Classroom Technology like Learning, 2016).

Once complete, students can save their document as image files or PDFs that they can transfer to docs, slides or spreadsheets to help develop and organize their written work. Another CAST (2011) intervention is to adopt collaboration among students. This allows students to work in larger groups to peer-review and peer-edit output from classmates, and share responsibility for their work. Google Docs and Google Slides provides the ability for multiple students to work on the same document which supports the peer-review and peer-editing interventions recommended by CAST (Collaborative Revision with Google Docs, 2007).

Finally, CAST (2011) recommends encouraging feedback that is timely and frequent, which helps students stay motivated when learning. Google Docs and Google Slides, while providing an environment with multiple users collaborating together, allows instructors to control the document the same way as students. This program is useful when considering feedback as teachers can open up a document that one or multiple students are working on, and provide notes, recommendations, feedback and words of encouragement in real time to help students succeed in several learning outcomes where Docs or Slides may be used.

Summary

With few exceptions, most articles reviewed indicated a positive impact when a UDL framework was used to structure an inclusive classroom. Recent research focuses on UDL implementation but often struggles to determine what is and what is not an intervention. The current study examines how teachers use Google Classroom applications to meet the needs of each student in their classroom through the principles of UDL in an inclusive classroom. This study also pursues an understanding of student perspectives on Google Classroom Applications as a means of assistive technology in inclusive classrooms. With inclusive classroom initiatives,

further research into assistive technology is needed to determine what technologies can meet the needs of all learners and what professional development is needed to support teachers.

The inclusive education mandate means our classrooms are presently filled with diverse learners with diverse learning needs and teachers are required to meet the academic needs of each student in the classroom. Google Classroom applications can be used as a form of assistive technology to help students, whether they require an accommodation or not. For typically achieving students, it provides an organized platform where students can access, work on and submit assignments, and "enables real-time learning all in the web. Teachers can view a student's work live and students can receive feedback as they go, even before they've submitted" (Government of Australia, 2015, p. 5). Given Google Classroom is a new means of educational intervention, this study aimed to determine if it meet the needs of the students in the inclusive classroom while covering curriculum outcomes.

Methodology

The focus study is qualitative in nature and investigates both instructors' and learners' experiences using Google Classroom and its functions that allow organization, communication, and customization to ensure student success. A qualitative research design provided the means to acquire detailed accounts from open-ended questions, candid insights from informal conversations, as well as vital information from a focus group with students, with emphasis on how teachers and students maximize their use of Google Classroom when engaging with the school curriculum and the assistive technology embedded within the software.

Research Design

This study employs a qualitative design because this approach is more "interested in whether the findings of a study support or modify existing ideas and practices advanced in the literature" (Creswell, 2012, p. 81), rather than making predictions with regards to findings. I chose to implement case study methods when collecting and analyzing data as "the group is often representative of a larger group, such as a third-grade classroom" (Creswell, 2012, p. 469). A case study is a thorough investigation of a limited system and is used to provide an informative and comprehensive depiction for research (Creswell, 2012). A single case study from a single school can often lead to skepticism. However, Yin explains that a single case study "could never provide a compelling rationale for establishing the importance of a single factor or variable" (Yin, 1981a, p. 62). To improve on our understanding of student learning and teacher practices, this study employs a single-case study methodology to better understand how teachers and students use and see benefits and limitations in the use of Google Apps for Education in their classroom. Single-case studies can be used to test theories and can provide valid test results when conducting experiments on a person or a group of people (Yin, 1981b). Through qualitative

research with teachers and students, I wanted to determine whether Google Classroom is a suitable means for all students in the inclusive classroom. This study used semi-structured interviews (Appendix G), and informal conversations with teachers, and a focus group with students (Appendix H), to collect data pertaining to the following research questions:

1. What benefits and challenges do teachers who use Google Classroom encounter when implementing it in the classroom?

2. Do teachers who use Google Classroom find it meets the needs of each student in an inclusive environment? Why or why not?

3. What are students' perception of Google Classroom and how it is used in the context of learning?

This study draws from a larger school in the province where the experiences of several different students, from different countries, cultures, abilities, socio-economic status were taken into account. The majority of teachers at this school have embraced technology and the implementation of new technologies that can make school curriculum more exciting for the students. The school's librarian and technology teachers were nominated by the Newfoundland and Labrador English School District to become Google Classroom experts and pass on this information to classroom teachers who are interested in implementing Google Classroom in their own teaching practice. The Newfoundland and Labrador English School District provides programming for both English and French Languages in every school. In unique situations where there is an influx of immigration, certain schools are equipped to support the learning needs of international students through specialized programs such as ESL (English as a Second Language) and LEARN (Literacy Enrichment and Academic Readiness for Newcomers). The school district meets the international students' learning needs by providing space and resources in the form of

teachers and technology to assist with students who encounter language barriers in a French/English bilingual country and cultural acceptance for every students' background.

Research Context

This study examines students in grades seven, eight and nine from a junior high school in St. John's, Newfoundland and Labrador, Canada. In 2018, this study took place in the Newfoundland and Labrador English School District, where there are approximately 65,000 students in 252 schools with over 8000 employees (Newfoundland and Labrador English School District, 2017). The study took place at Springfield Junior High (pseudonym used). According to the school's annual report, this school has a large student body with varying needs including visually and hearing impaired. It also has language barriers from challenges that stem from learning impairments to international students where neither English or French is a household primary language. The school in question was built in the 1970s and has in recent years seen upgrades to match the increased enrollment of the school. Increased immigration and reconfiguration of schools' zones to match the neighbourhood has resulted in an increase in the number of students in the school. I chose this school as it was a larger junior high school in the province with relative high number of international students. There are many classroom teachers, specialist teachers, instructional resource teachers, a LEARN teacher, and an ESL itinerant. This school was also chosen as more than three quarters of the staff use Google Classroom as a function to communicate content in the classroom, teachers allow students to meet learning outcomes through Google Classroom, and are familiar with the many functions Google Classroom has to offer for students.

The Newfoundland and Labrador English School District encourages classroom technology to help support teaching and learning. Their 2017 Annual report states a "Province-

wide implementation of Google Apps for Education (GAFE) came into effect for the 2016-17 school year" (Newfoundland and Labrador English School District Director's Report, 2017, p. 9). Furthermore, the report explains that the technology is used for collaborative teaching and learning, includes several applications that assist students in accessing information, and that information is 'in the cloud' and can therefore be accessed by any device, at any time, wherever there is an internet connection.

Participants

The focus school was chosen based on its size and diversity, and because teachers at this school have been recognized for taking a keen interest in using technology in the classroom. The participants in this research were chosen through purposeful sampling, which is used for "identification and selection of information-rich cases related to the phenomenon of interest" (Palinkas, Horwitz, Green, Wisdom, Duan, & Hoagwood, 2015, p. 533). Purposeful sampling for qualitative data collection and analysis requires data to be rich and abundant as we "learn a great deal about issues of central importance to the purpose of the inquiry" (Suri, 2011, p. 65). The group of participating teachers were selected based on their use of Google Classroom. Specifically, I contacted teachers who openly discussed the use of technology and Google Classroom in their teaching practice and attended Google Classroom tutorial sessions that were conducted by teachers on staff who are district trained Google Classroom experts. This amounted to about half of the teaching staff. Of those 17 or 18 that were nominated, eight chose to participate in the study. They are knowledgeable with the technology and could make connections with Google Classroom, and teaching practices. Of those teachers, eight responded to indicate that they were interested in participating. There were six participants in the focus group. Two of which were male, four were female. The focus group included students who were

selected based on their use and experience in using Google Classroom, and because the researcher did not instruct them, so as to deter bias. The researcher is a teacher at the focus school, and this relationship provides them with ample candid data that will be used to frame this study. To address personal bias, I will be reporting only objective data free of personal goals, political goals or judgement as suggested by Creswell (2012). Furthermore, once interviews were transcribed, both teacher and student participants were provided an opportunity to read their responses from the questions and further elaborate, if required. The focus study is designed to gather valuable data that will help students, teachers and administrators to select appropriate classroom technology to support the diverse learning needs found within their inclusive classrooms.

To help choose the best participants for this study, the study focused on teachers in the school who identify as using Google Classroom to help support student learning and success. First, I emailed the school principal to provide them with information regarding the study and ask for consent to allow the study to take place at their school. Teachers were sought who: (a) used a variety of technologies in their classroom to meet learning needs, (b) allowed and encouraged students to present their knowledge in a variety of ways, and (c) allowed students classroom technologies such as Chromebooks, iPads and the school's computer lab to complete classroom outcomes.

Eight teachers were selected to participate in the study. The eight teachers that chose to participate made up roughly 20 percent of the sample size. The participants were based on a population of 35 teachers, 8 of whom chose to participate. Creswell (2012) explains that through convenience sampling, researchers select participants as they are willing and available to participate in the study. Furthermore, while convenience sampling cannot say confidently that

these individuals represent the population at this school only, useful information can be gathered through this method of sampling. Participants consisted of four male teachers and four female teachers from a junior high school in the Newfoundland and Labrador English School District. I interviewed classroom teachers, the Instructional Resource Teachers (IRT), the LEARN teacher, and the ESL teacher.

Six students volunteered to participate in the focus group. This group was composed of two boys and four girls from grades seven, eight and nine. The three of the students were in early French immersion (French immersion starting in Kindergarten), and three were in late French immersion (French immersion starting in grade seven). None of the students in the focus group has or had an exceptionality or an IEP.

Ethical Clearance

The ICEHR (Interdisciplinary Committee on Ethics in Human Research) through Memorial University of Newfoundland granted ethical approval for this project, and formal consent was obtained from Newfoundland and Labrador English School District prior to conducting this study (See appendices). When the ethical approval was completed and received from both the ICEHR and the Newfoundland and Labrador English School District, I made contact with the administrators at the focus school outlining the intentions of the study, the potential benefits of the research, the lack of risk involved, as well as the research methodology. An agreement was made with the administrator and they offered their assistance.

Every potential teacher participant was given an information letter, which contained a recruitment portion of the document and they were also informed of the study via email. Both email and information document contained the project' intentions, benefits, lack of risk, process, and the recruitment script to review in order to feel comfortable with and better understand the

research methodology. An in-person information session was also provided to go over the contents of the document as well as to answer any questions regarding the study.

I collected student participants' parental consent forms, teachers consent forms, and student ascent forms, and stored them in an envelope, and which was locked away in a filing cabinet in the school office at the end of each day. Any identifying information (teacher interview data, student focus group data, field notes) were stored in a locked filing cabinet and on a password-protected computer. This information was accessible to my graduate supervisor and myself as the researcher. This information will be deleted off of the researchers' computers and/or shredded seven years after publication.

Recruiting

As there were both student and teacher participants, the recruitment process was different for both groups, as teachers could consent for themselves, and students required consent from their parents and had to ascent themselves as willing participants. The participating teachers were emailed a letter providing information with regards to the study and the types of questions the study set forth to address. Information sessions were provided for both teachers and students to elaborate on the study and answer any questions they had before they consent or ascent to the study (Appendices A and B).

Student recruitment was opened to the whole school. Homeroom teachers were provided information letters to hand to both students and their parents. I was not present while teachers handed out these information sheets for both students and parents. This was intentional to alleviate any actual or perceived influence on the students' decision to participate in the focus group. Students who were interested, and provided consent by their parents, were invited to attend a follow-up information session to further explain the details of the focus groups.

Students, once certain of the what was involved in the focus groups, were provided with ascent forms to sign if they chose to participate. If students did not wish to participate, they were asked to recycle the information sheet and consent form. Informed consent letters were gathered by homeroom teachers, returned to the researcher, placed in an envelope, and were locked and stored in the school office.

Role of the Researcher

As an instructor who teaches French immersion, math, science, social studies and language with the Newfoundland and Labrador English School District, I have experience implementing a variety of lesson plans to a variety of students of all learning abilities. I use assistive technology in my class to meet the needs of my diverse learners, but also to enhance every students' learning experience, and on a personal level, I have an interest in technology; more specifically, pertaining to how it can be manipulated to meet the needs of both teachers and students and how it is used to make learning tasks engaging and effective. I believe my teaching and technology experiences provide me with the ability to address the issues in the study and work effectively with both teacher and student participants. I aim to benefit not only the teachers and students involved with the study, but any student, teacher, administrator or district personnel from the Newfoundland and Labrador English School District. Both participants and district personnel involved with technology in education and implementation were provided research progress notes and results to best assist when implementing assistive technology in the classroom.

It is important that researchers acknowledge personal bias when conducting research. Given the nature of my relationship with the school, staff and students, I am aware of the impact my position may have at the school. Moreover, I am aware of my position as a researcher and the

impact that my position as a researcher, as well as teacher, may have on my research. To address this potential issue, every participant was given multiple verbal reminders as well as reminders in the information document that their responses to these questions will in no way have a negative impact personally or professionally for teachers or academically for students.

Data Collection Methods

Teacher participants contributed through semi-structured, open-ended interviews. Most interviews took place with teachers during mutual preparation periods, lunch time, or after school. The interviews took approximately one hour to complete. Teachers were asked 13 questions (Appendix G), supplemented by inquisitive (probing) questions. Interviews were audio-recorded and later played in Google's speech-to-text technology and edited. Teachers were given an information document about the study and were reminded of their rights with regards to their participation in the study, and that their responses to questions will be kept confidential, and any information that may reveal their identity will not be included when the interviews were transcribed. From the interviews, teachers were identified who use Google Classroom as a means to communicate with each student, as this practice aligns with the principles of UDL in an inclusive classroom. From the interviews, I gathered information that is pertinent to understanding teachers' use of Google Classroom as a form of assistive technology to meet the needs of every student in their classroom.

I spoke with teachers on an informal basis during unstructured time. Informal conversations provide researchers with raw data that can be analyzed and used to create themes (Creswell, 2012). These informal discussions provided further clarification of information provided in the semi-structured interviews regarding their use of Google Classroom as a form of

assistive technology. I asked teachers what brought them to begin using Google Classroom and questions surrounding assistive technology's impact on their classroom learning experiences. Responses to these questions were recorded in hand written field notes and later transcribed.

The focus group with students was organised to gain information surrounding their experiences with and perceptions of Google Classroom as a form of assistive technology and how it aligns with UDL. Focus groups are most useful in groups of four to six when interviewees are comparable to and supportive of each other (Creswell, 2012). Six students, two male, three female in grades seven, eight and nine, who participated in the focus group gave their ascent and had their parents consent. The focus group was audio recorded and conducted in a group during their lunch hour and took about 30 minutes to complete. Students were asked the following questions:

Question 1: In what ways do teachers present information?

Question 2: How does your classroom teacher use Google Classroom to present information?

Question 3: In what ways do you demonstrate what you know in your classroom?

Question 4: How is Google Classroom used by your teachers to allow you to demonstrate what you know?

Question 5: Describe your experience using Google Classroom to show what you know?

Question 6: Would you recommend other teachers and students use Google Classroom?

The data from the interviews and focus groups were accessible to teachers and students a once the research was complete. During the recruitment process, we recommended that participants complete the focus group and interviews in one session. This allowed students and teachers to give candid answers and allowed the researcher to occupy as little of the participants time as possible.

Data Analysis

Data analysis is the process of "taking the data apart to determine individual responses and then putting it together to summarize it" (Creswell, 2012, p. 10). After interviews were conducted and the focus group was completed, the interview results were populated on a transcript through the voice-to-text application on Google Docs. I played back the interviews and opened a speech-to-text recording session. On average, Google Docs speech-to-text was about 90% accurate. Participants who spoke clearly had results with 97+% accuracy where participants who spoke quickly and less concisely were about 75-80% accurate. These documents were then edited for verbatim transcripts of the interviews. Interviewees were then given a copy of their own interview and asked if they had anything to add or if they would like to further elaborate on anything they had mentioned. Member checking "is a process in which the researcher asks one or more participants in the study to check the accuracy of the account" (Creswell, 2012, p. 259). This process allows participants to have a second look at the questions and responses and allows them to add or omit to their responses. Once complete, transcripts were analyzed to get a broad sense of the data (Creswell, 2012). These transcripts were examined using a content analysis approach. A content analysis approach includes coding statements into key concepts and organizing these concepts into themes (Guba & Lincoln, 1985). The transcript data was then organized by question. For example, I would take each question and copy and paste each response from teacher participants under that question. Responses from teachers were given a colour code, which represented an emerging theme, to identify pertinent aspects to their responses. Similar responses across the interviews were collected and used to form themes (Creswell, 2012). For example, after transcribing data from teachers' responses and organizing

them by question, similar responses, key words, and/or ideas would be given a color code. These color codes were used to identify the main ideas in each question. The themes that presented themselves were related to how teachers present information, how students demonstrate their knowledge, their use of Google Classroom, benefits of Google Classroom, challenges associated with Google Classroom, and students' perception of Google Classroom. These responses were related to UDL guidelines (CAST, 2011). Organizing interview data by question from teacher participants allowed me to draw comparison from participants' responses and better understand how teachers use UDL principles in their teaching practices. The themes were connected to teachers' understanding of UDL, assistive technology, their ability to access technology at their school, their use of Google Classroom, their students' use of Google Classroom, and the associated benefits and challenges to this software. For example, a teacher mentioning the use of technological means to meet student's needs would be highlighted with one code. Whereas, if a teacher mentioned non-technological means to meet students needs, that would also be highlighted but with a different code. Themes included: Google Classroom Familiarity, Google Classroom for Projects, Google Classroom for Communication, Google Classroom for Organization, and Google Classroom to Support Learning.

Focus groups with students were audio-recorded and those recordings were played through Google's speech-to-text technology and edited verbatim. Similar to the interviews with teacher participants, transcripts were examined using a content analysis approach, which includes coding statements into key concepts and organizing these concepts into themes. The coding scheme was created to help identify themes from the data and add depth to our understanding about the research (Creswell, 2012). To minimize bias, a second reader authenticated the themes from teacher interviews and the student focus group (Creswell, 2012).

Data analysis ended when no new information developed from the analyses, and categories were saturated (Lincoln & Guba, 1985).

Trustworthiness

Trustworthiness pertains to the quality and value of a study. In qualitative research, bias is often unavoidable because of the researcher's position in the study and their inability to be removed from their own research (Creswell, 2012). Any data accrued by the researcher are left to their own interpretation and could be impacted by their perspective. To reduce personal bias, I employed the use of member checks, and dependability and confirmability techniques by relying on a second reader to confirm my themes (Guba & Lincoln, 1985). This study sought to determine whether assistive technology, when implemented within the framework of UDL, can help make an effective inclusive classroom.

Summary

This research was designed to answer the following question: How can Google Classroom help to support the three principles of UDL. To best answer this question, qualitative methods with purposeful sampling was used to represent the teacher and student participants at Springfield Junior High. Open-ended focus group questions, as well as candid informal conversations, served the research efficiently. All communication with both participant groups followed the outline provided by the ICEHR (Interdisciplinary Committee on Ethics in Human Research). The following chapter outlines the findings from the study.

Results

In this chapter, results are presented in two sections: individual teacher interviews and student focus groups. The first section will provide teacher responses to the semi-structured interview questions. The interview responses are organized by question, from questions 1 to 13. The second section presents the results from the student focus group.

Teacher Interviews

Semi-structured interviews were conducted with eight teachers. The teacher participants were asked 13 questions, and in certain cases probing questions to provide clarification or elaboration. The interviews were conducted to gather information on teacher participants knowledge of UDL, assistive technology, Google Classroom and its applications, and how teachers use Google Classroom as means to meet the needs of their diverse learners. The interviews also gathered information regarding the benefits and challenges that influence Google Classroom as means of assistive technology in their classrooms.

Eight teachers were nominated and consented to be interviewed. There were a mix of male and female teachers (4 female; 4 male) from a large junior high school. I interviewed classroom teachers, a special education specialist, and the school's LEARN (Literacy Enrichment for Academic Readiness for Newcomers) teacher. As previously indicated, one of the reasons this school was chosen was the size. As a larger school in the province, the selected school would provide access to a broad range of students and responses to give a wide representation of resulting data. The other reason for choosing this school was because I am an employee there and I have already built rapport with some of the participants. Moreover, the school is well known to be pioneers in the use of technology in teaching practices through classroom activities, science labs, Remote Operated Vehicle Teams, Day of Code among other

educational technology initiatives. Google Classroom is used by more than half of teachers at this school from a notice to expert capacity.

To ensure confidentiality, teachers were assigned a pseudonym. These names were used to identify participants throughout the data analysis process. The interviews with teachers were transcribed verbatim, narratives were read to identify key statements and emerging themes, and key statements were coded. A second reader verified major and minor themes from the interviews. Interviews were later organized by question to establish common themes identified within each question.

The following table presents the teacher participants, under pseudonym, and their years of experience. The teacher participants teach grades seven, eight and nine in the English stream and French immersion stream, as well as an ESL teacher.

Table 1: Interview Participants' Years of Teaching Experience

	Teaching Experience		
	< 10 years	**11 - 20 years**	**> 20 years**
Mr. Farley		✓	
Mr. Finn	✓		
Ms. Grundy			✓
Ms. Lewis	✓		
Mr. Mickelson		✓	
Mr. Potter		✓	
Ms. Strickland		✓	
Ms. Tobin	✓		

Question 1: Are you familiar with the term Universal Design for Learning?

Three teachers were familiar with the term UDL, and five teachers were not aware of the term. With the three who were familiar with the term, Ms. Lewis said she was familiar with the term and Ms. Tobin expressed that she is somewhat familiar with it, speculating that it ensures every student can learn. Ms. Grundy explained, "I should be, because I did a doctoral thesis on it". Mr. Finn said that it sounded familiar, but he could not quite give me a definition, and five were not familiar with this expression.

Question 2: Are you familiar with the term Assistive technology?

Every teacher interviewed was familiar with the term assistive technology. While seven teachers gave one-word or one-sentence answers, Ms. Strickland expressed that not only does the school have assistive technology, but discussed that the school uses speech-to-text technology and Speak Q, to accommodate students with specific learning disorders, such as difficulties with written expression, by allowing them to express their answers orally.

Question 3: Is Assistive technology available in your school?

Every teacher interviewed responded that there was assistive technology available to them at the school and it could be accessed throughout the school day. They further stated that they use it for the voice-to-text options for students with written output issues. The ratio of computers to students is just under 1:5, and they are found through Chromebook and iPad carts, a computer lab and a resource center. Additionally, during lunch hour, the resource center is open for students who want to access technology for study or free time.

Question 4: Are you able to access Assistive technology whenever you require?

Seven teachers said they could access assistive technology. One of the eight teachers said that this year they do not require any assistive technology in their classes as they do not have any

students with exceptionalities, and another said she does not require assistive technology, as the need is not great. One teacher said the technology is available, but it is sometimes outdated and does not always meet her needs. One teacher expressed that technology is not readily available when required as there is a lack of resources.

Question 5: Describe the range of learning needs present in your classroom.

Teachers expressed the learning needs in their classroom as 'diverse' with a wide range of learning abilities. Classrooms were described as ranging from high achieving, where no accommodations were required at all, to very weak, with several barriers to learning. Every class but one had students with accommodations included as part of their Individual Education Plan (IEP). Some teachers commented that they had students with a number of exceptionalities in their class that included language barriers, specific learning disorders, and autism; and while they mentioned high achieving students, none mentioned giftedness. One teacher said:

> If you had a one-to-ten scale where you had a student who could not read or write up to somebody who needed absolutely no assistance and could do advanced things, I would say I have right through the spectrum. (Mr. Brees)

There was also another teacher who stated that she is the school's LEARN teacher and therefore teaches students who are new to Canada. She indicated that daily, she educates students with significant educational gaps in their learning and could see students with four-year gaps in language and two-year gaps in mathematics. These students are also second language learners to English, and encounter many challenges in communication before academics are even discussed.

Question 6: What types of assistive technologies are recommended for use on the IEPs of the students in your class?

Most teachers named the use of assistive technology as recommendations on their individual education plans. They discussed various forms of assistive technology including: audio recordings as well as audiobooks, the use of word processors, text-to-speech and speech-to-text technology, as well as technologies involving visual cues to assist students. Specific technologies or brand names were not mentioned by any teacher; however, one teacher stated:

> Chromebooks can encompass a number features ranging from scribing to narration, playing text that's been pre-recorded; they can use that for typing, preparing, speaking, if they're familiar with that technology, so it's one nice package that does a lot of the separate needs that used to be separate before. (Mr. Potter)

Most teachers referenced the use of computers or tablets to assist with written output. Four of the teachers said they used Chromebooks specifically to meet this need. As mentioned above, Chromebooks meet the need of students as they can simply press a button, speak, and the words populate. If they see text, they can copy that text in a Google Doc, and have it read to them. There is also built in word prediction software.

The LEARN teacher discussed that because students in her class are arriving to her class one week after arriving to Canada, there are no IEPs in place, and it is her job to determine their needs and help implement an IEP moving forward.

Other than web-based, electronic technology, one teacher mentioned the use of 'hush-ups', which are tennis balls that are cut to fit around the bottoms of chair legs to help avoid the noise from chairs being moved along the floor. The softening of the noise helps students who are sensitive to sound.

Question 7: What measures do you take to meet the needs of students in your classroom?

The teachers interviewed in this study discussed a variety of ways in which they meet the needs of students in their classroom. The most common strategies teachers discussed were differentiated instruction, which is the teaching of materials in different ways to communicate information, group work with peer-learning, incorporation of technology as well as assistive technology, use of visuals during instruction, alternate programs and settings, and the use of videos. Many teachers indicated that they try to make learning as individual as possible through conversations with students, using differentiated instructional techniques, and providing multiple means to complete an assignment.

Many teachers discussed the use of differentiated instruction in their assessments. One teacher discussed "mixing up the activities" (Mr. Brees) to allow different instruction for different learning styles with a goal to best communicate to each student. Two other teachers discussed allowing students choice of assessment. While not getting into specific strategies, Ms. Strickland said, "you have to vary your teaching methods, and your assessment strategies, to make sure that you support difference" and "They need to have a choice in assessments, and have other options, instead of just you know using the board." Ms. Tobin said:

> Most of the time is offering choice in assessment so they're doing group work right now where they get to pick what they're doing. If writing a full page is not something that works for them, they have the option of doing a drawing of a small paragraph. They have the option of doing something oral so it's usually kind of mixing up the learning style.

Ms. Grundy, who is a language teacher department head, conferences with other language teachers in her department and does her own rounds with classes to better understand classroom needs and helps put together IEPs for students, as well as develop alternate programming where

required. The LEARN teacher has a different program for each student she teaches and covers curriculum from kindergarten to grade six. The main issues that she encounters is that many students have *some* education from kindergarten to grade six, but not all. Her job is primarily to fill in the gaps that are missing from their schooling experience thus far.

Question 8: How did you become familiar with Google Classroom?

Google classroom was popularized in the school system as a new technological means to communicate with and assess students. While it initially gained popularity through teacher's independent use and sharing of information with others, the school district began to see this as a viable means of communicating with students. Six teachers mentioned they became familiar with Google Classroom when the Newfoundland and Labrador English School District began providing training to technology teachers who, in turn, provided training to teachers in their school. Further to that, the Newfoundland and Labrador English School District offered professional development to familiarize teachers with Google Classroom to supplement in-school training provided to technology teachers. One of the school's technology teachers said:

> I was one of the people that was assigned as a Google administrator. And so I received PD training for the school administrator. There are three of us and I'm one of them. So that first was familiarization with the classroom and its various features, different plugins and then how to set up kids. (Mr. Potter)

Some teachers discussed how Google Classroom was a district directive, two citing it was district mandated, while other said they had received training from the learning resource teacher during after school sessions. Newer teachers discussed how "it was introduced to us from the start they basically told us that all teachers should have a code and a classroom" (Ms. Tobin). The Google Classroom initiative, however, was not supported by every teacher. One teacher

said, “I personally am not a fan of Google Classroom” (Ms. Grundy), citing that based on clientele, not every student will have access to Google Classroom at home.

Question 9: How do you use Google Classroom to support teaching and learning?

Teacher participants use Google Classroom to support learning by enhancing organization, communication, and assessments, and supplementing material they already present. Teachers commented that all course materials are readily found on their Google Classroom, and classes are all organized by subject, therefore, short of having an internet connection at home, students are always able to access their course materials. Mr. Farley discusses how he uses Google Classroom as means for students to access “notes, or assignments, or relevant information”. Furthermore, Ms. Strickland noted Google Classroom, “Mostly as an organization tool. I have all my materials on my Google Classroom sites for all my classes”, and Mr. Potter explains that students can access this information 24/7.

Google Classroom is also used as a communication tool. While many teachers have their own websites and the school has their own homework site, many teachers discuss how Google Classroom allows communication between teachers, students, and their parents. “It’s supplementing the teacher website quite well, because having your own website and then putting all your assignments in Google Classroom,” (Mr. Potter). He also added that “you can allow parents to see what's in there, so I can have another view of the upcoming material.” Furthermore, Ms. Tobin said, “Parents are invited so I'll usually post, like, what we did that week, so they get in a weekly summary and we do projects on there as well.” Teachers are also able to provide feedback to students as well as edit documents they create. Ms. Strickland explains that she is:

> able to provide them with descriptive feedback in “Francais” because they do a lot of writing, a lot of essays, I use the editing tool so that sends messages to them right away, tells them how to improve and at home wherever they are.

Ms. Lewis explains that she’s able to post video links and Quizlet activities to her Google Classroom so students can work or review at home.

Students can also communicate with the teacher through Google Classroom, or through a forum, though, Mr. Farley restricts the forum from usage in a Junior High Classroom: “I disable any communication with students on the Google Classroom itself, if this is relevant, because I find they tend to fool around and ask say, frankly, idiotic things and time-wasting things there”.

Students also can complete assignments online. Using Google Slides, or Google Docs, a teacher can create an assignment, post it to Google Classroom, and students can complete their assignment with their phone, laptop, desktop, Chromebook or tablet anywhere there is an internet connection. Mr. Brees says he uses Google Classroom for certain projects, especially group projects, because students can often work together to complete projects and learn things together. Mr. Mickelson explains:

> I try to use Google Classroom frequently... for any type of... of projects or assignments that would require students to use, I guess, second language and having the assistive technology there to... to help them translate is very advantageous to me and my classroom with up to 35 students in one room, having translation technologies there to help students and allow them to use it in Google Classroom is very helpful to me. (Mr. Mickelson)

Question 10: How do your students use Google Classroom to support learning?

According to the interviewed teachers, students supported their learning through Google Classroom through the ability to complete projects, assignments, and class work using computer technology and accessing content at any time, including communication and feedback from their teachers, peer-support and group-based activities, and the ability to review classroom activities and materials at home, even if they misplaced some of their own classroom materials.

Individually, students have plenty of opportunity to access, interpret and communicate their knowledge in many ways. Additionally, they have access to copies of notes, assignments, Quizlet activities and anything that may have been forgotten in the classroom.

> They can access them whether it's in the form of a PDF, Google doc, it can be links to other websites, it can be a plug-in such as FlipGrid, which we use in the English stream, to promote representing, as well as giving non-written journal entries, they can record themselves, and there is some good security to keep it so that it's only within the classroom you can lock it down so only the teacher can see the final report.
>
> (Mr. Potter)

When considering classroom activities that require practice and revision, most teachers look to Google classroom to post classroom materials, so students can access them at home, practice, repeat, and perfect. Ms. Lewis finds use in having all the materials online for student revision at home, citing:

> They use it [Google Classroom] to have copies of their work so… assignments that they have, study guides, and things that we watched in class I put those links back on there so they can watch them again 'cause they often need more repetition.

Mr. Mickelson echoes this sentiment adding that:

Google Classrooms is used by students to support learning as the vast majority of... of notes, study materials, learning objectives are provided to students through Google Classroom, and students are free to use, I guess, these learning tools on their own time to... to help them advance in the class or achieve academically.

Mr. Brees mentions that most written pieces can be done using Google Docs, and it is always available when students have online access and they can access supplementary materials to help complete student work to meet outcomes. Similarly, when students have to do a presentation that includes visuals similar to PowerPoint, they have a Google alternative, Slides, which has many of the same components of PowerPoint, only through Google, and there are many more support options that help with communication, collaboration and feedback. With both Docs and Slides, students work together on the same project, on the same document or slide show, from different computers, to allow peer editing and therefore learn from each other. Ms. Strickland says, "Google Slides and the peer editing is well, I find that really great, so they can edit each other's work and not just me giving them feedback they suggest edits for each other". Additionally, Ms. Strickland adds that teachers that assign a Google Docs or Google Slides project are also able to access the same document and quickly give feedback and suggest edits for students.

Question 11: Are there benefits to using Google Classroom to meet the needs of each student in your classroom?

All but one teacher addressed the benefits of using Google Classroom, and the one that was skeptical did see the potential, but prefers the use of pencil and paper assessments. For the teachers that could see the benefit, many of the ideas from the previous two questions were

reiterated. Mr. Brees added that students benefit by using Google Classroom through teacher's accessibility:

> Checking in on individual progress, Google Classroom makes it really easy to see, you know, where a student is and how I can help them because the fact that I can see their work being developed from start to finish is a lot more beneficial than just seeing you know a blank page and then the finished product. I'm able to check in on him and see how they're arriving at what they're doing. (Mr. Brees)

Mr. Potter reiterated the fact that students no longer have the excuse of "left my notes at school" or "We're out of ink" as everything is available online.

In addition to the previous questions, Ms. Strickland suggests that students who completed assignments through Google Classroom stay on task too, explaining that:

> when we're using Google Classroom, students that are often very unfocused it, it helps them to really focus and I'm thinking about a few students in particular that when we're doing activities in Google classroom, they produce a lot better (Ms. Strickland).

Moreover, Mr. Farley explains that the built-in software supports (word prediction, autocorrect, etc.) helps students with writing difficulties produce better than if they were only given a pencil and paper.

Finally, Ms. Tobin explains that there is less stigma attached to students who need supports. They're all using the same intervention, and students are using the same device to meet their individual needs.

> I was able to give everybody the same project except for two students who needed it modified so they can get a different project without having everyone blatantly see that they were working on a different project, so that was nice. (Ms. Tobin)

Question 12: Are there challenges to using Google Classroom to meet the needs of each student in your classroom?

When discussing the challenges, most teachers agreed that having access to technology while at school was the primary hindrance to using not only Google Classroom, but access to computers, laptops, Chromebooks or tablets. In addition, the school's Wi-Fi did not always meet requirements to power numerous devices at the same time. Moreover, another teacher discussed that students with exceptionalities who have severe challenges with curriculum sometimes have challenges with the use of technology, and sometimes require assistance to complete tasks using Google Classroom.

The lack of access to technology that enables the use of Google Classroom was a common theme that teachers noted when discussing challenges associated with using Google Classroom and meeting the needs of each student. Because technology has a cost, a school can only afford so many Chromebooks per year, and even if a school had the ability to give every student a device, there would have to be a costly upgrade to the Wi-Fi to support the connection of several hundreds of devices at the same time. Mr. Potter explains:

> We don't have a one-to-one device policy here and even when we have multiple devices in say one wing of the school, we're often challenged with the amount of network that we have available […] mobile devices will swamp the Wi-Fi that we have within the school and then some will not be able to connect, or they'll be intermittent, or spotty.
>
> (Mr. Potter)

Ms. Strickland echoed the notion of availability by saying, "a big challenge is the availability of technology. I find I have to book the labs, and the sets of Chromebooks really far in advance". The school in question has two sets of Chromebooks (30 in a set), and one set of iPads (30 in a

set), a computer lab that is often accessible, and a library resource center that is almost always available, with the exception of a teacher who teaches one class in there. Mr. Mickelson expressed concern that while it is a different way for students to complete assignments at school with the given technology, not every student has a computer, laptop, tablet or mobile phone.

Another challenge with Google Classroom is support. While this intervention often assists students who have an acute learning exceptionality, a student with more severe learning needs often needs support to access technology. Students with acute learning exceptionalities can use Google word predict, spell check, speech-to-text, text-to-speech, and have text read to them as a means to promote text accessibility. Students with more severe exceptionalities often need help logging into their computer, remembering their passwords, creating a document or slides, and need an alternative language to help explain assignment or projects.

> The needs of students are ranging, and I said 1 to 10. I can have some students that are very technology literate per se and I've got others who, you know, need a bit more help you know not just with the curriculum but then and just how to actually access this technology... how to use what I'm getting them to use. (Mr. Brees)

Mr. Potter explained that our current students, for the most part, are capable with handheld technology. They know how to use a phone, take a video, send a text, and download and navigate and an app. With that said, their keyboarding skills are on a decline:

> Due to the fact that they are growing up with tablets and smartphones, they don't know how to type. All they can do is swipe or they can type with their thumbs if they're texting. So, getting keyboarding skills back into the hands of the kids is something that's becoming more pressing. (Mr. Potter)

Question 13: In your opinion, what are students' attitudes towards the use of Google Classroom?

Every teacher, but one, expressed that students' attitudes towards Google Classroom are very positive. Mr. Farley, however, expressed that while "the students who are engaged like that convenience and... like the way in which we supplement what happens in the class with material," students who are not generally enthusiastic about school are not enthusiastic about Google Classroom.

Mr. Brees expressed that, "They rejoice if I booked out the computer lab or get the Chromebooks. They're happy to get on Google". Mr. Potter explains that students know their course content is accessible anywhere a device can be used, and it takes the pressure off them to remember to take everything home. Ms. Strickland at one point asked her students their opinions towards Google Classroom:

> They love being able to complete work electronically. Being able to collaborate is good. Not having to print anything, so few people have a printer anymore and they love the organization piece that they can access it anywhere, they love the creativity, they love that it automatically saves. (Ms. Strickland)

Ms. Lewis explains that her students have a positive attitude towards Google Classroom because it keeps all of their subjects in the same place. Because she is the school's LEARN teacher, she is responsible for filling in the educational gaps that may be missed during a students schooling career. Ms. Lewis said, "the kids they can come in, sit down with me, pull up Google Classroom from science, from social studies, from technology, and then their work assignments are there."

Focus Group

Focus group participants met in my homeroom and were provided the six questions that were going to be asked. They were also provided with the rules of the focus group (Appendix H). I then explained what the questions meant and the procedures for participating. Students stood up in a line in front of me and were provided with a tennis ball to hold onto during their turn to speak. Students would receive the tennis ball once they were asked a question, and were asked to pass it to the person next to them when they were done answering the question. When all six students answered the question, the last participant would hand me the ball and I would refer to the next question on the list. Students were told they could "pass" if they did not have an answer for a question right away and we could come back to them if they came up with anything later. The focus group took about 30 minutes to complete. Their responses were audio recorded and then transcribed through Google speech-to-text technology and then edited to correct any mistakes from the software. The transcriptions of the focus group were then examined to identify themes from the responses. A colour-coding scheme was used to categorize responses that were deemed similar among the students. The focus group questions and responses were as follows:

Question 1: What are ways teachers present information?

Question 2: How does your classroom teacher use Google Classroom to present information?

Question 3: What are ways you demonstrate what you know in your classroom?

Question 4: How is Google Classroom used by your teachers to allow you to demonstrate what you know?

Question 5: Describe your experience using Google Classroom to show what you know?

Question 6: Would you recommend other teachers and students use Google Classroom?

After the interview were recorded, played through speech-to-text software and edited verbatim, three major themes emerged, namely:

1) Students enjoyed having direct access to teachers to receive prompt feedback on their school work.

2) Teachers use Google Classroom to communicate information important to the course, post class notes, deadlines, and study materials.

3) Students enjoy interacting with technology to complete assignments.

The six students at Springfield Junior High indicated that teachers present information through class comments on web boards, write it on the board, as well as use Google Docs, Google Slides, and PowerPoint. Another followed by saying most information can be found on Google Classroom. Through Google Classroom, teachers provide information, review materials, deadlines, and links to supplementary materials. One student offered that Google Classroom offered "links, to like, Google Slides and Quizlet and Docs" (Participant 2). Another student added that teachers put deadlines and rubrics in their Google Classroom and that helps students know how to complete assignments and the expectations of the assignment. Further to information being published through Google Classroom, students also have the opportunity to demonstrate what they have learned by creating their own presentations through Google Slides and Docs. This is supplementary to quizzes and tests, and other assessments. The students expressed appreciation in knowing that as they are completing their work, a teacher can monitor their work in real time and make suggestions, "We have to complete work and then they'll be able to check it and see that you've done it right or wrong whatever" (Participant 5). When using Google Classroom to demonstrate their learning, students experience was very positive. Students' echoed the fact that teachers have access to the document students create and can

provide feedback in real time and noted that teachers can look at your work and tell you "you're wrong or you're right when you're doing it instead of having to take in a piece of paper and kind of look at it" (Participant 5). Instead you're doing it in a Google Slide or Google Doc. Students also discussed that they like interacting with a keyboard instead of the traditional pencil and paper. Student participants at Springfield Junior High unanimously recommended the use Google Classroom as a teaching intervention to supplement their learning.

Summary

Responses from both teachers and students indicated that students enjoy having access to their teachers who provide them with prompt feedback, and communication of classroom information and material online where they can access it anywhere, and interacting with technology when completing class work. Teachers provided detailed depictions of how Google Classroom was used and while student responses were not as rich, they helped to validate emerging themes.

Discussion

The discussion section of this study considers previous research on the integration of assistive technology in the inclusive classroom alongside results from the current study. Teacher and student perceptions of Google Classroom and its impact in the inclusive classroom are presented. Moreover, areas where further examination is required are highlighted and recommendations are made for further research.

When I first reflected on the impact of the implementation of Google Classroom in the inclusive classroom as means to provide multiple means of representation, expression and engagement to students, I expected predominantly positive feedback from students and teachers alike about the use of Google Classroom as a teaching tool. Feedback provided me with confirmation of my initial belief and insight as to how present-day technologies can be improved in the universal classroom. It also provided me insight as to technology's use in the classroom, when teachers choose to implement it, and reasons why teachers choose not to use technology in the classroom in certain instances.

Teachers' perception of Google Classroom

At present, there is limited research on Google Classroom and its impact on the UDL classroom. There is, however, research on assistive technology and its positive impact on the UDL classroom (CAST, 2011). Teachers in the focus study discussed the many values associated with Google Classroom, and as websites have been used in the past, teachers have begun to post not only materials, but assignments on Google Classroom. Teacher participants discussed the benefit of having material and assignments online, as it is a safe space, which prevents misplaced materials, and can be organized to help the students focus. Reports from both teachers and students express a positive attitude towards Google Classroom as means to organize their

subjects by having them and their materials in the same place. Devices, such as electronic dictionaries, audio books, or calculators improve a students' accessibility to curriculum outcomes (Messinger-Willman & Marino, 2010). Furthermore, current technology, namely, text-to-speech software, and word prediction software, help support students in mathematics, reading and writing (Bryant, Rao, & Ok, 2014).

When considering Google Classroom software, and components, I would suggest that some of the applications, namely Google Docs, Google Slides, and Google Translate, meet the criteria of assistive technology. Google Docs, Google Slides and their components such as speech-to-text, peer/instructor revision tools, word prediction, and spellcheck functions fall under the realm of assistive technology. The results from the interviews show most teachers agree that the use of these functions found within Google Classroom help students with reading, writing, group work, organization, creativity and engagement. Additionally, strategies like differentiated instruction, group work, peer learning, and use of visuals and videos a re used by the teachers to make students' learning as individual as possible but can also be beneficial when used through technology like Google Classroom. For example, if students are required to write a paragraph based on a novel or a classroom discussion, they have choice through Google Docs to press a button and express what they know orally through speech-to-text options if they are more comfortable communicating that way, or by typing. Alternatively, if they have difficulty with written component of curriculum outcomes, through Google Classroom, students are offered choice again. Ms. Tobin explained that as an alternative to writing a paragraph, students can draw a picture or create a comic to express their knowledge, which is possible through Google Draw. The focus group revealed that students generally have positive feelings towards the use of technology in the classroom for various reasons, including interacting with technology, as well

as often having live feedback from teachers instead of getting feedback once an assignment is complete. This feedback from Springfield Junior High supported previous research by Bryant and colleagues (2014), who discovered that both students with and without exceptionalities showed significant engagement with assistive technology interventions. Bryant et al. (2014) came to this conclusion using case study methodology with observations and interviews with teachers who used a web-based book builder, digital graphic organizer, and an interactive whiteboard app. They found that students who interact with technology to type or speak or organize their school materials are more engaged and even excited to complete and show course work. This increased engagement, as noted by Kortering, McClannon, and Braziel (2008), could potentially lead to academic success. Kortering and colleagues found that nearly 90% of students found their classroom activities to be enjoyable or worked hard that day when in a classroom using UDL interventions. Appleton, Christenson, Kim, and Reschly (2006), found that students who are engaged in their learning have academic success which leads to the eventual completion of school. Future studies may focus on multiple schools, in different communities to gain a broader perspective. Most teacher participants noted that students who were more engaged and participated in school related activities enjoyed the implementation of Google Classroom, Docs and Slides; however, some teachers commented that students who are generally disengaged in classroom activities, regardless of technological interventions, would often hi-jack commenting boards and would remain disengaged with technological interventions. Future studies may consider more focus groups, with a variety of students, to shed light on the disengaged students' perspective. Students in this study were volunteers and the invitation to participate was done over the school announcements. A student who is disengaged may ignore or miss the announcement and choose to not participate in extra-curricular school related activities.

Disengaged students may not have participated in the focus group, and this impacts the generalizability of the current study's findings.

Students' perception of Google Classroom

Student participants stated that teachers presented information, materials, deadlines and links to supplementary materials through web boards (homework website), Google Docs, Google Slides, and Google Classroom. No students discussed confusion or inability to access technology inside or outside school, and therefore had ample time and resources to complete course curriculum. Students noted that they enjoyed having access to rubrics, so assignment expectations are clear, preferred interacting with a keyboard instead of pencil and paper, and really enjoyed it when teachers were able to access their assignments so they can be provided with prompt feedback during the completion of their assignment rather than at the end. Parents were also invited to be a member of their child's Google Classroom subjects. This allows an open line of communication between teachers, students, and parents when dealing with curriculum content, upcoming events, and assessment data. Students who are less eager to complete curriculum outcomes may find motivation in collaborating and sharing (MacArthur, 2009), and can collaborate with both teachers and students when completing an assignment. Students who are eager but have limited writing ability can avail of Google Docs, as Martin and Lambert (2015) said, it can help students who struggle with writing output. They explain that students who are digital drivers, meaning comfortable with digital writing technology, use collaboration with instructors, peers, and digital Internet tools to competently complete a written assignment. There are, however, barriers to entry. Teachers cite access to Chromebooks, computer labs, laptops and tablets is not always readily available. Furthermore, if we were to equip each student with a device, the school's Wi-Fi network would need to be upgraded as it

would not be able to support that many devices at the same time. Both instances come down to budgetary constraints, which Anstead (2016), expressed as a major barrier to technology implementation in the United States. Moreover, Anstead (2016) explains that the acquisition of technology in the classroom is competitive and careful consideration must be taken to ensure an equal distribution of funding and personnel is taken when implementing. While it would constitute more work, Maich and Hall (2016) explain that there are options that teachers and schools can seek out to acquire classroom technology. These options include grant applications for tech funding as well as Apple Financing, which offers a leasing options as well as links to acquire federal funding for classroom tech initiatives. Outside of school, while students in the focus group discussed being able to access school material outside of school, one teacher did not support this notion, stating that, "not every student will have access to Google Classroom at home" (Ms. Grundy). As students are only in school for six hours a day, five days a week, there is a lack of equity among students who have access to Google Classroom at home and those who do not. Another barrier is the decline of students' keyboarding skills. Mr. Potter noted that most students these days are able to use handheld technology, quickly send text messages and interact with phone apps, but when it comes to actual keyboarding on a computer, they are very weak.

Google Classroom as Assistive Technology

The concept that Google Classroom meets the needs of students as a means of assistive technology in the inclusive classroom is based on research on UDL, assistive technology, and the inclusive classroom. Messinger-Willman and Marino (2010) discuss how assistive technology such as electronic dictionaries, audio books, and word prediction software benefit students with disabilities and note inclusive educational initiatives are best accomplished through UDL approaches. As Google Classroom provides manipulation in content, and built-in assistive

technology applications (Government of Australia, 2015), it meets the criteria set to deem it a form of assistive technology which can be used to support UDL. The school board in the focus study has an inclusive education mandate that celebrates diversity among students (Newfoundland and Labrador Department of Education, 2017). UDL is believed to allow every student the opportunity to learn. Coyne, Pisha, Dalton, Zeph, and Smith (2012) show that UDL classrooms produce hopeful outcomes for both students with and without disabilities through scaffolding. Scaffolding allows students to solve a problem, complete an assignment or achieve an outcome with minimal assistance (Coyne et al., 2012). Assistive technology provides an opportunity to meet standards outlined by UDL (Lopes-Murphy, 2012). While there is limited research on Google Classroom as a form of assistive technology, it provides multiple interventions found in the realm of assistive technology given the applications within the software provide students with writing disabilities the opportunity to speak their thoughts and have it written down on paper, the ability for text to be read to a student who has difficulty reading, and the ability for students to collaborate while using this software alongside other applications. In the current study, some responses from teachers support the notion that Google Classroom can be useful for students who require assistive technology. Mr. Potter explained that, "Chromebooks can encompass a number of features ranging from scribing, to narration, playing text that's been pre-recorded, they can use that for typing, preparing, speaking." Students agree that technology within Google Classroom enables them to complete a project with the teacher's help along the way. Student 2 stated, "It's a lot easier for the teacher to look at it and it's like you're wrong or you're right when you're doing it." When posing questions to the focus group, participants addressed multiple means of representation and engagement. However, they did not explicitly express that speech-to-text, audio reading or any other assistive technology was

beneficial to their learning. Future research should include questions which address specific functions of Google Classroom that provide students with multiple means of representation, expression, and engagement as it pertains to assistive technology in the inclusive classroom. While most teachers agreed that Google Classroom supports students in the inclusive classroom, some felt that it depended on the student, expressing that students who are engaged will really enjoy Google Classroom's functions and the ways where information can be found and communicated, and students who are generally disengaged, will likely remain disengaged even after providing technological interventions (Mr. Farley). Finally, teachers discussed the stigma attached to students with exceptionalities using assistive technology. Ms. Tobin explained that through Google Classroom, she can give every student a project with a second version of the assignment that was modified to meet the needs of students IEPs without anyone else knowing there are modifications to certain assignments. Any stigma associated with students who use assistive technology was removed since every student in the class was using a Chromebook or computer to complete an assignment, but they were all using them slightly differently.

The following table presents the principles of UDL and how interviews from teacher participants support these principles.

Table 2: Means of Engagement

Provide multiple means of **Engagement** Affective Networks The "WHY" of learning	Teacher Responses	Students' Responses
Provide options for **Recruiting Interest** - Optimize individual choice and autonomy - Optimize relevance, value and authenticity - Minimize threats and distractions	"I disable any communication with students on the Google Classroom itself if this is relevant, because I find they tend to fool around and ask say, frankly, idiotic things and time-wasting things there, so if they want to communicate with me about what they have to do they can email me but I don't generally I don't open up Google Classroom like a forum for everybody." (Mr. Farley)	"It is good because even like some at your work through Google classroom and have direct access to it." (Student 2)
Provide options for **Sustaining Effort & Persistence** - Heighten salience of goals and objectives - Vary demands and resources to optimize challenge - Foster collaboration and community - Increase master-oriented feedback	"I guess, the assistive technology with regard to like Chromebook, or iPads, or laptops, or computers to help them complete assignments, work together, collaborate with classmates, as well as communicate to the teachers in whatever way that they want." (Mr. Mickelson)	
Provide options for **Self Regulation** - Promote expectations and beliefs that optimize motivation - Facilitate personal coping skills and strategies - Develop self-assessments and reflection	"They're [students] very positive towards it. They know that the materials there for them, they don't have to worry about remembering to take home so many things so that takes a little pressure off them" (Mr. Potter)	

Note. Table heading from CAST (2011)

Table 3: Means of Representation

Provide Multiple Means of **Representation**: The "what" of Learning	Teacher Responses	Students Responses
Provide options for **Perception** - Offer ways of customizing the display of information - Offer alternatives for auditory information - Offer alternatives for visual information	"Keyboards for, for writing out longer answers on a test. You could have recordings so audio, you know, and even some visual cues, pictures of things." (Mr. Brees)	
Provide options for **Language & Symbols** - Clarify vocabulary and symbols - Clarify syntax and structure - Support decoding of text, mathematical notation, and symbols - Promote understanding across languages - Illustrate through multiple media	"I do use it... the voice-to-text option with students that have writing output issues." (Ms. Strickland) "FlipGrid, which we use to in the English Stream, promote representing as well as giving non-written journal entries, they can record themselves" (Mr. Potter)	*How does your classroom teacher use Google Classroom to present information?* "Links to like Google Google slides and Quizlet and Docs" (Student 2)
Provide options for **Comprehension** - Activate or supply background knowledge - Highlight patterns, critical features, big ideas and relationships - Guide information processing and visualization - Maximize transfer and generalization	"Literacy background, their numeracy background is all very unique so I'm building individual programs for each of those kids and then trying then to help them access the grade level curriculum as soon as they can with whatever scaffolding and spots that we put in" (Ms. Lewis)	

Note. Table heading from CAST (2011)

Table 4: Means of Action and Expression

Provide multiple means of **Action and Expression** Strategic Networks The "HOW" of learning	Teacher Responses	Students Responses
Provide options for **Physical Action** - Vary the methods for response and navigation - optimize access to tools and assistive technologies	"Teachers can access it when they need it." (Ms. Tobin)	"[We] go to the computer lab and we'll find information from there" (Student 5)
Provide options for **Expression and Communication** - Use multiple media for communication - Use multiple tools for construction and composition - Build fluencies with graduated levels of support for practice and performance	"We have assistive technology here at the school, we use voice-to-text technology Speak Q which accommodates students with learning disabilities or issue such as dysgraphia allows them to give answers orally things like that." (Ms. Strickland)	"Google Docs and like they print off the stuff from Google Docs and there's PowerPoints and yeah Google slides" (Student 4)
Provide options for **Executive Functions** - Guide appropriate goal-setting - Support planning and strategy development - Facilitate managing information and resources - Enhance capacity for monitoring progress	"Google Classroom makes it really easy to see you know where a student is and how I can help them because the fact that I can see their work being developed from start to finish" (Mr. Brees)	"A lot of times I'll just like have links where we have to complete work and then they'll be able to check it and see that you've done it right or wrong" (Student 5)

Note. Table heading from CAST (2011)

The data from the literature review suggests that many schools are shifting towards inclusive education models using UDL, assistive technology, and training. The goal is to meet the needs of every student. Google Classroom applications as a form of assistive technology has had success in engaging students and meeting learning needs of students through a UDL framework.

Implications of the Research

This study was developed to shed light on Google Classroom applications as a form of assistive technology to communicate curriculum in universally designed classrooms. Students, teachers, administrators, school district personnel, and government policy makers can use this information to support professional development and Google Classroom initiatives.

Teachers and students shared that Google Classroom provided a means to allow for multiple means of representation, engagement, and expression. The left column in the above tables explain interventions used for representation, engagement and expression. The right columns in the tables above are quotations from teachers and students that support Google Classroom as an assistive technology through UDL. While there is no previous research addressing the use of Google Classroom as means to promote UDL, previous research suggests assistive technology can support the learning needs of students (Edyburn, 2010). Google Classroom and associated applications for education meet the criteria set out as assistive technology. Assistive technology being, "a combination of […] devices and services that are intended to enhance the skills of people with disabilities in a variety of contexts of interaction, for example, at school, in the home, at the workplace, and in recreation" (DaCosta & Seck, 2014, p. 13). Google Classroom provides assistance through speech-to-text, text-to-speech, word prediction, and spellcheck software.

When considering the implications from the focus study, it is important to keep in mind that the focus group consisted of six students in a school of more than 600. The students from this study were selected based on a school wide announcement and may not reflect an accurate representation of the student body. It is possible different recruiting methods, that are not limited to targeting students who listen to the announcements, may more accurately portray the student body as they may yield different findings from the focus group. Using multiple focus groups may also yield a variety of results. For these reasons, future research should employ larger sample sizes to help validate the findings.

According to teacher participants, Google Classroom provides multiple valuable applications. Specifically, it can be used to work with peers, consult with the teacher, and provide organizational support and accessibility to course material 24 hours a day. While interviews were only conducted with teachers who tend to incorporate technology in their class, and use Google Classroom to post assignments to allow students to complete assignments and supplement their website, it may be beneficial to all teachers if educational administrators could narrow down which applications will present longevity in the classroom. This could allow skeptics and teachers that are less keen on technology to take on a more exploratory role in technology when developing new curriculum. If this study were to be replicated, I would ask teachers who use technology to give one recommendation to teachers who are late adaptors to new technology in the classroom.

The teacher participants were chosen based on their ability and willingness to use and implement new technology. Every teacher participant that was interviewed had been using Google Classroom for at least one year and were very comfortable using it. It may be beneficial

to conduct interviews with teachers who are new to using Google Classroom and get their perceptions prior to and after using Google Classroom in their teaching.

Recommendations

While many senior teachers have systems that work for them, for newer teachers, or teachers seeking out new means to communicate within the inclusive classroom, I recommend using Google Classroom. Interview data depicted that Google Classroom provides teachers with the opportunity to post and organize their materials that so students can access it. It also provides a means for teachers to provide prompt feedback to students as they complete their assignment. Furthermore, students can collaborate and use applications to complete assignments together while meeting their learning needs. While this is effective in the inclusive classroom to allow students to meet curriculum outcomes, it is a relatively new initiative and teachers still need effective instructional practices outside of technology.

Google Classroom is currently recommended for use to meet the needs of students in the inclusive classroom and is a school board supported initiative as outlined in the "Province-wide implementation of Google Apps for Education" (Newfoundland and Labrador English School District Director's Report, 2017, p. 9). Teachers expressed that their ability to post pertinent classroom information and content was highly beneficial. Moreover, they can create assignments that students can complete online, at school, and at home provided they have tech access, or with peers. Google Classroom meets the needs of students with reading or writing exceptionalities through speech-to-text, text-to-speech, word prediction, and spellcheck. Ms. Strickland explained, "when we're doing activities in Google Classroom they (students) produce a lot better. Also, you know, just being able to complete it on a keyboard on a computer allows a lot of students with writing issues to be able to get what they need." Every student in the classroom

can use the same technology and interventions to complete an assignment, and it would be challenging to identify which student has an exceptionality, which can reduce the stigma attached to students with exceptionalities using assistive devices. Ms. Tobin explained that she can give everyone an assignment, make slight modifications for some, and students can all work on similar devices without knowing if a student in their class has an exceptionality.

Students feel comfortable with Google Classroom. While one teacher mentioned that students rejoice when they get to create an assignment with a peer through Google Slides, students expressed that interacting with a computer is enjoyable, they can consult with their teacher, and would recommend other teachers and students use Google Classroom. Google Classroom is a relatively new form or educational technology, it is not branded as assistive technology, and this interview was based on very few applications that Google Classroom provides. Given that the technology is new, it may be wise to try and figure out which features of the technology are most effective. Recently, Google announced a commitment of one billion dollars to enhance educational initiatives involving educational technology (Bindi, 2017). I believe the funding should be used to increase the number of devices that provide assistive technology (iPads, Chromebooks, laptops), and provide professional learning sessions to teachers on how to use these devices and software so they can be effective in an inclusive educational setting. According to Maich and colleagues (2017), there is generally a lack of assistive technology training for teachers in some school settings. This leads to some teachers experiencing difficulty when trying to implement assistive technology in their classroom. Many teachers from this study were frustrated with the lack of training provided to allow teachers to be efficient with assistive technology in their classroom and therefore lacked comfort to implement assistive technology in their classroom. Funding should be used to upgrade school Wi-Fi

connection to enable as many devices to connect as possible. Many teachers discussed how they can generally access technology when they require; however, one of the technology teachers said it was imperative to have a network that supports the connectivity of one device for each student.

Limitations

The current study explored how teachers use Google Classroom as a form of assistive technology to meet the needs of each student in their inclusive classrooms. I recruited teachers who implemented the use of Google Classroom as part of their teaching practices. The interviews conducted in this study were only with teachers and students from one school in the Avalon east region of Newfoundland and Labrador. Interviewing six French immersion students without an exceptionality or IEP and eight teachers from one school may be deemed insufficient as it does not allow for generalization to the larger student body (Creswell, 2012). It may be argued that even though similar answers allowed for saturation of the emerging themes, the sample size is considerably small given the number of teachers in the school. Moreover, interviewing students and teachers from one school may yield different results from other schools in the city, schools from other cities, and schools in rural areas. However, the interviews allowed for saturation of the emerging themes, which added confidence to the findings. During the interview process, I spoke with 8 volunteering teachers and asked 13 different questions to each teacher. Over the course of the interviews, I found variations in teachers' responses to the interview questions; however, themes quickly became apparent. Over half of the teachers on staff were recruited to participate in this interview. Given that a smaller group is often representative of a larger one (Creswell, 2012), I chose to interview 8 participants who volunteered, as 6 to 10 participants are deemed sufficient for a qualitative study (Creswell, 2012).

Technology is implemented and distributed in many ways. There are many forms of assistive technology available; however, Google Classroom is strongly supported by the Newfoundland and Labrador English School District, as it is committed to the promotion of assistive technology, and it has the budget to become a front runner in the educational and assistive technology industry (13 Chrome Accessibility Tools 2018).

Future Research

The focus of this study was to provide students, teachers, administrators and district personnel with insight as to whether Google Classroom applications can enhance the inclusive classroom. Several recommendations arose from this study. When speaking with students, many of their responses addressed their use of Google Classroom and ways teachers' present information in the classroom. Six students were recruited for the focus group. While four to six students in a focus group can often produce a theme (Guest, Namey, & McKenna, 2017), future research should seek out focus groups in multiple schools in both rural and urban settings to achieve as much authenticity in the results as possible.

This study focused on how students use technology and Google Classroom to meet curriculum objectives. Students participated in a focus group and were asked a series of questions. These questions explored how teachers presented information in class through Google Classroom. Focus group questions asked students to describe how Google Classroom allowed students to demonstrate acquired curriculum outcomes. While the answers to the questions did shed some light on the positive impact Google Classroom had on students, and their ability to communicate what they know, future studies should pose questions that address how Google Classroom is being used as a form of assistive technology. Future research should ask students and teachers how some of the applications in the Google Classroom package, that provide

speech-to-text, text-to-speech, word prediction, and spellcheck, support learning; and if they use it, how they use it; and why it may or may not have had a positive impact on their learning.

Qualitative research methods seek to answer questions by conducting interviews with informants, gathering data from interview questions, and bringing forth an unbiased conclusion in regards to the findings (Johnston, 2010). The current study conducted interviews with teachers and had a focus group with students to gather their opinions regarding Google Classroom as the encouraged technology brought forth by the Newfoundland and Labrador English School District. While these interviews were rich in data, future research should employ observations to see if Google Classroom applications have an impact on student engagement, as well as use test scores as markers of student performance. Further to this research, it has been noted that there are many teachers who still prefer non-technological, traditional methods of instruction. Some teachers opt not to incorporate new technology or instructional methods in their teaching practice. Future research, which would be quantitative in nature, could seek out test scores from students whose teachers use Google Classroom to complete assignments and gather study notes, and teachers who do not incorporate Google Classroom as a classroom intervention.

The current study conducted interviews with teachers and asked how they used Google Classroom to support teaching and learning and how their students used Google Classroom to support learning. Responses from teachers could yield subjectivity from the teachers as it would be based on their goal with technology in the class. Future research should consider third party classroom observations as means to gather data as, through an observer, data gathered could be more objective.

This study was conducted in one junior high school, in a particular geographic area, in a small province in eastern Canada. From this school, only eight teachers and six students

participated. The study should be replicated with additional schools allowing for inquiries with both students and teachers in primary, elementary, and high school environments. Moreover, the research should be conducted in schools in rural setting as well as in school in major cities. The results could help support schools with a larger variety of learning needs and academic abilities.

Conclusion

The applications attached to Google Classroom provides students with exceptionalities in the inclusive classroom support in reading, writing, and comprehension when completing curricular outcomes. The same technology can be used by students without exceptionalities to enhance their grasp of learning outcomes. When every student in the classroom is using the same device to complete a task, and it is not labelled 'assistive technology', there is no stigma attached to any student. As inclusive education is becoming increasingly common, teachers need to be equipped to teach in the inclusive classroom and to instruct every student in the classroom (Florian, 2012). Through UDL, and the assistive technologies found in Google Classroom, we have means to create a truly inclusive classroom.

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Appendix A

Letter of Information for Teachers

Title: *Examining how Google Classroom Supports Universal Design for Learning*

Researchers:
Primary Investigator
Dr. Gabrielle Young, Assistant Professor, Faculty of Education
Box 169 - G. A. Hickman Building
Memorial University of Newfoundland
St. John's, NL A1B 3X8
gabrielle.young@mun.ca
(709) 864-4413

Graduate Student Investigator
Stephen Sharpe, Master's Candidate, Faculty of Education

Invitation to Participate
You are invited to take part in a research project entitled, *"Examining how Google Classroom Supports Universal Design for Learning"*.

This form is part of the process of informed consent. It should give you an idea of what the research is about and what your participation will involve. It also describes your right to withdraw from the study. In order to decide whether you wish to participate in this research study, you should understand enough about its risks and benefits to be able to make an informed decision. This is the informed consent process. Take time to read this carefully and to understand the information given to you. Please contact the primary investigator, Dr. Gabrielle Young, if you have any questions about the study or would like more information before you consent.
It is entirely up to you to decide whether to take part in this research. If you choose not to take part in this research or if you decide to withdraw from the research once it has started, there will be no negative consequences for you, now or in the future.

Introduction
Dr. Gabrielle Young is an Assistant Professor at Memorial University of Newfoundland. She will be the primary investigator of this study and her research interests surround the use of assistive technology by students with special learning needs, learners' self-beliefs and the self-esteem of individuals with learning disabilities, and the use of universal design and differentiated instruction to support the inclusion of students with exceptionalities in the general education classroom.

Stephen Sharpe is a Master's student in the Faculty of Education at Memorial University of Newfoundland. Stephen obtained his Bachelor of Arts (French), Bachelor of Business Administration, and Bachelor of Education from Memorial University. He is currently a French Immersion, Math, Science, and Social Studies teacher with Newfoundland and Labrador English

School District. Stephen is currently completing his Master's of Education with a focus on Google Classroom, and is conducting this research under the supervision of Dr. Gabrielle Young.

Purpose of Study

This study seeks to understand how teachers use Google Classroom, the benefits and challenges associated with classroom technology, and students' perception of the use Google Classroom. The findings from this study will be used to assist educators in meeting the learning needs of students in inclusive classrooms.

What You Will Do in this Study

Interviews

Teachers who identify as users of Google Classroom will be asked to participate in an open-ended, semi-structured interview. This interview will last approximately thirty minutes and will be conducted at school at a time that is most convenient for you in an informal setting. The conversation will be audio recorded and speech-to-text technology will be used to document responses and assist with the transcription process, prior to being reviewed and edited for accuracy. Information from conducted interviews will be kept confidential and identifying information will be removed from the edited transcripts.

Interviews with teachers will focus on:

- Your understanding of inclusive education, and universal design for learning.
- Your understanding of Google Classroom and its' applications for teaching and learning.
- Teaching techniques used to support inclusive education.
- Methods of presenting information to a classroom.
- Learning activities and assignments used to meet curriculum and inclusive education outcomes.
- Your classrooms learning abilities.
- Your perception of assistive technology as beneficial to students.
- How you use Google Classroom.
- Your perceived limitations to Google Classrooms' function.
- Assistive technology that's available in your school.
- Where technology is found and used in your school.
- How technology is used in today's classroom.
- Teachers' perception of how students use Google Classroom.

Informal Conversations

You will be provided with a copy of the transcribed interview, and have the opportunity to engage in informal conversations that will help clarify the interview transcript. These conversations will happen at your convenience, when we are not on instructional time. These conversations will help to further clarify your use of Google Classroom.

Member Checks

You will be given a copy of your interview transcript, as well as a summary of the research findings. You will have the opportunity to provide clarification, or further elaborate on your interview responses, and comment on the findings, before they are prepared for publication.

Length of Time
We are interested in understanding effective classroom practices with assistive technology in the inclusive classroom. Participation in this study will not add to your current workload. Interviews will be approximately thirty minutes, and informal conversations will occur during non-instructional time. Focus groups will be conducted with students outside of instructional time and you will be provided with an opportunity to comment on the transcript during another meeting outside instructional time. Students in this focus group are not required to attend.

Withdrawal from the Study
You can withdraw from participation in this study at any point during data collection, without giving any reason. There are no consequences for withdrawal from the study. If you decide to withdraw, you will be given the opportunity to remove previously collected data from the study. Data collected from the study will be anonymous, but it cannot be withdrawn once the study has been completed and the data has been compiled and prepared for publication.

Possible Benefits
For teachers, the findings of this study can benefit participants as they reflect on their educational practices. Participation in this study provides opportunities to reflect on practice and share your knowledge and strategies with peers who are supporting all learners in their classroom. Participating will benefit the education community as findings may be used to inform policy makers when considering the diverse need of students in an inclusive setting.

Possible Risks
There are no known risks associated with participation in this study.

Confidentiality
The ethical duty of confidentiality includes safeguarding participants' identities, personal information, and data from unauthorized access, use, or disclosure. To ensure confidentiality, the identities of participants will only be available to the authorized researchers. Results from this project will be published and may be presented at conferences; however, your identity will be kept confidential. Data from interviews and focus groups will be combined; therefore, it will not be possible to identify individuals based on responses to interview questions. Consent forms will be kept separate from interview transcripts and recordings, thus, taking optimal measures to inhibit associating a name with a response.

Anonymity
Anonymity refers to protecting participants' identifying characteristics, such as name or description of physical appearance. Every reasonable effort will be made to ensure your anonymity. You will not be identified in publications without your explicit permission. While direct quotations will be used from interviews in the research results, names and information pertaining to the country, province, school district, school, teacher and student will be changed to ensure anonymity. There will be no photographs or video of students, student work, teachers, or schools when completing this paper.

Although the researcher will safeguard the confidentiality of the discussion to the best of his/her ability, the nature of focus groups prevents the researcher from guaranteeing that other members of the group will do so. Students will be reminded to respect the confidentiality of the other members of the group by not repeating what is said in the focus group to others, and be aware that other members of the group may not respect your confidentiality.

Recording of Data
When recording data, interviews will be both voice recorded and text will be recorded and transcribed through speech-to-text technology. The data will be transcribed and edited post-interview. Informal conversations will be recorded in the researcher's notes.

Reporting of Results
Data from this study will be shared with members of the research team and will be presented to the university's education faculty. Data collected for this study will be presented in a Master's thesis, and upon examination, this thesis will be publicly available at the QEII library.

Storage of Data
Data collected from you, as part of your participation in this project, will be stored on a password-protected computer, and signed consent forms will be kept in a locked cabinet. Data will be kept for a minimum of five years, as required by Memorial University policy on Integrity in Scholarly Research. Only the researchers involved in the project will have access to the data. When the data is no longer required, all data will be appropriately destroyed (i.e., papers will be shredded, audio recordings will be erased, and original transcripts will be deleted).

Sharing of Results with Participants
If you would like to obtain a summary of the results from this study, please provide you email address to have findings sent to you.

Email address: _____

Questions
You are welcome to ask questions before, during, or after your participation in this research. If you would like more information about this study, please contact: Gabrielle Young through e-mail (gabrielle.young@mun.ca) or Stephen Sharpe (u24sds@mun.ca).

The proposal for this research has been reviewed by the Interdisciplinary Committee on Ethics in Human Research and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research, such as the way you have been treated or your rights as a participant, you may contact the Chairperson of the ICEHR at icehr@mun.ca or by telephone at 709-864-2861.

Appendix B

Teacher Consent Form

Title: *Examining how Google Classroom Supports Universal Design for Learning*

Consent:

Your signature on this form means that:

- You have read the information about the research.
- You have been able to ask questions about this study.
- You are satisfied with the answers to all your questions.
- You understand what the study is about and what you will be doing.
- You understand that you are free to withdraw participation in the study without having to give a reason, and that doing so will not affect you now or in the future.
- You understand that if you choose to end participation during data collection, any data collected from you up to that point will be retained by the researcher, unless you indicate otherwise.
- You understand that withdrawal from participation in the study will not affect your current employment
- You understand that if you choose to withdraw *after* data collection has ended, your data can be removed from the study up to **June 29, 2018.**

Consent for recording data:

I agree to be audio-recorded during the interview for later transcription.	☐ Yes	☐ No
I agree to the use of direct quotations	☐ Yes	☐ No
I am aware that that the data collected for this study will also be used towards a Master's thesis	☐ Yes	☐ No
I agree to the use of direct quotations	☐ Yes	☐ No
I am aware that that the data collected for this study will also be used towards a Master's thesis	☐ Yes	☐ No

By signing this form, you do not give up your legal rights and do not release the researchers from their professional responsibilities.

Your Signature Confirms:

☐ I have read what this study is about and understood the risks and benefits. I have had adequate time to think about this and had the opportunity to ask questions and my questions have been answered.

☐ I agree to participate in the research project understanding the risks and contributions of my participation, that my participation is voluntary, and that I may end my participation.

☐ A copy of this Informed Consent Form has been given to me for my records.

_____ _____

Signature of Participant **Date**

Researcher's Signature:
I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participant fully understands what is involved in being in the study, any potential risks of the study and that he or she has freely chosen to be in the study.

_____ _____

Signature of Principal Investigator **Date**
Gabrielle Young
Assistant Professor, Memorial University

_____ _____

Signature of graduate student investigator **Date**
Stephen Sharpe
Master's of Education Candidate

Appendix C

Letter of Information for Parents

Title: *Examining how Google Classroom Supports Universal Design for Learning*

Researchers:
Primary Investigator
Dr. Gabrielle Young, Assistant Professor, Faculty of Education
Box 169 - G. A. Hickman Building
Memorial University of Newfoundland
St. John's, NL A1B 3X8
gabrielle.young@mun.ca
(709) 864-4413

Graduate Student Investigator
Stephen Sharpe, Master's Candidate, Faculty of Education

Your child is invited to take part in a research project entitled, *"Examining how Google Classroom can Supports Universal Design for Learning".*

Introduction
Dr. Gabrielle Young is an Assistant Professor at Memorial University of Newfoundland. She will be the primary investigator of this study and her research interests surround the use of assistive technology by students with special learning needs, learners' self-beliefs and the self-esteem of individuals with learning disabilities, and the use of universal design and differentiated instruction to support the inclusion of students with exceptionalities in the general education classroom.

Stephen Sharpe is a Master's student with the Faculty of Education at Memorial University of Newfoundland. Stephen obtained his Bachelor of Arts (French), Bachelor of Business Administration, and Bachelor of Education at Memorial University. He is currently a French Immersion Math, Science, and Social Studies teacher with Newfoundland and Labrador English School District. Stephen is currently completing his Master's of Education with a focus on Google Classroom under the supervision of Dr. Gabrielle Young.

Invitation for Your Child to Participate
Many teachers at your child's school have been recognized for using Google Classroom as a form of assistive technology and have chosen to participate in this study. Your child was chosen as part of this focus group as many of their teachers demonstrate expertise in the use of technology with the in the framework of universal design for learning (designed for every student in your child's classroom) in an inclusive classroom setting. To decide whether you consent for your child to participate in this study, you should recognize the potential risks and benefits for your child and be able to make an informed decision. Please carefully read the information provided. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please contact Dr. Gabrielle Young, if you have any questions about the study or would like more information before you consent.

It is up to you to decide whether your child participates in this research. Participation is optional, and you can remove your child from this study once it has started, and there will be no negative consequences for you or your child.

Purpose of Study

This study is designed to understand how teachers use Google Classroom, and how it is used to support diverse learning needs, the benefits and challenges of classroom technology, and students' perceptions of Google Classroom. The findings from this study will be used to assist educators in meeting the learning needs of the students in an inclusive classroom.

What Your Child Will Do in This Study

Focus Groups with Students

Consenting students will be invited to participate in a focus group, which will be conducted in a group of between 6 and 10 students. The focus group sessions will last approximately 30 minutes and will occur during the lunch hour student council meetings. The students' responses will be audio recorded so that they can be transcribed. The focus group questions will surround students' views on:

- Receiving instruction in a variety of formats.
- Demonstrating their knowledge in a variety of ways.
- How Google Classroom is used to assist with learning activities.

Member Checks

Students who participate in the focus group will be given a copy of their interview transcript, as well as a summary of the research findings. If students choose to do so, the researchers will summarize the information, read it aloud, and allow the students to read it themselves. Furthermore, students will have the opportunity to be provided with clarification, or to further elaborate on their focus group responses, and comment on the findings before publication. This should take less than 30 minutes.

Length of Time

We are interested in understanding effective classroom practices surrounding the use of technology in inclusive classrooms. Your child's participation in this study will not add to their current workload. Focus groups will be conducted with students during their lunch period and students will be provided with the opportunity eat their lunch. Students will also be invited to comment on the transcript during a separate lunch time meeting, but they are not required to attend. If your child consents to participate in the focus group, they will have the opportunity to meet with the researchers during two separate lunch hours and each meeting will not exceed 30 minutes.

Possible Benefits

For students, reflecting on the use of technology in the classroom provides insight surrounding technology practices in today's inclusive classrooms. Your child's participation in this study will help to increase the knowledge base surrounding strategies to support the effective use of technology in the classroom. The results from this study may benefit the education community as findings may be used to inform policy surrounding the use of technology in an inclusive setting.

Possible Risks
There are no known risks associated with participation in this study.

Withdrawal from the Study
Your child can withdraw from participating in this study at any point during data collection, without giving any reason. There are no consequences for withdrawal from the study. If you decide to withdraw your child, you will be provided with the opportunity to remove previously collected data from the study. Data collected from the study will be anonymous, but it cannot be withdrawn once the study has been completed and the data has been compiled and prepared for publication.

Confidentiality
The ethical duty of confidentiality includes safeguarding participants' identities, personal information, and data from unauthorized access, use, or disclosure. To ensure confidentiality, the identities of participants will only be available to the authorized researchers. Results from this project will be published and may be presented at conferences; however, your child's identity will be kept confidential. Data from interviews and focus groups will be collective; therefore, it will not be possible to identify individuals based on responses to interview questions. Consent forms will be kept separate from interview transcripts and recordings, thus, taking optimal measures to inhibit associating a name with a response.

Anonymity
Anonymity refers to protecting participants' identifying characteristics, such as name or description of physical appearance. Every reasonable effort will be made to ensure your child's anonymity. Your child will not be identified in publications without your explicit permission. While direct quotations will be used from interviews in the research results, names and information pertaining to the country, province, school district, school, teacher and student will be changed to ensure anonymity. There will be no photographs or video of students, student work, teachers, or schools when completing this paper.

Although the researcher will safeguard the confidentiality of the discussion to the best of his ability, the nature of focus groups prevents the researcher from guaranteeing that other members of the group will do so. Students will be expected to respect the confidentiality of the other students by not repeating what is said in the focus group to others and will be reminded to be aware that other members of the group may not respect their confidentiality.

Recording of Data
Interviews will be voice recorded and text will be recorded through speech-to-text technology. The data will be transcribed and edited for accuracy post-interview. Informal conversations will be recorded in the researcher's notes.

Reporting of Results
Data from this study will be shared with members of the research team and will be presented to the university's education faculty. Data will be used towards a Master's thesis, and upon examination, this thesis will be publicly available at the QEII library.

Storage of Data
Data collected from your child as part of their participation in this project will be stored on a password-protected computer, and signed consent forms will be stored in a locked cabinet. Data will be kept for a minimum of five years, as required by Memorial University policy on Integrity in Scholarly Research. Only the researchers involved in the project will have access to the data. When the data is no longer required, all data will be appropriately destroyed (i.e., papers will be shredded, and audio recordings will be erased, and original transcripts will be deleted).

Sharing of Results with Participants
If you would like to obtain a summary of the results from this study, please provide you email address to have findings sent to you.

Email address: _____

Questions
You are welcome to ask questions before, during, or after your participation in this research. If you would like more information about this study, please contact: Gabrielle Young through e-mail (gabrielle.young@mun.ca) or Stephen Sharpe (u24sds@mun.ca).

Appendix D

Parent Consent Form

Project Title: *Examining how Google Classroom Supports Universal Design for Learning*

Consent:
Your signature on this form means that:

- You have read the information about the research.
- You have been able to ask questions about this study.
- You are satisfied with the answers to all your questions.
- You understand what the study is about and what your child will be doing.
- You understand that your child is free to withdraw participation in the study without having to give a reason, and that doing so will not affect your child now or in the future.
- You understand that if you choose to end participation during data collection, any data collected from you up to that point will be retained by the researcher, unless you indicate otherwise.
- You understand that withdrawal from participation in the study will not affect your child's academic standing.
- You understand that if you choose to withdraw *after* data collection has ended, your child's data can be removed from the study up to **June 29, 2018.**

Consent for recording data:

I agree to have my child audio-recorded during the interview for later transcription.	☐ Yes	☐ No
I agree to have my child's direct quotations used in this study.	☐ Yes	☐ No
I am aware that that the data collected for this study will be used towards a Master's thesis.	☐ Yes	☐ No

By signing this form, you do not give up your legal rights and do not release the researchers from their professional responsibilities.

☐ Yes _____
Please e-mail the results from this study to the above listed e-mail address.

Your Signature Confirms:
☐ I have read what this study is about and understood the risks and benefits. I have had adequate time to think about this and had the opportunity to ask questions and my questions have been answered.
☐ I agree to participate in the research project understanding the risks and contributions of my participation, that my participation is voluntary, and that I may end my participation.
☐ A copy of this Informed Consent Form has been given to me for my records.

_____ _____

Signature of Participant **Date**

Researcher's Signature:
I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participant fully understands what is involved in being in the study, any potential risks of the study and that he or she has freely chosen to be in the study.

_____ _____

Signature of Principal Investigator **Date**
Gabrielle Young
Assistant Professor, Memorial University

_____ _____

Signature of graduate student investigator **Date**
Stephen Sharpe
Master's of Education Candidate

Appendix E

Letter of Information for Students

Title: *Examining how Google Classroom Supports Universal Design for Learning*

Researchers:
Primary Investigator
Dr. Gabrielle Young, Assistant Professor, Faculty of Education
Box 169 - G. A. Hickman Building
Memorial University of Newfoundland
St. John's, NL A1B 3X8
gabrielle.young@mun.ca
(709) 864-4413

Graduate Student Investigator
Stephen Sharpe, Master's Candidate, Faculty of Education

Invitation to Participate
You are invited to take part in a research project entitled, *"Examining how Google Classroom Supports Universal Design for Learning"*.

This letter is given to you to provide information about this study to help you decide if you would like to participate. If you do not want to participate or at first want to participate and then decide later that you do not want to anymore, there will be no negative consequences.
Before you decide, you should know what the study is about. Please carefully read this document and listen to the information being provided by the researchers to help understand this study. If you have any questions or need something explained a bit more, please ask before you make a decision on participation.

Purpose of the Study
This study is designed to understand how teachers use Google Classroom and how it is used to help students learn. We want to understand benefits and challenges your teachers have with the use of Google Classroom and what students think about the use of Google Classroom.

What You Will Do in This Study
- You will be invited to participate in a *focus group*.
- You may *check* to make sure you agree with the information that was given by students in the focus group.

Focus Groups with Students
You are invited to participate in a focus group with 6-10 other students. The Focus groups will last about 30 minutes and will be held during your lunch hour during your student council meeting. Your responses will be audio recorded as well as speech-to-text recorded. The focus group questions will focus on your views on:
- Receiving instruction in a variety of formats.
- Demonstrating your knowledge in a variety of ways.

- How Google Classroom is used to assist with learning activities.

Member Checks
After the focus group session, you will have a chance to review and comment on the interview transcript, as well as a summary of the research findings. If you choose to participate, the researchers will summarize the information, read it aloud, and allow you to read it yourself. You will have a chance to share additional thoughts about what you said in during the focus group session during the follow-up session. This should take less than 30 minutes.

Length of Time
Your participation in this study will not add to your current workload. Focus groups will be conducted with students at lunchtime and you will be provided an opportunity to eat your lunch. Member checks will last about 30 minutes and will take place during another lunchtime after the focus group session. If you participate in these sessions, you will be meeting during two separate lunch hours, for no more than 30 minutes at a time.

Withdrawal from the Study
You can withdraw from participating in this study at any point during this study, without giving any reason. There are no consequences for withdrawal from the study. If you decide to withdraw, you will be given the opportunity to remove previously collected data from the study. Data collected from the study will not include your name, but data cannot be withdrawn once the study has been completed and the data has been compiled and prepared for publication.

Possible Benefits
Participating in this study will allow you to tell us what you think about Google Classroom, and this information may used to help peers in today's classroom. By participating in this project, you will become familiar with the research process and you will help educators and your own teachers learn about technology.

Possible Risks
There are no known risks associated with participation in this study.

Confidentiality
Confidentiality means that only the researchers will know your identities and personal information, and will protect your data from unauthorized access, use, or disclosure. To ensure confidentiality, the identities of participants will only be available to the researchers. Results from this project will be published and may be presented at conferences; however, your identity will be kept confidential. Data from interviews and focus groups will be organized so that it will not be possible to identify you from your responses to the interview questions.

Anonymity
Anonymity refers to protecting participants' identifying characteristics, such as name or description of physical appearance. The names of students, teachers, school, school district and region will not be kept private. You will not be identified in publications. While direct quotations will be used from interviews in the research results, names and information that identifies the country, province, school district, school, teacher and student will be changed.

The researchers will keep the focus group discussions confidential, and we request that students who participate the focus group do the same. Please respect the confidentiality of the other members of the group by not repeating what is said in the focus group to others and be aware that other members of the group may not respect your confidentiality.

Recording of Data
Interviews will be voice recorded and text will be recorded through speech-to-text technology, as well as recorded in the researcher's notes.

Reporting of Results
Data from this study will be shared with members of the research team and will be presented to the university's faculty of education, submitted for publications, and used towards a Master's thesis. If you agree to participate, focus group data will be summarized, and we will use direct quotations surrounding your perceptions of using technology during class time.

Storage of Data
The results from this study, collected from you as part of your participation in this project, will be stored on a password-protected computer, signed consent forms will be stored in a locked cabinet. Data will be kept for a minimum of five years, as required by Memorial University policy on Integrity in Scholarly Research. Only the researchers involved in the project will have access to the data. When the data is no longer required, all data will be appropriately destroyed (i.e., papers will be shredded, and audio recordings will be erased, and original transcripts will be deleted).

Sharing of Results with Participants
If you would like to obtain a summary of the results from this study, please provide your email address to have findings sent to you.

Email address: _____

Questions
You are welcome to ask questions before, during, or after your participation in this research. If you would like more information about this study, please contact: Gabrielle Young through e-mail (gabrielle.young@mun.ca) or Stephen Sharpe (u24sds@mun.ca).

The proposal for this research has been reviewed by the Interdisciplinary Committee on Ethics in Human Research and found to be in compliance with Memorial University's ethics policy. If you have ethical concerns about the research, such as the way you have been treated or your rights as a participant, you may contact the Chairperson of the ICEHR at icehr@mun.ca or by telephone at 709-864-2861.

Appendix F

Student Consent Form

Title: *Examining how Google Classroom Supports Universal Design for Learning*

Consent:

Your signature on this form means that:

- You have read the information about the research.
- You have been able to ask questions about this study.
- You are satisfied with the answers to all your questions.
- You understand what the study is about and what you will be doing.
- You understand that you are free to withdraw participation in the study without having to give a reason, and that doing so will not affect you now or in the future.
- You understand that if you choose to end participation during data collection, any data collected from you up to that point will be retained by the researcher, unless you indicate otherwise.
- You understand that withdrawal from participation in the study will not affect your educational standing in any way
- You understand that if you choose to withdraw *after* data collection has ended, your data can be removed from the study up to **June 27, 2018.**

Consent for recording data:

I agree to be audio-recorded during the interview for later transcription.	☐ Yes	☐ No
I agree to the use of direct quotations	☐ Yes	☐ No
I am aware that that the data collected for this study will also be used for the purpose of Stephen's master's thesis	☐ Yes	☐ No

By signing this form, you do not give up your legal rights and do not release the researchers from their professional responsibilities.

☐ Yes _____

Please e-mail the results from this study to the above listed e-mail address.

Questions

You are welcome to ask questions before, during, or after your participation in this research. If you would like more information about this study, please contact: Gabrielle Young through e-mail (gabrielle.young@mun.ca) or Stephen Sharpe (u24sds@mun.ca).

Your Signature Confirms:

☐ I have read what this study is about and understood the risks and benefits. I have had adequate time to think about this and had the opportunity to ask questions and my questions have been answered.

☐ I agree to participate in the research project understanding the risks and contributions of my participation, that my participation is voluntary, and that I may end my participation.

☐ A copy of this Informed Consent Form has been given to me for my records.

_____ _____

Signature of Participant **Date**

Researcher's Signature:
I have explained this study to the best of my ability. I invited questions and gave answers. I believe that the participant fully understands what is involved in being in the study, any potential risks of the study and that he or she has freely chosen to be in the study.

_____ _____

Signature of Principal Investigator **Date**
Gabrielle Young
Assistant Professor, Memorial University

_____ _____

Signature of graduate student investigator **Date**
Stephen Sharpe
Master's of Education Candidate

Appendix G: Interview Questions for Teachers

1. Are you familiar with the term *Universal Design for Learning*?

2. Are you familiar with the term *Assistive technology*?

3. Is Assistive technology available in your school?

4. Are you able to access Assistive technology whenever you require?

5. Describe the range of learning needs present in your classroom.

6. What types of assistive technologies are recommended for use on the IEPs of the students in your class?

7. What measures do you take to meet the needs of students in your classroom?

8. How did you become familiar with Google Classroom?

9. How do you use Google Classroom to support teaching and learning?

10. How do your students use Google Classroom to support learning?

11. Are there benefits to using Google Classroom to meet the needs of each student in your classroom?

12. Are there challenges to using Google Classroom to meet the needs of each student in your classroom?

13. In your opinion, what are students' attitudes towards the use of Google Classroom?

Appendix H: Focus Group Questions for Students

Rules

1. Students may only speak when they hold the tennis ball.

2. If students do not wish to answer a question they may pass.

Question 1:

What are ways teachers present information?

Question 2:

How does your classroom teacher use Google Classroom to present information?

Question 3:

What are ways you demonstrate what you know in your classroom?

Question 4:

How is Google Classroom used by your teachers to allow you to demonstrate what you know?

Question 5:

Describe your experience using Google Classroom to show what you know?

Question 6:

Would you recommend other teachers and students use Google Classroom?

Appendix I: TCPS Certificate

PANEL ON RESEARCH ETHICS

Navigating the ethics of human research

TCPS 2: CORE

Certificate of Completion

This document certifies that

Stephen Sharpe

has completed the Tri-Council Policy Statement:
Ethical Conduct for Research Involving Humans
Course on Research Ethics (TCPS 2: CORE)

Date of Issue: **17 December, 2017**

Appendix J: Curriculum Vitae

Name: Stephen Douglas Sharpe

Post-Secondary Education and Degrees:

Memorial University of Newfoundland
Newfoundland and Labrador, Canada
2019
Master of Education: Curriculum, Teaching and Learning Studies

Memorial University of Newfoundland
Newfoundland and Labrador, Canada
2012
Bachelor of Business Administration

Memorial University of Newfoundland
Newfoundland and Labrador, Canada
2011
Bachelor of Education: Intermediate/Secondary

Memorial University of Newfoundland
Newfoundland and Labrador, Canada
2008
Bachelor of Arts: French

Related Work Experience:

Classroom Teacher: Intermediate/Secondary
Newfoundland and Labrador English School District
2011-2019

- French Immersion Math, Science and Social Studies teacher. Worked with teachers to develop cross-curricular activities, course content and course modifications through Google Classroom and corresponding applications (Drive, Docs, Slides)

Relevant Certifications: Level VI Teaching Certificate