Transdisciplinary Inquiry:
Exploring a New Approach to Professional Learning in Education

by

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In the Department of Curriculum and Instruction

Supervisory Committee

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Abstract

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Traditional, transmission methods of professional development (PD) for educators have been criticized as being ineffective, failing to provide enough time, context, autonomy, active engagement, and content information to enable educators to meaningfully shift their practice. This case study examined if and how transdisciplinary inquiry could be used as a vehicle for professional learning in the public-school system. Over six months, seven educators with diverse academic backgrounds, developed into a team, identified a shared concern, and engaged in transdisciplinary inquiry. To address the issue of concern, they created and utilized a set of mini-lessons on metacognitive strategies to help intermediate grade students, with a wide variety of learning exceptionalities, to reflect on and regulate their own learning. At the same time, the educators purposefully attended to their own learning as well as the learning of their fellow team members.

Interview and focus group data suggest it was possible and productive to use transdisciplinary inquiry as the vehicle for professional learning. Participants reported that the experience facilitated educator learning, provided opportunity to apply knowledge, introduced multiple perspectives, and fostered positive relationships. Findings suggest that the transdisciplinary team acted as a complex system with cohesive and divisive forces working

together with information from the environment to occasion learning within the system. Findings also suggest that the use of transdisciplinary inquiry projects as professional learning opportunities may be an effective and practical supplement to traditional PD methods currently used in the public education system.

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Chapter 1: Introduction

In British Columbia, as in the rest of Canada, our society has changed immensely over the past few decades and the schools of our children are quite different from those of our parents. Gone, for the most part, are the one-room rural schools with the teacher writing the day's lesson for seven grades on the chalk board and the children copying information into their notebooks. Gone, for the most part, are the classrooms in which the teacher and textbooks are the only source of information. Gone, for the most part, are classrooms and curricula that focus solely on reading, writing, and arithmetic. Although times have changed, educators continue to play an enormously important role in helping the students of today learn and develop. With the proliferation of computer technology, changes to the family unit, and increased globalization, the traditional functions of schools are in the process of enormous change. Correspondingly, the educator's role as well as the skills and abilities required by educators are evolving. These comprehensive changes may require a complete transformation of educator practice if they are to help the students of today learn and develop into 'educated citizens' of tomorrow.

The role of the teacher has evolved a great deal over the past few decades, fuelled by major transformations in the ways in which information is obtained and used. The information age and use of computers have revolutionized the ways in which we communicate, access information, and express ourselves. Computers and search engines are now instantly accessible to almost everyone and information is available at the touch of a button. Google's collective cache of data has, in some instances, replaced textbooks and teachers as the primary source of available information. Additionally, changes in communication and the development of virtual environments have provided students with the ability to collaborate instantly with diverse people throughout the world and easily present their own knowledge and ideas in a variety of ways to

global audiences. These changes in the methods we use to obtain, utilize, and share information are shifting the roles that educators play in helping students develop and use knowledge. Today, the traditional role of the teacher as expert, who holds and doles out a store of knowledge, is becoming redundant and educators are struggling to understand and redesign their roles based on the changing needs of their students and society.

In addition to helping students obtain, evaluate, and understand the vast amount of information available to them, teachers and educators are increasingly called upon to support student learning in much broader ways than ever before. For example, educators are increasingly asked to personalize education to meet diverse needs; understand and utilize cutting-edge technology; engage parent and community participation; transform curriculum to effectively include elements such as personal and social responsibility, identity, and culture and creativity; and expand methods of evaluating and reporting on student learning and growth. Even if the educators of today had received exemplary pre-service education, it is unlikely that they would be prepared for all the changes and challenges they would experience throughout their careers (Organization for Economic Co-operation and Development, 2009).

As educators struggle to determine their new role in helping students learn in the twenty-first century, it has become increasingly apparent that there is a need for educators themselves to be supported in their endeavors to learn how to adapt their practice to the changing times. Traditional forms of professional development (PD), based on historic roles of teachers as experts, that utilize traditional transmission models of teaching to improve teacher practice, have been called into question (Broad & Evans, 2006; Caena, 2011; Garet, Porter, Desimone, Birman, & Yoon, 2001; Louck-Horsley, Hewson, Love, & Stiles, 1998). Effective professional learning opportunities that focus on helping educators transform their own learning and enabling them to

face the challenges of an ever-changing society are essential if they are going to be able to help the students in their care to learn and grow.

Problem: Shifting from Professional Development to Professional Learning

Transmission-style professional development. Traditional, transmission methods of professional development (PD) for educators mirror the traditional roles of teachers, and typically include an expert providing one-day workshops or presentations on educational topics. This implies the ability to transmit information to educators who acquire and apply these ideas and in their practice. Even within the past decade, attending conferences or workshops has been the most common professional development activity for educators (Cordingley et al., 2015; Garet et al., 2001; Organization for Economic Co-operation and Development, 2009). These traditional PD opportunities often utilize a directive teaching approach and occur outside of classrooms or schools. Typically, they involve experts working with or lecturing to educators. The purpose of traditional PD activities is to improve educator practice by providing additional content knowledge or skill development (Broad & Evans, 2006; Garet et al., 2001). However, the effectiveness of traditional transmission styles of PD have been challenged by both educators and researchers. These types educational experiences often occur out of context and are unable to provide enough time, autonomy, active engagement, and content information to allow educators to transform their practice (Caena, 2011; Garet et al., 2001; Louck-Horsley et al., 1998).

Today, we are gaining a better understanding of learning and knowledge through both research and experience (Amineh & Asl, 2015; Jarvis, 2007; Jost, 2017; Putnam & Borko, 2000). Slowly, the realization is dawning on educators and administrators alike that learning is not a commodity that can simply be provided to the individual from an external source, but a process of growth and change that an individual undergoes regardless of age or stage of learning. A more

current understanding of knowledge emphasized that knowledge is built and created by a community as individuals work together to negotiate a situation or problem (Amineh & Asl, 2015; Burr, 2003; Kinnucan-Welsch, 2010). A more contemporary understanding of learning and cognition reveals that learning arises as individuals live, transform, and adapt to the changing world around them; as individuals interact socially within communities and reflect on these interactions; and as groups converse and collaborate to create new understandings (Amineh & Asl, 2015; Begg, 2013; Cordingley et al., 2015; Li & Winchester, 2014; Merriam & Biereman, 2014; Mudiyanse et al., 2016; Osberg, Biesta, & Cilliers, 2008; Schäfer & Schä, 2017; Sumara & Davis, 1997; Ward, Silverman, & Villalobos, 2017; Yilmaz, 2011). With new insights into learning and knowledge, perhaps it is possible to shift the paradigm of educator PD away from a traditional, unidimensional, transmission approach toward a multidimensional approach that combines knowledge, collaboration, multiple perspectives, experience, and creativity in a transformative process.

One positive shift in methods of PD away from the traditional, transmission model can be seen in the development of collaborative inquiry groups or professional learning communities of educators (Cherrington & Thornton, 2015; Crockett, 2002; Gersten, Dimino, Jayanthi, Kim, & Santoro, 2010; Hipp & Huffman, 2010; Organization for Economic Co-operation and Development, 2009). These learning communities situate PD activities within the school context and honour educator expertise; they aim to provide space and time for communication between educators as they work collaboratively to develop their craft. In some cases, these learning communities inquire into an area of instructional concern (Ermeling, 2010). Ideas are exchanged and learning occurs within context and through critical reflection within a community of

individuals who share similar experiences (Cherrington & Thornton, 2015; Gersten et al., 2010; Stanley, 2011; Torres-Guzmán et al., 2006).

In some cases, however, very narrowly focused learning communities with particular topics of study are imposed on educators by district administrators or school supervisors to improve teacher performance and reflect the school district's agenda rather than encouraging the organic development of networks for the purpose of educator learning (Sims & Penny, 2014). Because imposing professional learning communities on educators reduces autonomy, it can create a lack of educator 'buy in' or motivation which is counterproductive to the learning process (Sather, 2009; Sims & Penny, 2014).

Other concerns with learning communities have been identified. For example, communities of practice or collaborative inquiry groups are often created by individuals with similar experiences. Without an outside perspective, dissenting viewpoints can be supressed. By supressing unique or dissenting ideas, group decisions can become less effective and creativity can be stifled (Hargreaves & Fullan, 2012; O'Grady, 2013; Stoll & Seashore, 2007) Another concern about this type of PD is that there is often a lack of structure in both how collaboration occurs within the community and how the members access external information (O'Grady, 2013; Sather, 2009; Vescio, Ross, & Adams, 2008). Finally, concerns have been expressed about the lack of time that educators are given to engage in these communities (Sims & Penny, 2014). However, even with these shortcomings, professional learning communities are a step away from traditional, transmission forms of PD because they occur within a specific context and do attempt to build collaboration between educational professionals for the purpose of professional learning.

Aiming for collaborative, embedded professional learning. The aim of the current study was to examine a new approach to professional learning for educators; to develop and

implement a professional learning community that maintained the positive elements of educator autonomy and peer collaboration, while providing increased diversity in perspectives, access to external information, organized facilitation, and ongoing support as educators applied the knowledge they developed together within the context of their individual working environments. I believed I might accomplish this goal by facilitating the development of a transdisciplinary team that would identify and address a joint issue of concern whilst members simultaneously reflected on their own learning and the learning of their colleagues. I believed that this process could possibly become an effective method of professional learning and provide a positive alternative or addition to traditional methods currently used in the public-school system. This professional learning opportunity would differ from traditional methods in that it would include elements of both transdisciplinary inquiry and embedded professional learning.

Transdisciplinary inquiry. The current study utilized transdisciplinary inquiry by extending across traditional academic and professional boundaries to address a complex societal issue. Seven educators from different disciplinary backgrounds and professions worked together to address the complex issue of improving student learning. This transdisciplinary inquiry developed over many months during which time the group collaborated, integrated information and methods across disciplines, developed a shared conceptual framework, and implemented ideas to help students in the intermediate grades (4 to 7) learn about and use metacognitive strategies particularly in the areas of listening and understanding verbal information.

A transdisciplinary approach to inquiry can be differentiated from monodisciplinary, multidisciplinary, and interdisciplinary approaches. Because there is significant variation in the use of these terms within the literature, I believe it is important to clarify my use of these terms here. A monodisciplinary approach to inquiry occurs when all members of a group come from

the same academic discipline and all of the knowledge, information, and methods needed to address the issue can be found within this discipline (Gibbs, 2015). In this approach, all members of the group hold similar assumptions and use a common vocabulary.

Alternatively, a multidisciplinary approach to inquiry occurs when individuals from two or more academic disciplines share knowledge to address an issue. This process is typically additive rather than integrative and each academic member shares a viewpoint from their discipline's perspective. Often, the goal of this approach is to provide information, assessments, and recommendations required for other stakeholders to implement solutions rather than to build joint understanding between disciplines, develop new knowledge, or implement solutions (Choi & Pak, 2006; Fam, Neuhauser, & Gibbs, 2018; Nicolescu, 2005; Stock & Burton, 2011; Toomey, Markusson, Adams, & Brockett, 2015).

An interdisciplinary approach is typically more cooperative in nature than a multidisciplinary approach to inquiry. Interdisciplinary inquiry can be either theoretical or practical in nature and integrates differing disciplinary ideas, viewpoints, and methods to address real world issues. The terms transdisciplinary and interdisciplinary are sometimes conflated both in the literature and in practice because in both approaches differing disciplinary viewpoints and methods are integrated to address an issue. Interdisciplinary appears to be used more often to describe integration of knowledge across research within university settings. Additionally, unlike the transdisciplinary approach, interdisciplinary inquiry typically does not actively endeavour to create a shared conceptual framework, strive to implement ideas within the context of society, or routinely include non-academic professionals or stakeholders (Min, Allen-Scott, & Buntain, 2013; Stock & Burton, 2011; Toomey et al., 2015).

Transdisciplinary inquiry utilizes collaboration among individuals from different academic disciplines and professions as well as community stakeholders. It strives to produce and apply academic, experiential, and local knowledge and expertise to address a complex societal issue. It is place-based in nature; occurs over time; integrates methods; encourages development of joint understanding; is highly interactive and participatory; acknowledges contradictory positions; and attempts to address societal issues whist contributing to the academic understanding of them. (Fam et al., 2018; Klein, 2018; Min et al., 2013; Robinson, 2008; Stock & Burton, 2011; Toomey et al., 2015). Table 1 represents a summary I created from the literature differentiating these four different approaches to inquiry.

Table 1. Differentiating Mono- Multi- Inter- and Trans-disciplinary

Monodisciplinary	Multidisciplinary	Interdisciplinary	Transdisciplinary
• All members from same academic discipline; • All knowledge needed to address the issue can be found in one discipline; • All members hold similar assumptions & common language.	• Members are from 2 or more disciplines; • Members work in parallel to share knowledge and address an issue; • Discrete disciplinary perspectives and methods are maintained; • Common language is not necessarily developed.	• Members are from 2 or more disciplines; • Focuses on real word problems; • Collaborative & seeks to bridge boundaries; • Integrates information from differing disciplines; • To some extent common language and ideas are developed.	• Members are from 2 or more academic disciplines & can include community stakeholders; • Focuses on complex real-world issues in context; • Highly collaborative & seeks to transcend boundaries to create new knowledge; • Shared conceptual framework and language is developed.

Embedded professional learning. Job-embedded, professional learning for educators refers to learning that is based in daily practice. It is typically classroom or school-based and involves activities that are integrated into the workday of educators as they find solutions for authentic issues arising from their practice. It can include: peer observation, team teaching, analysis of student data, or action research projects. This type of professional learning is a shared, continuous process that typically involves active engagement, collaboration, and inquiry-based work (Boyle, Lamprianou, & Boyle, 2005; Caena, 2011; Campbell et al., 2017; Guskey & Yoon, 2009).

Research Questions

The current case study was developed with two purposes in mind. First, since I could find no academic research on the use of transdisciplinary inquiry as a method of professional learning in the public education system, I wanted to know if such an endeavour would be possible. Secondly, if indeed such a professional learning opportunity could be initiated and developed, then I was interested in answering two questions about the process: How might a transdisciplinary approach to collaborative inquiry facilitate professional learning for educators in the public-school system? How might I, as a school psychologist, initiate, facilitate, and participate in transdisciplinary inquiry as a means of embedded professional learning?

A Personal Perspective on Teaching and Learning

Both of the above research questions are best answered using a qualitative research methodology which requires an active reflexive process to establish credibility. Therefore, throughout the research, I engaged in a continuous process of reflection on how my personal background, values, and assumptions influenced my research practice. To provide some level of transparency as to how these elements influenced the current study, I found it necessary to

position myself within the research and turn the investigative lens inward focusing on my personal beliefs particularly in the areas of teaching and learning. In this section, I hope to convey how my experiences, background, and beliefs inform the interpretation of the information obtained from this research and what I have learned from the study.

I began my professional practice as a biology teacher holding a major in biology and a minor in English within the field of education. This contrasting combination of science and art seems to have set the stage for the rest of my life. I began my working life as a teacher but underwent many changes throughout a number of careers. I transformed from a biology teacher to a police officer; police officer to educational administrator; administrator to English teacher; English teacher to student and university researcher; and researcher to school psychologist. Upon reflection, I realize I am drawn to the certainty of science, yet I love the creativity and openness of literature. I understand the need for precision and measurement, in some contexts, but also recognize the importance of metaphor and synecdoche. I enjoy exploring the theoretical yet desire to be a pragmatist. I might have chosen to dedicate my life to developing theories and research, but instead have devoted myself to the concrete application of what others have researched. I feel a dissonance in myself and I can see this dialectical tension reflected in the paths I have chosen to follow in life. I seem to oscillate between science and art, knowledge and learning, wonder and investigation. I have 'cross-trained' in a variety of fields including education, psychology, biology, the humanities, and criminology; undoubtedly this multidisciplinary background has influenced the way I have chosen to undertake my research. Even now as I am on this road of discovery in my PhD, I can feel the seemingly opposing forces of science and art, empiricism and constructivism, philosophy and practicality pulling on me. Through this process I have struggled to reconcile them. To understand how I did so, it is

important to understand my views on professional learning, my philosophy of teaching, and my theoretical perspective on learning as I engaged in this research project.

Definition of learning. If I was asked to define 'learning' from my perspective, I would have to start, as I did with my formal education, from a biological position. When examining living organisms from the viewpoint of biology, learning has been defined as a process of accumulating new information, abilities, and experience for the purpose of being better suited to succeed in a particular environment, typically resulting in changes in behaviour (Kolb & Whishaw, 2006). However, when thinking about learning as it pertains to humans, I need to expand this definition to include not only changes in behaviour, but also changes in attitudes and beliefs (Hollingsworth, 1989; Tam, 2015). For people, succeeding in an environment includes developing behaviours, attitudes, relationships, and communication that allow them to thrive, obtain personal goals, and develop feelings of self-efficacy. I believe that this type of transformative learning can be facilitated through exposure to a wide variety of experiences and viewpoints that challenge the learner's long-held attitudes, assumptions, and beliefs. This exposure pushes individuals to explore previously unimagined possibilities and sets the stage for more effective decision making within a multidimensional environment.

Although this definition does stem from a biological perspective, it accurately describes learning as I have experienced it across diverse situations in my life. For example, when I was learning to become a police officer, I was acquiring new information, skills, understandings, and attitudes regarding criminal law and psychological processes. I was required to work closely with individuals from a variety of backgrounds who held beliefs dissimilar to my own. I gained new skills in defensive tactics and report writing, a new communication style with my colleagues, and real-world experience in investigating criminal acts. I experienced situations as a police officer

that I could never have imagined as a civilian and the learning that I gained through these experiences changed the way I interpreted and responded to the world around me. It also altered some of the beliefs and attitudes I held. These changes prepared me to be more successful in my new role as police officer. They also helped me adapt to my new environment so I would not put myself or others seriously at risk.

Similarly, when I was learning to become a school psychologist, I was acquiring new information, skills, understandings, and attitudes towards measurement, intelligence, and learning; I worked closely with individuals and professionals from different backgrounds who held different beliefs than I; I gained new skills in interviewing, measurement, and report writing; I developed new communication styles with my colleagues; and I gained real world experience investigating and intervening with the learning exceptionalities of the students with whom I worked. This learning also changed the way I interpreted and responded to the world around me, altered some of the beliefs and attitudes I held, and better prepared me to help others in my new role as a school psychologist.

Correspondingly, I believe that this definition of learning also ideally describes the professional learning that educators should experience. Through my engagement in PD activities over the many years that I was an educator, I have found that educator professional learning also includes the accumulation of new information and skill, development of new beliefs and attitudes, and the application of these skills and attitudes within the real-world environment for the purpose of helping others learn. Professional learning for educators should help educators adapt to new environments and conditions so they can help peers and pupils develop the skills, attitudes, and knowledge they need to lead productive and healthy lives. The challenge is

determining how to best provide professional learning experiences that effectively serve this purpose.

Philosophy of teaching. When I reflect on my philosophy of learning and teaching, I must admit that it has also developed over many years across many environments. I hope that by offering some examples of my experiences with 'teaching', I will be able to more clearly convey my personal philosophy of teaching and how it has developed. As I look back upon my own philosophy of teaching, I can see clearly that some of the tenets that I hold to be true today, were developed when I was a swimming instructor. For example, I still believe that teachers cannot actually teach anything, but rather they design an environment and provide support to help students learn. I believe that before learning occurs, there needs to be a trusting relationship between the individuals involved in the process. I feel that the learning environment must be engaging and interesting. I believe that the learning situation must be designed to provide not only challenge to the student but also provide the student with a feeling of accomplishment. Learning needs to be applied in the real world. Finally, I know that helping someone else learn is reciprocal; the teacher, as well as the student, inevitably learns something from the process.

Before I attended university, the first time, to become a teacher, I was a swimming instructor and was already working with people and helping them learn. In fact, the first time I seriously considered the act of 'teaching' was when I was asked to teach the *Absolutely Terrified Adult Swimming Class* at the YWCA. I quickly realized that it is impossible for a swimming instructor to 'teach' an adult, who is 'absolutely terrified' of water and doesn't even want to leave the locker room, how to swim. First, I had to design the environment in a way that the student would feel safe and supported. Then I had to engage the student in a situation that would provide success and then make the situation fun and interesting so that the student wished to

investigate and try new things. For my ‘absolutely terrified’ adult, that meant starting by walking her into the shower room and feeling the water on her feet, helping her come to the very shallow side of the pool and sit and dangle her legs in the water, playing a kicking water game that resulted in the instructor getting soaked, and finally, when she was ready, actually entering the very shallow end of the pool. Eventually throughout the first year the student learned to put her face in the water, to float and kick her feet, and begin to move her arms while she floated. Then, on one momentous day, the student requested to try floating in the deep end. The process took over a year, but the student was no longer ‘absolutely terrified’ and was beginning to learn to swim. This could not have been accomplished remotely by talking about swimming or watching someone else swim. It had to be experienced by the learner and applied to the real world. Additionally, I, as the swimming instructor, learned a great deal about helping students learn.

I have seen these elements of successful learning situations (environmental design, student support, trusting relationship, engagement, appropriate levels of challenge, experience of success, and application in the word), play out both as teacher and as a student. As a teacher, in a small rural community in Saskatchewan, I found that one of the most important aspects of helping my students learn was to get to know them as people and to build a trusting relationship with them. Many of my students had First Nations backgrounds and their own and their parents’ experiences with the school system were not positive ones. Building trust and having students feel safe had to occur before a great deal of learning would happen. Building such relationships takes time and attention. It has to be intentional. Learning about students as people first and then thinking about what they needed to learn always served me well as a high school teacher.

After building good relationships and a safe learning environment, I found it important to create interesting learning experiences. As a biology teacher, I was lucky because there were

many opportunities to create exciting learning activities both inside and outside of the classroom. I could engage students in showing their knowledge through art, project presentations, and lab work. For example, my Biology 11 class developed the 'classroom zoo' of animals that became a tradition over the eight years I was the biology teacher at that school. Each student pair was responsible for choosing an animal to build a habitat for and take care of throughout the year. The class had a pair of boys building a two-story rabbit hutch, and a pair of girls feeding the piranhas. The class had parents donating huge fish tanks and businesses donating building materials. We had a lizard that ate insects, several guinea pigs, a parrot, and a chinchilla. We also had many less-interesting animals such as hamsters, gerbils, and rats. All the animals were chosen by the students and bought through their fundraising efforts. All the animals were cared for by the students. Once a year the grade 7's would get a tour of the 'classroom zoo' and the grade 11's would present their 'pets'. Through these experiences, I learned just as much as the students about the topics of the projects, communication, teamwork, and learning.

On one occasion, the pet rabbit, Stu, developed a growth on his chest. The students and I went to a vet and discovered that this was quite a common occurrence in rabbits. We were instructed on how to lance the growth and pack the wound. We obtained antibiotics from the vet and completed the procedure ourselves. One of my students, who was sure she wanted to be a vet prior to this incident, decided afterward that perhaps she was better suited to teaching. The rabbit survived and later that summer when the students took it home for the holidays, we discovered that Stu was actually Sue because she ended up having babies. It is quite tricky to tell the sex of a rabbit – who knew? I learned that it is amazing how much math, science, and English can be taught through project work and how easily students learn when they are interested in what they are doing.

As a learner, I also observed the importance of student support, trusting relationships, engagement, appropriate levels of challenge, experience of success, and application of learning. When I became a police scuba diver, I had to develop new knowledge and skills beyond what I had possessed as a recreational diver. I also had to have new diving experiences such as diving in a dry suit, under the ice, in enclosed spaces, in search patterns, and diving alone. All of these new experiences were necessary to prepare me to do the job. I had to build relationships with other team members, so when I dove under the ice or into submerged vehicles, and my only lifeline and source of communication was the rope held by another team member, I would trust them enough to be relaxed and confident. Equally important was that my teammates would trust me. The nature of this type of learning was in itself both interesting and challenging. All of the experiences and training made me better equipped to be successful in an operational dive and allowed me to adapt to my new role as police diver.

Similarly, in becoming a school psychologist I had to undergo a great deal of learning. I had to learn immense amounts of factual knowledge about the brain, cognition, psychometrics, and statistics; but I also had to learn new skills including report writing (very different from police reports), interview skills (very different from interrogation skills), standardized test administration skills (very different from teacher administered tests) and intervention techniques (very different from instruction). Through numerous practical classes and practicum placements, through research projects and an intensive internship, I also obtained real-world experience. Now, after having been in the job for four years, I am still learning through practical application and collaboration with other professionals. Through both my formal and informal education in the area of school psychology my skill, knowledge, understandings, and beliefs have changed to allow me to better help the students and families with whom I work.

As a student, I have also experienced learning situations that were not engaging or challenging, did not provide a supportive trusting environment, and seemed to have no application to real life; I recall these instances as times that I learned relatively little. One particular occurrence illustrates this point. When I was in police college, the atmosphere was very formal, and some classes were completed in a paramilitary style. Guest lecturers, who were operational police officers themselves, were often seconded to lecture at the college. Some instructors were very effective and created engaging and interesting lessons, demonstrated how to apply the information they provided, developed trusting relationships with the class, and challenged our assumptions. Other instructors were less effective.

I will always remember the lesson my class received from a member of the bomb disposal unit on explosives. My whole class was very excited that we were finally going to hear a member of the bomb disposal team talk about explosives and detonation. After spending weeks studying more mundane topics such as the *Snowmobile Act* and *How to Apply for a Warrant*, we thought that the 'bomb talk' would be extremely interesting. We imagined hearing stories about actual bomb calls, instances when the bomb team had safely detonated devices, or descriptions of how the bomb team would work with the SWAT team to enter rooms using explosives. We had visions of perhaps being allowed to hold detonation cord or even don part of the Explosive Ordnance Disposal (EOD) suit. We hoped we might see the bomb robot in action or perhaps view a video of a BLEVE (Boiling Liquid Expanding Vapor Explosion). At the very least we wished to discuss what would be expected of us, as new constables, if we went to a bomb call.

Unfortunately, we were sorely disappointed and the whole experience was a good non-example of how to help students learn. The class was presented in a lecture format. The lecturer appeared very uninterested in our class and barely looked at us (in retrospect, I suspect he was

just nervous). He spent the first half an hour trying to get the PowerPoint slides to show up on the screen. When he did begin the lecture, he read definitions from the screen, talked about the criminal code, and showed an old video of how the water cannon was developed. It was three hours of detailed information that I could not recall the day after it was presented. This experience reminded me that even though a topic might be innately interesting, if the environment is not designed to promote trust, engagement, challenge, and real-life application, very little learning may occur.

These vignettes of my experiences as both a teacher and a learner emphasize the importance of building supportive relationships with and engaging environments for learners. I hope they demonstrate why I feel that the best educators design effective learning environments, provide support to learners, afford opportunity for real-world application, and engineer situations that will allow student to experience success.

Professional learning for teachers. My experiences as a former teacher who has engaged in formal PD activities, and now in my role as a school psychologist who is often asked to provide formal PD activities for teachers, have demonstrated to me that much work needs to be done to change the approach to professional learning in education. Currently in my district, as in many districts, the predominant form of PD provided to teachers occurs during district in-service days. On these days, experts identified by the administration attempt to transmit information to educators on topics the administrators feel are important. Often outside experts are invited into the district to lecture on a topic. Alternatively, sometimes experts from within the district provide a few of short workshops across a number of weeks. Although this expert/transmission model of PD has been used historically and can provide educators with new knowledge, it does present a number of problems. Educators typically have to go offsite to listen

to lecturers or engage in workshops; educators often lack choice regarding the topics of the professional learning available to them; presentations are often of short duration and do not allow for educators to apply the information in context; and educators are often left to their own devices to try to implement some of the ideas presented to them.

As a school psychologist, I have been one of the 'experts' in the district asked to provide PD activities. When I am asked to present on a topic such as reading interventions for example, teachers come to a half-morning presentation where I review a number of reading interventions available to target particular reading difficulties. The session may involve the participants watching video clips of teachers implementing the intervention, completing a mock practice of the intervention or assessment, discussing the interventions the participants have tried, and providing opportunities for participants to review resources and discuss their experiences with their peers. However, for the most part, after the workshop the participants are left on their own as far as applying their new knowledge in their classrooms. I believe that there has to be a better way of providing professional learning opportunities for educators.

Through my current study, I endeavoured to change my practice as well as the way in which educators and administrators view professional learning. I worked with colleagues to develop and examine a new approach to the professional learning process that expands upon the idea of a professional learning community. I initiated an inquiry project within a school by inviting educators from a particular school site to work with associated professionals from the district level to address an issue identified by the members involved. My goal was to ultimately engage a transdisciplinary team of educators in collaborative inquiry whilst encouraging team members to reflect on their professional learning and the learning of their fellow team members.

A transdisciplinary team refers to a group of individuals from diverse academic and philosophical backgrounds who work together using concepts, methods, and questions that cross traditional academic boundaries in order to tackle complex issues in society (Fam et al., 2018; Robinson, 2008). This team, of which I was a member, collaborated to learn about a joint area of interest within a school. The individual members worked together to develop knowledge and directly applied this knowledge within the context of the school environment over time. The aim was to develop relationships, facilitate learning conversations, build new collective knowledge, and to support each other in applying this knowledge in our professional practice.

Theoretical Framework

The current research examined the utilization of transdisciplinary inquiry as the vehicle for professional learning within the public education system. One goal was to obtain educators' reflections on the process and determine important elements that emerged as the group endeavored to utilize a more participatory and transdisciplinary approach to educator learning. Another goal was to better understand and represent the forces at play as the individual educators worked together and developed into a learning community. The theoretical underpinnings of the study were created by combining two theoretical perspectives on knowledge creation within a complexity framework (Turner & Baker, 2019).

Social constructivism and enactivism are separate theoretical perspectives regarding the nature of knowledge creation or coming to know, as described more fully below (Proulx, 2008). Complexity is an ontological belief that the world is mostly comprised of interacting complex systems (Byrne, 2014; Turner & Baker, 2019). Complexity depicts the natural world as being holistic, multidimensional, interconnected and unpredictable rather than linear, dichotomous and determinant (Davis, Sumara, & Luce-Kapler, 2008; Radford, 2008; Turner & Baker, 2019). By

viewing the nature of knowledge creation and learning through a complexity lens, elements of social constructivism (active co-construction of knowledge, shared experience and collaboration, and the importance of language) and enactivism (embodied action and engagement with the environment, autonomy, and overlapping of experience, emotion and cognition) were combined to provide a holistic, theoretical framework for the current case study. The focus of the case study therefore was to examine a learning community's attempt to develop and utilize transdisciplinary inquiry as a method of professional learning.

Social constructivism and learning. Social constructivism is a variety of cognitive constructivism that is more concerned with collective understanding than individual knowledge. It emphasizes both the social and cognitive aspects of knowledge creation. Constructivists view learning as a cognitive process and take a relativist perspective (Davis, Sumara, & Luce-Kapler, 2008; Merriam & Biereman, 2014). New knowledge is not absolute but rather constructed within an individual's cognitive framework and developed through past experiences. Knowledge is relative to the cognitive development and prior experience of the learner.

Social constructivism extends constructivism into social settings and incorporates the effects of culture and language on learning. From this viewpoint, knowledge is a value-laden, human product that is actively, socially, and culturally constructed through interaction with others. It is developed collaboratively within a culture of shared artifacts with shared meanings. Social constructivists do not necessarily locate learning within the individual learner but rather the learner is seen as part of a learning system. Social constructivists view learning as changes in how individuals construe the world based on social interactions; learning is seen as a collaborative process occurring within an specific community and context (Amineh & Asl, 2015;

Collin, 2017; Davis et al., 2008; Doolittle, 2014; Merriam & Biereman, 2014; Prawat, 1999; Stetsenko & Arievitch, 1997).

Assumptions underlying the current study. Social constructivism underlies the current study in that the professional learning process developed through transdisciplinary inquiry is reliant on a team of diverse individuals working together in a joint inquiry within a social context. The focus is on the issue being addressed -- not on individual disciplinary knowledge, but rather a holistic examination of the matter at hand. The current study posits that professional learning will occur as knowledge is co-constructed by the team members as they use language to actively collaborate and engage in a shared experience. This view of the process of professional learning is based on a number of critical assumptions that must be acknowledged.

First, according to social constructivist theory, learners are viewed as active participants in understanding and shaping their own knowledge and development (Amineh & Asl, 2015; Doolittle, 2014; Stetsenko & Arievitch, 1997). This assumption can be seen underlying the organization of the current study in that team members were not the recipients of information provided by an expert. Instead, the learners were situated within their own social and cultural context and asked to identify and work together to address an issue. The choice of inquiry topic and how to address the topic was not dictated by the researcher or district administration but was developed and determined by the team members. The team members actively participated in group discussion, project development, and activity and lesson application within their own working environments. The knowledge created was shared by the team and each member was able to choose how to apply it in their own context.

Secondly, from a social constructivist stance, knowledge and understanding are not derived from within the individual, but are developed or created through shared experiences and

collaboration between individuals (Amineh & Asl, 2015; Hibberd, 2005; Stetsenko & Arievitch, 1997). From this perspective, learners are encouraged to reflect critically on their unexamined assumptions and implicit beliefs. In the current study, information was not provided through text book readings or lecture, instead it was created by the team members as they engaged in group and pair discussions regarding the inquiry, as team members shared diverse and sometimes contradictory viewpoints, as they interacted with the students that they typically work with, as they discussed ideas with individuals outside of the group, as they used language and symbols to create a joint conceptual framework for their learning, and as they adjusted their prior knowledge and assumptions in view of new experiences and ideas shared as a group.

Thirdly, according to social constructivism, language acts as a cultural mediator and is of enormous importance in the development of knowledge. Social constructivists identify language as one of the main methods by which knowledge is constructed (Burr, 2003; Hibberd, 2005; Stetsenko & Arievitch, 1997). The current study provided a variety of mediums in which team members could communicate with language and symbols such as: whole group meetings which facilitated real time conversations and discussions; small group conferences in which some members of the group engaged in oral discussion as well as the creation of written and symbolic representations of ideas; individual hallway conversations in which pairs of learners discussed specific aspects of their learning and the project; electronic communications through email and PowerPoint slides that allowed for the written distribution of ideas; and access to the written work and academic research of others to allow for idea expansion and sharing.

Enactivism and learning. Enactivist theory originated from the ideas of Maturana and Varela (1972) about autopoietic systems. Autopoietic systems can include both living and societal systems; these complex systems are comprised of networks of components or agents that

interact with each other in autocatalytic, self-organising, and self-sustaining ways (Begg, 2013; Boden, 2000; Kolb & Kolb, 2009; McMullin, 2006; Ward et al., 2017). Autocatalytic refers to the ability of agents in the system to regenerate the processes that created them without being depleted. The process of self-organizing means the system is autonomous and demonstrates a preference for one situation over another allowing for goal-directed behavior (Heylighen, 2008); and self-sustaining means the system can maintain its order regardless of disruptions from the external environment (Castillo, Kloos, Richardson, & Waltzer, 2015). Autopoietic systems co-evolve or couple with their environment, allowing the system to act on external conditions but also allow it to adjust to the environment. In adapting to the environment the system demonstrates knowing and learning (Boden, 2000; Maiese, 2017; McMullin, 2006; Sheya & Smith, 2010). Learning, or coming to know, can develop in any autopoietic system as it interacts with its environment (Begg, 2013; Schäfer & Schä, 2017). When using an enactivist lens, aspects of constructivism and embodied cognition are combined such that cognition and context cannot be extricated and actions themselves are viewed as necessary for understanding (Stewart, 2010; Van Den Berg, 2013; Ward et al., 2017).

Assumptions underlying the current study. Enactivism underlies the current study in that the professional learning process developed through transdisciplinary inquiry was reliant on a team of diverse individuals collaborating within the context of their working environments and interacting with that environment to develop a sense of knowing. Interacting with the environment included, but was not limited to, discussions and meetings with team members, engaging with academic research, creating lesson plans and activities, and implementing these lessons and activities with students. In this study, I posit that professional learning through the process of 'coming to know' developed as the team members interacted physically, reflected

mindfully, and interrelated affectively within the context of their workplace. This view of the process of professional learning is based on a number of critical assumptions that must be acknowledged.

First, viewed through an enactivist lens, learning occurs through the embodied action and engagement of a person within their world. Knowing is thought of as a complex web that is self-sustaining, perceptive, reactive, and constantly changing. The knower is 'coupled with' the environment (De Jesus, 2016; Loaiza, 2019; Sumara & Davis, 1997; Ward et al., 2017). This assumption can be seen underlying the current study in that the team members did not passively receive and process information from the external world, but rather they engaged in purposeful activity in the form of an inquiry process which continually changed and developed through the research. The team members engaged in reciprocal interaction directly with the environment which included: other team members, the physical school site, the current socio-political situation, the students that the educator's worked with, the research articles that were available to them, as well as other aspects of the environment. These interactions changed the team members as well as the environment itself.

Secondly, enactivist theory suggests that even though living beings and systems are open to and part of the environment, they are also purposeful self-producing wholes which maintain autonomy throughout change (Begg, 2013; Loaiza, 2019; Sumara & Davis, 1997). This assumption is represented in the research in that each team member was unique and their knowing was facilitated through slightly different interactions with the environment. Although all members of the team engaged in the group planning meetings and electronic transfer of information, some felt it would be more useful to them if they used completed lessons with a class of students whilst others felt that they wanted to use the ideas with individual students or in

small groups. Each team member controlled how much or how little they participated and in what manner they were involved. They were given autonomy over their learning.

Thirdly, from the enactivist perspective, sense-making requires the overlapping of experience, emotion, and cognition. An individual cannot simply evolve with the environment in a neutral manner but rather needs to develop a 'notion of concern' with the given facts of an environment (Begg, 2013; Loaiza, 2019; Thompson, 2007). Throughout the current case study, efforts were made both by team members and me, as facilitator, to provide affective support to all members of the team. The members actively engaged in creating an environment in which it was safe to share dissenting opinions because of the assumption that it is through feelings of safety, belonging, and acceptance that individuals learn and effective learning communities develop.

Complexity and learning. From a complexity standpoint, much of the world is seen from a holistic, non-reductionist, non-linear perspective. Complexity theory suggests that complex systems make up a majority of the world and exist when numerous elements or agents engage in dynamic interactions with each other (Byrne, 2014; Mason, 2008; Ovens, Hopper, & Butler, 2013). These agents or elements can be individual cells such as neurons interacting within the neurological system, individual organisms such as people interacting within a learning community, or institutions such as an individual schools interacting within the educational system. Complexity thinking describes the nature of complex adaptive systems and differentiates them from simple, closed systems (Turner & Baker, 2019). Complex systems are comprised of networks of autonomous agents that interact, adapt, and emerge. The behavior of these systems is not necessarily determined by the properties of the individual agents within the system but rather the interaction between these agents. Small changes in the interactions between local

agents can have large effects, making behavior less linear and less predictable (Byrne & Callaghan, 2014; Davis, 2008; Hopper, Sanford, & Fu, 2016; Mason, 2008; Stacey, 1996; Sumara & Davis, 1997; Turner & Baker, 2019). Complexity thinking accepts that there are a wide variety of interactions occurring between nested components in complicated natural phenomenon. This theory, therefore, compliments the transdisciplinary approach.

Through a complexity lens, intricate natural systems are described as self-organizing and self-determining, 'ambiguously bounded', environmentally adaptive, and 'far from equilibrium' (Davis & Sumara, 2006; Doolittle, 2014; Ramiah, 2014). Self-organization and self-determination represent the ability of agents within a system to autonomously interact and transform themselves without the need of a supervisor. 'Ambiguously bounded' means that although complex systems are somewhat closed, in that they maintain their identity or internal organization, they are also open in that they interact and exchange information and matter with their environments. Complex systems typically exist in states 'far from equilibrium,' meaning that they are not in balance or stable because contexts and environments are always changing.

Complex systems are environmentally adaptive and react to changing conditions through the use of positive and negative feedback loops and changing schemas shaped by experience of the external and internal environments (Davis et al., 2008; Doolittle, 2014). Schemas, in the neurological and social systems sense, refer to internal associated network patterns of information, developed through past interactions with the environment, that aid in guiding understanding and performance (Ghosh & Gilboa, 2014; Gilboa & Marlatte, 2017). Feedback loops refer to the process by which the output from a system is returned as input allowing a system to regulate its performance. Positive feedback loops reinforce new actions of agents within a system that move the system toward instability and change. Negative feedback loops

moderate the actions of these agents to stabilize the system and work to bring it back to equilibrium (Davis et al., 2008; Turner & Baker, 2019). Finally, from a complexity lens, learning is represented by the processes of adaptation and emergence. Emergence occurs as the system changes based on feedback processes. Emergence allows the system to adjust internal schemas and adapt to changing environments. Emergence creates a whole that is unique from the sum of the original parts and occurs during 'bottom up' learning (Davis, 2008; Davis & Sumara, 2006; Morrison, 2008; Ovens et al., 2013; Ramiah, 2014; Sanford, Hopper, & Starr, 2015; Turner & Baker, 2019). Learning in a complex system, therefore, can be both simple and transformative. Simple in that basic knowledge is acquired; transformative as the system moves toward emergence. Transformative learning goes beyond knowledge attainment to deep changes in perspective, feelings, beliefs, and behavior representing a shift in the way the world is viewed (Mezirow, 2003; Simsek, 2012; Swartz & Sprow, 2010).

Assumptions underlying the current study. Complexity thinking underlies the current study in that the development of the transdisciplinary team and the team's engagement in the inquiry process was viewed as an example of the emergence of a complex system. This complex learning system developed in a non-hierarchical way with the power and expertise distributed among the members as the learning team members interacted with each other and the environment. Knowledge was shared and created, whilst the team itself emerged into a learning community that developed knowledge beyond that of the individual members. The team became self-sustaining in that it adapted to the environmental situations and maintained energy as well as organization in the face of challenges and change. By examining the learning community as a complex system, the case allowed for the description of the forces that acted on the system as

emergence occurred. This view of the process of professional learning at the systems level is based on a number of critical assumptions that must be acknowledged.

First, the study of learning communities as complex adaptive systems allows for the investigation of the conditions in place when emergence occurs. One important force that helps to catalyze emergence is the information flow through the system (Stacey, 1996). Therefore, by examining the transdisciplinary inquiry through the lens of complexity, we assume that learning occurs, in part, due to the flow of information from the environment through the learning community. This assumption can be seen underlying the current study in that the context of the transdisciplinary inquiry was deemed important as was the direct interactions between the educators (agents) and their physical environment as well as with each other during their daily working lives. Information flow into the system occurred as educators interacted with their students, other educators, the physical site, research articles and materials, and lessons which they created. Additionally, information flowed between individual educators within the system during whole group meetings, small group work, hallway chats, and electronic communication. This flow of information is also seen as an important aspect of learning.

Secondly, complexity thinking posits that production of knowledge occurs within a system as information flows through and interacts simultaneously with the connectivity among individuals as well as the diversity of cognitive schemas between individuals (Stacey, 1996). In other words, learning occurs when both diversity and redundancy exist (Davis & Sumara, 2006; Ramiah, 2014). Diversity refers to the differences in viewpoints, specializations, and experiences held by those members in the same system. Redundancy refers to the similar attributes, skills, understandings, and responsibilities experienced by members that make up the system.

This assumption can be seen underlying the current study in that a transdisciplinary inquiry was utilized which focused on bringing together individuals with views from different academic disciplines and different levels of experience. Through the creation and maintaining of the transdisciplinary team and its collaborative inquiry work, individual members were presented with connectivity in the form of a common purpose, joint conceptual framework, and positive relationship development. The members were also provided with diversity in that the team was designed to contain individuals with diverse perspectives working on the project in slightly different work contexts. By ensuring both connectivity and diversity were present during the inquiry, the current project attempted to facilitate the emergence of the learning community.

Complexity theory suggests that feedback loops shape the evolution and emergence of a complex system. Systems start as collections of individuals who self-organize and create relationships. The relationships form in response to positive and negative feedback. Positive feedback moves the system forward toward a goal whereas negative feedback suppresses change and drives the system toward the status quo. Through the tension between new goal attainment and maintaining homeostasis, space develops as the system is maintained far from equilibrium. This position allows for new behaviours, beliefs, and schema to emerge which are qualitatively different from the sum of the individual parts (Horn, 2008; Mason, 2008; Morrison, 2008). The assumption of the importance of feedback on learning or emergence can be seen in the current study in that the transdisciplinary team did engage in a cyclical inquiry process that utilized input obtained by the team members as well as from students, parents, and other educators. This input provided both positive and negative feedback loops. As input pushed the understanding and experiences of the individuals farther from their normative state, positive feedback loops were created that pushed the system toward new understandings and emergence. Through individual

and group reflection on their experience, the environment, and each other, the transdisciplinary team developed into a learning community creating knowledge that surpassed that of any one team member.

A combined theoretical lens. Although these three perspectives are different in that complexity views learning as the emergence of a complex system as it adapts to the environment, enactivism views learning as the process of coming to know for the purpose of living, and social constructivism views learning as a product that is co-constructed for the purpose of understanding the world, they are in fact somewhat compatible for the purpose of designing research. Although social constructivism focuses on the social and cognitive aspects of learning, it does not purport that embodied cognition is impossible. In fact, social constructionists often encourage experiential or real-world learning. Although enactivism focuses on learning as part of living in the world, it does not discount the importance of language in doing so, nor does it discount self-reflection. In fact, it emphasises a variety of types of thinking including sensorimotor, contemplative, and emotional. Although complexity focuses on learning systems, it conceptualizes complex systems at the molecular, individual, and group levels.

These three views have a number of elements in common. None of these perspectives represent the learner as an isolated entity detached from the environment and engaged in a solely intellectual endeavour. All three characterise learning as a complex, iterative activity that is engaged in by groups of individuals over a period of time within the context of their environments. Additionally, all three viewpoints emphasize the importance of the iterative flow of information between the learner and environment.

Chapter 2: Literature Review

Current Goals and Definitions of Professional Development in Education

Professional development (PD) activities in education usually refer to those learning opportunities accessed by certified teachers (Craft, 2000; Creemers, Kyriakides, & Antoniou, 2012) and can include a variety of activities from mandated training sessions designed to improve teacher knowledge and skill, to voluntary learning activities chosen by teachers to enhance themselves professionally (Alpha et al., 2008; Craft, 2000; Creemers et al., 2012; Wei, Darling-Hammond, Andree, Richardson, & Orphanos, 2009). In the field of education, most definitions of professional development (PD) include both formal and informal learning activities engaged in by educators to enhance their professional practice (Broad & Evans, 2006) and can include: increasing professional knowledge, developing expertise, improving skills, changing attitudes and beliefs, and improving student learning outcomes (Creemers et al., 2012; Guskey, 2002).

Internationally. The Organization for Economic Co-operation and Development (OECD) is an international organization promoting policies to improve the economic and social welfare of people world-wide. In 2009, the OECD defined PD in education as: "activities that develop an individual's skills, knowledge, expertise and other characteristics as a teacher" (p.49) and can include attending courses, workshops, teacher visits, collaboration, and coaching (Organization for Economic Co-operation and Development, 2009). According to the OECD, possible goals for ongoing teacher development include: to update educators' subject area, curricular and pedagogical knowledge in accordance with new objectives, circumstances, and educational research; to update individuals' skills, attitudes, and approaches to education; to assist teachers in implementation changes in curriculum and teaching practices; to facilitate

exchange of information and expertise among educators; and to increase teacher effectiveness (Mitchell, 2013; Organization for Economic Co-operation and Development, 2009).

In Australia, PD opportunities accessed by practicing teachers are typically introduced and provided by employers; however, professional learning opportunities are increasingly being provided by professional associations, publishers, universities, and private consultants. The Australian national PD framework identified four broad principles necessary for PD in Australia: to make professional learning an essential element of schools; to focus on student learning; foster deep academic content and assessment knowledge; and to create professional learning environments congruent with current learning theory (Ling & Mackenzie, 2017; Timperley, 2011). Much PD for teachers in Australia is still provided using a unidirectional model of knowledge transmission, however it is gradually beginning to include activities such as workshops, mentoring and coaching, university courses, and action research projects (Ling & Mackenzie, 2017).

In the United States, the Teaching Commission (2004) reported that teaching was America's most valuable profession and argued that "helping our teachers to succeed and enabling our children to learn is an investment in human potential, one that is essential to guaranteeing America's future freedom and prosperity" (p. 11). The report goes on to state that school principals must guarantee teachers receive ongoing PD training and the content of which should: be based on student need as determined by frequent student testing; be aligned with state and district goals; and involve opportunities for collaboration to facilitate teachers learning from each other. The goal of collaboration, according to the Teaching Commission, should always be to share effectual, research-based strategies for the purpose of improving educator understanding and practice (The Teaching Commission, 2004). According to the Manpower Demonstration

Research Corporation (MDRC) in America, PD for teachers includes prescribed in-service training designed to improve the subject area knowledge and pedagogical skills of teachers (Quint, 2012). In many cases teacher PD is associated with and include rigorous teacher evaluation which include teacher-evaluator conferences to provide teachers with feedback on their instruction (DeMonte, 2013). Interestingly, both the MDRC and the U.S. Department of Education identify that the 'one-shot' workshop, commonly criticized in the research literature, is not effective PD and instead teacher PD should include activities such as summer institutes, group sessions, and coaching (Quint, 2012). All of these examples still stem from and appear to rely on a philosophy of unidirectional transmission of information from expert to learner.

In Finland, the basic qualification for school teachers is a master's degree. The purpose of teacher professional learning is to improve student motivation and learning, but also to encourage teacher professional growth and wellness (Niemi, 2015). The Finnish National Board of Education (FNBE) identified four primary goals for teacher professional learning. These include helping educators: become life-long learners, develop a research-based orientation, increase their effectiveness, and anticipate future needs in education. Finnish teacher education programs have a solid research focus where reflective and critical knowledge creation is deemed important (Niemi, 2015; Puustinen, Säntti, Koski, & Tammi, 2018; Sahlberg, 2010). There is movement away from individual in-service training days and toward long-lasting development projects and programs. Most universities have education centers for teachers' in-service training that provide long-term development projects rather than short courses. The aim is for teachers to critically reflect on their own work and design small action research projects through which they can collaborate with colleagues, develop new skills, and share ideas (Niemi, 2015). The purpose for some learning activities such as developing a research-based orientation and increasing

effectiveness appear to have a similar purpose to the professional development activities provided to teachers in the US, the goal being to transmit information to educators for the purpose of improving practice. However, Finland's movement toward including longer-term small action research projects that include collaboration and skill sharing, demonstrates an interest in moving toward addressing authentic issues identified by educators and encouraging them to have the autonomy to address them.

Nationally. Canada's education system is decentralized, meaning it is administered at the provincial level with departments or ministries of education being responsible for developing curriculum; distributing funding; setting policies; and administering provincial assessments. Therefore, the definitions and implementation of professional learning for educators differ across the provinces and territories (Mirzazadeh, 2015). However, key principles of effective professional learning have been identified through research across Canada. These principles include the development of both subject specific and pedagogical knowledge that is evidence-informed and student outcome focused; a balance of system and self-directed content; learning experiences that are active, variable, collaborative, and job-embedded; and support that is ongoing, well resourced, and advocated by leadership (Campbell et al., 2017; Campbell, 2017).

Historically, the Ontario Provincial Government stated that a primary goal for teacher professional learning was to support student learning and develop student potential (Ontario Ministry of Education, 2004). The 2004 discussion paper noted that one of the problems with current PD programs was a disconnect between learning opportunities and the working lives of teachers and students in schools. The paper stated that teacher professional learning occurs during both formal and informal means. Therefore the term 'professional learning' was divided into three parts to differentiate PD from staff development and training (Ontario Ministry of

Education, 2007). *Training* is defined as providing teachers with information required by the terms of their employment such as training in workplace hazardous materials, the harassment policy, or information systems. *Staff development* is defined as educational activities directed by district administration to enhance teacher practice and might include workshops on changes in curriculum or skill and knowledge-building activities. *Professional development* is defined as individual or group learning activities chosen by teachers which could include such activities as action research, lesson study, or graduate work (Ontario Ministry of Education, 2007).

The Provincial Government of British Columbia identified PD for teachers as the enhancement of instructional abilities through a wide range of courses, programs, and other activities (Government of British Columbia, 2017). The British Columbia Public School Employer's Association identified teacher PD as an ongoing process which enables teachers to refine their professional practice and enhance their skill and knowledge. It can include both formal learning activities such as workshops, professional meetings, and formal mentoring as well as informal initiatives such as reading professional literature and self-directed learning (British Columbia Public School Employers' Association, 2014).

According to the British Columbia Teachers' Federation, "the purpose of professional development is to enhance student learning through socially responsible quality teaching" (B.C. Teachers' Federation, 2016, p. 98). Teacher PD is defined as "a process of ongoing growth, through involvement in programs, services, and activities designed to enable teachers, both individually and collectively to enhance professional practice" (BC Teachers' Federation, 2019. p. 120). Professional development can include teacher networks, research, study groups, inquiry groups, and school-university collaborations (Alpha et al., 2008).

The BCTF differentiates between PD and in-service training. Professional development is initiated by teachers and includes activities which focus on development of expertise through the personal engagement of teachers. It also is characterized by having immediate relevance to the classroom. In-service activities are mandatory and initiated by school administration, focused on satisfying legal or managerial requirements. The BCTF identifies that the 'one-shot' workshops are not adequate and that true PD should be rooted in practice, research-based, collaborative, long-term, and aimed at instructional improvement (B.C. Teachers' Federation, 2016).

Commonality across definitions. Regardless of the source, all definitions indicated that teacher PD is important for the enhancement of student learning. Additionally, literature suggests that teacher knowledge and skill are important factors contributing to student learning (Broad & Evans, 2006; Wei et al., 2009; Wilson, Floden, & Ferrini-Mundy, 2001). All definitions and descriptions of PD agree that teachers use these opportunities, either formally or informally, to enhance their professional practice. However, the goals for PD and the degree to which teachers are able to choose what type of learning in which they engage, varies between sources. Furthermore, the type of activities that would constitute teacher PD seems to vary depending on location, source and ideological lens.

Examining Some Current Methods of Professional Development

In Canada there is a wide variety of independent and collaborative professional development opportunities available to educators (Caena, 2011; Craft, 2000; Campbell et al., 2017; Organization for Economic Co-operation and Development, 2009). Independent activities can include: reading professional literature, personal reflection, technologically facilitated learning (podcasts, online study), study in university programs, and attending conferences or workshops. Collaborative opportunities can include: school visits, job shadowing, collegial

discussions, peer-assisted learning, and collaborative inquiry. The following is an examination of some of the more common methods of professional development activities available to educators including conferences, workshops, peer-assisted learning, collaborative learning, and participation in multi-disciplinary teams. Although all of these methods of professional development aim to provide learning opportunities to educators, many focus on the transmission of information or skill from expert to novice and rely on expertise that exists outside of the context of a particular classroom or school.

Conferences and workshops. Conferences and workshops are two common types of professional development activities (Garet, Porter, Desimone, Birman, & Yoon, 2001). According to the Teaching and Learning International Survey (TALIS) which obtained responses from more than 70,000 teachers across 24 countries, 49.8 % of the teachers surveyed reported attending an educational conference or seminar, while 81.2 % of teachers attended courses and workshops in the past 18 months (Organization for Economic Co-operation and Development, 2009).

Conferences and workshops are typically located outside of teachers' classrooms or schools and use a structured approach to transmit information. Often experts, with specialized areas of skill and knowledge, work with or lecture to educators who attend the sessions with the goal of providing additional content knowledge or skill development (Garet et al., 2001).

Lectures and workshops can be efficient methods for sharing broad ideas or information with a large group. Attending a conference or workshop can be a good way to obtain specific information, engage with well-known experts, view a resources, and network with other educators (Avalos, 2011; Guskey & Yoon, 2009; Ward, 2011). However criticism of these types of PD activities include their lack of ability to foster meaningful change in educator practice

(Broad & Evans, 2006; Caena, 2011; Garet et al., 2001; Louck-Horsley et al., 1998). They offer little individualization or choice and do not provide ongoing support for learning (Broad & Evans, 2006; Guskey, 2002).

Coaching and mentoring. There has been a growing interest in coaching and mentoring as a type of peer-assisted learning for professional development over the past decades (Denton & Hasbrouck, 2009). According to TALIS almost one third of the teachers surveyed engaged in some type of mentoring or peer support (Organization for Economic Co-operation and Development, 2009). The terms 'coaching' and 'mentoring' are sometimes used interchangeably when an experienced educator helps a less experienced educator. Often the mentor or coach is a member of the school district staff and transmits information or demonstrates skill to the novice educator in an ongoing process. However, there is still a great deal of confusion about these approaches with a huge variation in definitions (Allison & Harbour, 2009; Dominguez & Hager, 2013; Fletcher, 2012; Ghosh, 2012; van Nieuwerburgh, 2012). The roles and duties of the mentors and coaches are not always well defined (Castanheira, 2016; MacPhee & Jewett, 2016; Tschannen-moran & Tschannen-moran, 2011). In some cases the coach or mentor is also expected to take on a supervisory role and complete official assessments on their charge which can create a power imbalance and undermine the trust needed for effective peer-helping (Bullough, 2012; Castanheira, 2016).

In general, however, coaching is often more skill focused than mentoring and can cover topics such as classroom management techniques, unit and lesson planning, instructional techniques, curriculum implementation, intervention, and assessment methods (Devine, Houssemand, & Meyers, 2013; Pearce, de la Fuente, Hartweg, & Weinburgh, 2019). The coaching process generally involves the coach helping a learner, the person being coached, to

achieve goals or improve performance through planned individual conversations, reflection, observations, and modelling (Devine et al., 2013; Foltos, 2013; Soisangwarn & Wongwanich, 2014; van Nieuwerburgh, 2012). Coaches typically have specific skills either within a curricular area or in questioning, communication, and reflection. Types of coaches identified in the literature include: literacy coaches who focus on improving use of literacy instruction strategies and evaluation techniques (Calo, Sturtevant, & Kopfman, 2015; Van Leent & Exley, 2013); peer coaches who focus on helping each other with specific work goals (Cox, 2012; MacPhee & Jewett, 2016; Zwart et al., 2009); and instructional coaches who focus on utilizing reflection and dialogue to improve practice (Cornett et al., 2009; Denton & Hasbrouck, 2009; Knight, 2011). Some coaching models focus on improving the skill and performance through cycles of observation, modeling, and discussion, whilst other models specialize in personal development and problem solving (Allison & Harbour, 2009; Cordingley & Buckler, 2012; Fletcher, 2012; Ives, 2008).

Mentoring is often identified as a long-term process used to help new teachers gain the confidence, knowledge, and skill they need within their work environment (Castanheira, 2016; Pearce et al., 2019). Mentors typically have more knowledge of and experience with the workplace than the individuals they mentor and aim to help their charges develop both professionally and personally. The mentor-mentee relationship has sometimes been characterized as that of an expert-novice connection (Lord, Atkinson, & Mitchell, 2008); as new teachers begin their working life, they are paired with more experienced mentors who use their knowledge and expertise to support the learning and career development of the new teacher. In some cases, the mentor also supports areas of personal and emotional development (Ghosh, 2012).

Academic literature suggest that both mentoring and coaching can have a positive impact on educators' job satisfaction, skill and knowledge development, and retention (Ingersoll & Strong, 2011; Martin, McCaughtry, Kulinna, Cothran, & Faust, 2016). Some research suggests coaching and mentoring may be a more effective in changing educator practice than activities such as onsite or online courses (Boyle et al., 2005). Both mentoring and coaching have been shown, in some cases, to increase educator knowledge and skill base, improve feelings of competence, increase reflectivity, and improve problem solving skills (Cordingley et al., 2015; Lord, Atkinson, & Mitchell, 2008). Coaching and mentoring take time and represent long-term investments for organizations especially when coaches and mentors are well trained and have the time to work collaboratively with those they are helping (Fletcher, 2012).

However, due to lack of time and resources, mentors and coaches are not always adequately trained or prepared for their role; they often do not have satisfactory access to support during changing times, and are not provided with enough time to effectively collaborate with their charges (Bullough, 2012; Fletcher, 2012). Some coaches and mentors may lack relational competence and communication skills, may not have the skills and knowledge necessary to meet the learner's needs, and may have unrealistic expectations, whilst some learners may lack motivation, become over dependant, or experience feelings of inadequacy (Bullough, 2012; Ehrich & Hansford, 1999; Kilburg & Hancock, 2006; MacPhee & Jewett, 2016; Parker, Kram, & Hall, 2013). In some cases 'mentees' and 'coachees' felt that their coach or mentor actually hindered their learning process and damaged their self-esteem (Castanheira, 2016; MacPhee & Jewett, 2016; Tschannen-moran & Tschannen-moran, 2011).

Collaborative learning. Collaborative professional learning is a method of PD in which teachers work together over time to improve their practice. According to TALIS, 40% of the

teachers surveyed had engaged in some type of professional development network, whilst approximately one third of those surveyed participated in individual and collaborative research (Organization for Economic Co-operation and Development, 2009). Authentic, joint, work-focused, learning activities can improve teacher confidence, improve teachers' technical competence, help find solutions to instructional problems, and build relationships between colleagues (Ferrance, 2000; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006; Vescio et al., 2008). There are a number of types of collaborative learning groups including study groups, professional learning communities, and collaborative inquiry groups.

Educator study groups typically involve a group of teachers coming together to discuss, share knowledge, and support each other in their learning. This can include learning about and discussing the implementation of new curriculum or instructional practices, developing and discussing school improvement plans, and researching and discussing new research-based practices (Gersten et al., 2010; Murphy, 1992). These groups appear to help lessen feelings of isolation, provide a variety of supports, and focus on student learning (Guskey, 2002; Stanley, 2011; Stoll et al., 2006). They also provide the opportunity to discuss ideas and reflect on new information. Teacher study groups are more likely to be successful if they occur over a longer term to allow time for relationships to develop and knowledge to be shared. Attention must be given to how roles develop within these groups and plans for identifying and resolving differences must be examined. Finally, group goals need to be established to avoid tensions that might arise between individuals seeking practical classroom strategies and those looking to engage in deep intellectual conversation (Stanley, 2011).

Professional Learning Communities (PLCs) have been defined as a group of professional educators engaged in purposeful collaboration to create and maintain a culture of learning

(Cherrington & Thornton, 2015; Hipp & Huffman, 2010). In these groups, development of community, reciprocally supportive relationships, and shared norms and values are important. In these communities, skill and knowledge is acquired whilst professional autonomy is maintained. Effective PLCs share a number of characteristics: mutual values and vision; collective responsibility for student learning; reflective inquiry and dialogue; collaborative activity; and promotion of group and individual learning (Stoll et al., 2006). In some cases, PLCs can engage in collaborative inquiry.

Collaborative inquiry groups are designed to tap local expertise and develop joint knowledge within a community. These groups aim to provide a space and time for teachers to communicate new ideas, collaboratively develop their craft, and tackle issues relevant to their practice (Cherrington & Thornton, 2015; Gersten et al., 2010; Stanley, 2011; Torres-Guzmán et al., 2006). When engaging in collaborative inquiry, teachers identify common issues, systematically collaborate, analyze relevant data, and investigate instructional approaches in an effort to address the identified challenges (David, 2009). Teacher inquiry groups, however, vary widely in their form, duration, rigor, reflection, and analysis (Ermeling, 2010; Ferrance, 2000; Gallimore et al., 2009).

Some teacher inquiry groups engage in collaborative problem-solving utilizing an action research framework. In these cases, teacher knowledge is constructed by combining formal and practical knowledge; knowledge develops through collaboration between educators as they engage in a systematic inquiry within their own cultural and social context (Hopper et al., 2016). Through this iterative process, an issue of interest is identified, action is taken, data is collected, reflection occurs, and a plan is created to improve student and teacher learning or performance (Levin & Rock, 2003). A number of critical features of these groups have been recognized

including: identification of a specific instructional problem within the local context; connecting theory to action; using evidence to drive reflection; and persistently aiming to improve (Ermeling, 2010). Action research projects can stimulate thinking and communication skills, increase feelings of self-efficacy, and facilitate changes in attitude (Ferrance, 2000).

The development of these small learning groups for PD address some of the concerns leveled at the one-size-fits-all conference lecture or workshop methods. Some advantages to this type of PD include: use of collaboration; development of joint knowledge; creation of supportive, professional environments; use of self-investigation, critical reflection and co-reflection to improve practice; and use of student work to inform instruction (Cherrington & Thornton, 2015; Stanley, 2011). However, building a community of professional learners and encouraging collaboration does not guarantee meaningful change. Because communities of practice are often created by similar individuals with common experiences, knowledge, and beliefs, these communities can lack outside perspective and external information. Therefore, unique or untraditional ideas can be overlooked or actively supressed, group decisions can become compromised, and discussions may become opinion-focused instead of research-focused (Guskey, 2002; O'Grady, 2013; Stanley, 2011). Additionally, because effective collaboration takes time and organization (Guskey, 2002) there is concern about the lack of time available for educators to develop and work within these communities (Sims & Penny, 2014) as well as worry that self-organized professional communities can lack structure in how collaboration occurs between members (Sather, 2009; Vescio et al., 2008). Finally, in some cases, administration has hijacked the name of collaborative learning to promote their own plans. Although groups may be called PLCs, in reality they are narrowly focused learning communities imposed by

administration to improve teacher performance and reflect school district agendas thus reducing educator autonomy and motivation (Sather, 2009; Sims & Penny, 2014).

Participation in multidisciplinary teams. Multidisciplinary collaboration is often encouraged in both the health care and educational systems as a method of decision making (Cole, Siegel, & Yau, 1992; Hrovat, Thompson, & Thaxton, 2013). By examining situations from a variety of perspectives, enhancing information sharing, and combining skills from a number of disciplines, creative and effective decisions can be developed. In this way, services can be provided in a planned and co-ordinated manner to meet a large variety of needs (Mental Health Commission, 2006; Smith & Stephens, 2001). Rather than considering professional learning as a byproduct of multidisciplinary decision-making, participation in multi-disciplinary teams has recently been examined as a method of professional development. This type of professional learning was not identified in the TALIS survey as a method of professional development (Organisation for Economic Co-operation and Development, 2009).

Research in healthcare has demonstrated that multidisciplinary team meetings can be used as helpful learning tools (Masters, O'Toole Baker, & Jodon, 2013; Oborn & Dawson, 2010; Smith & Stephens, 2001). The interactions between diverse professionals in the team can provide increased learning opportunities and changes in practice for all involved. Additionally, participation in multidisciplinary team meetings can help professionals better understand each other and improve collaboration (Cole et al., 1992; Hrovat et al., 2013; Zafiropoulos & Byfield, 2016). This recent research in healthcare may provide a suggestion as to how a new approach to professional learning in education might be developed. By bringing together educators with multiple backgrounds to address a joint concern, perhaps a multi-perspective professional learning team can be developed that both addresses an issue and also facilitates learning (Masters

et al., 2013). Advantages to using multi-disciplinary work as a method of professional learning is that diverse professionals can come to a better understanding of each other and can learn to acknowledge each other's perspective (Zafiropoulos & Byfield, 2016). Multidisciplinary team work and collegial support is frequently identified as an important source of reward and motivation for team members (Mental Health Commission, 2006). Additionally, the introduction of multiple perspectives helps individuals to identify the assumptions they make and allow assumptions to be challenged (Oborn & Dawson, 2010b).

Involvement in multidisciplinary teams as a method of professional learning does have its challenges. There can be difficulties with communication, professional boundaries, disagreement, time, and facilitation of the process (Hrovat et al., 2013; Mudiyanse et al., 2016; Skeil, 1995). Problems in communication have been identified as a barrier to the functioning of diverse communities of practice. In fact, sometimes the "art of one practice tends to be opaque to the practitioners of another" (Schön, 1987, p. 271). Additionally, multiple disciplines working together can sometimes produce discord and conflict because rather than trying to learn from each other, individuals may be more interested in advocating for their own discipline. Finally, the process by which learning across disciplines can be facilitated is not well understood (Hrovat et al., 2013; Mental Health Commission, 2006).

Research on Effective Professional Learning in Education

Shifting from professional development to professional learning. The traditional methods of professional development, 'teaching as telling' or 'sit and get' models, that have dominated education for over 50 years have been "called into question" (Lieberman, 1995, p. 592). Typically these traditional methods have consisted of a short workshop or lecture delivered by an expert who provides generalized disciplinary knowledge with the hope that this

information will be taken up and applied by educators within their own context without ongoing support (Cordingley et al., 2015; Garet et al., 2001; Organization for Economic co-operation and Development, 2009). Research on learning and organizational change suggests that people learn best when they are actively involved in meaningful, contextually relevant, and ongoing activities that encourage reflection and discussion with others (Dewey, 1938; Knowles, Holton, & Swanson, 2005b, 2005a; Kolb & Kolb, 2009; Nerbert, 2009; Schön, 1987; Stelter, 2008). Although transmission styles of PD may encourage educators' awareness or interest in developing knowledge and skills, they rarely provide sufficient time, support, or practice to foster learning which deeply enhances educator knowledge or practice (Boyle et al., 2005; Lieberman & Mace, 2008). Increasingly it has been suggested that traditional, transmission models of professional development likely have contributed to the 'theory-practice divide', meaning that the learning educators obtain from these types of activities is not adequate to ensure that the theories of best practice developed through research and educational institutions find their way into educator practice (Kinyaduka, 2017; Lieberman, 1995; Scott, 2010).

Over the past two decades there has been a shift from the transmission model of professional development towards the active engagement of educators in their professional learning. Professional learning (PL) can be differentiated from professional development in that professional learning often is considered the learning that professionals experience through the ongoing and active engagement in their practice (Caena, 2011). Professional learning is conceptualized in the research as dynamic, ongoing and embedded; knowledge is constructed through experience and often is linked to teacher inquiry (Boyle et al., 2005; Campbell, 2017; Guskey, 2000, 2002).

A great deal of interest and research in the area of educator professional learning has been amassed over the last two decades as researchers and policy makers try to determine the types of professional learning activities that will best support educators in helping their students learn. From this research, it is possible to identify some components that exist in effective professional learning activities (Borko, 2004; Boyle et al., 2005; Caena, 2011; Campbell, 2017; Copur-Gencturk & Papakonstantinou, 2016; Dunst & Raab, 2010; Farmer, Gerretson, & Lassak, 2003; Quint, 2012; Walter & Briggs, 2012; Wei et al., 2009). Internationally and consistently, the academic literature suggests that effective PL for educators is collaborative and job-embedded, promotes educator autonomy, fosters trusting relationships, is sustained over time, and focuses on both content and pedagogy.

Contextual and collaborative. Research evidence suggests that collaborative learning experiences within a real-world context are more effective and more appreciated by educators than conceptual learning which occurs out of context (Boston & Smith, 2009; Caena, 2011; Campbell, 2017; Garet et al., 2001; Walter & Briggs, 2012; Wei et al., 2009). Collaborative, embedded learning experiences often occur within the school or classroom in which the practitioner regularly works. Examples of this type of learning are: peer observation, peer demonstration, co-teaching, co-planning, collaboratively reviewing student work, peer-assisted learning and involvement in professional learning communities (Boyle et al., 2005; Caena, 2011; Guskey, 2000). When active learning occurs within the practitioner's working environment with their own colleagues, educators build relationships, practice practical skills, and build knowledge within the culture of their workplace. Collaborative professional learning activities tend to be more effective than individual activities in: promoting changes in educator practices and

attitudes, encouraging risk-taking, developing trusting environments, improving student learning (Ingvarson, Meiers, & Beavis, 2005; Wei et al., 2009).

When asked to rate professional development activities, teachers identified active, on-site professional learning as more useful in helping them to improve their classroom practices than learning activities such as presentations and workshops. Active embedded professional learning opportunities were able to provide more choice, variety, and ongoing opportunity learn from other teachers in similar positions (Dunst & Raab, 2010; Sandholtz, 2002). Studies suggest that participants in active, embedded PL experiences reported enhanced understanding of the teaching and learning process, expressed desire for continued collaboration, experienced reduced feelings of isolation, and transferred skills and knowledge learning into their daily practice (Broad & Evans, 2006; Slater & Simmons, 2001). It was noted that concrete, embedded professional development could be enhanced by having external expertise brought into the work environment (Walter & Briggs, 2012).

Educator autonomy. Another important aspect of successful professional development appears to be the ability of educators to choose the type and topics of their professional development as well as the peers with whom they will collaborate. Evidence suggests that when educators choose their own learning activities, they experience increases in: subject knowledge, commitment to the profession, and desire to help their students learn (Caena, 2011; Moor et al., 2005; Walter & Briggs, 2012). Voluntary relationships have been found to be stronger and more productive than those mandated by administration (Cox, 2012). Providing practitioners choice regarding the content of what they learn, how they learn, and who they learn with helps to provide motivation and allow the learning experience to be tailored to the practitioner's interests and needs (Broad & Evans, 2006; Diaz-Maggioli, 2004; Iucu & Marin, 2014).

Trusting relationships. A third element of effective professional learning activities is the development of strong, high-quality relationships between peers. High-quality relationships exhibit features such as connectivity and flexibility that facilitate the development of strength, support, and positive regard (Dutton & Ragins, 2007). These types of relationships contain increased levels of trust, support, and openness; they facilitate learning because they enable social connections and open communication that allow individuals to access, exchange, risk and build knowledge (Brueller & Carmeli, 2011; Parker et al., 2015).This appears to be particularly important for some types of coaching and mentoring but is likely beneficial for any collaborative relationships and within organizations (Caza & Cameron, 2009). Active learning within trusting, safe relationships minimizes individuals' feelings of risk and can produce positive performance and satisfaction. Trust was also identified as an important aspect of the coaching relationship (Parker et al., 2015). Educators reported they learn best when they felt supported to experiment with new methods and felt that they could discuss their experiences within a safe, constructive environment (Cox, 2012; Zwart et al., 2009).

Sustained over time. A fourth important element of effective professional learning appears to relate to duration. For professional learning to be effective in changing thinking, increasing knowledge and impacting educator practice, it must occur over a sufficient length of time (Campbell et al., 2017; Cordingley et al., 2015; Timperley, 2011; Wei et al., 2009). When involved with long-term professional development activities, research suggests that educators become more reflective, analytic, and systematic in their teaching (Boyle et al., 2005; Levin & Rock, 2003). Learning experiences of longer duration generally are more likely to provide educators with the time, variety of activity, and depth of content needed to increase knowledge, produce meaningful enhancements to their practice, and allow for greater development in

classroom culture (Boyle et al., 2005; Copur-Gencturk & Papakonstantinou, 2016; Supovitz & Turner, 2000). Educators themselves report the importance of ongoing support for maintaining changes in their practice, identifying that increased time spent in professional development and collaborative activities improved their teaching (Copur-Gencturk & Papakonstantinou, 2016; Lewis et al., 1999; Sandholtz, 2002; Supovitz & Turner, 2000)..

Combining content and pedagogy. Professional development activities that focus on both content knowledge and pedagogy appear to be more effective in developing educator instructional practice (Boston & Smith, 2009; Campbell, 2017; Farmer et al., 2003; Sandholtz, 2002). A great deal of evidence over recent years, particularly in the areas of mathematics and science, has suggested that learning activities which help educators increase knowledge in both the content area as well as develop knowledge and skill in how to help students to learn about the content has positive effects on educator learning and supports the transfer of this learning to classroom practice (Desimone, 2009; Garet et al., 2001; Supovitz & Turner, 2000). Numerous studies across methodologies (case study, educator data, quasi-experiments, longitudinal studies, meta-analysis and experimental designs) suggest that providing professional development focused on subject matter content and how students learn that content is most effective (Desimone, 2009; Guskey & Yoon, 2009; Shulman, 2013; Yoon et al., 2007).

A New Method of Professional Learning? Transdisciplinary Collaborative Inquiry

A response to wicked problems. A tame problem is one that is well-defined, with a single solution, and a set of precise rules (Rittel & Webber, 1973). Examples of tame problems may be determining the factors in a quadratic equation or identifying a type of bird by using a biological field manual. But many important problems, such as those which exist in a complex society, are neither simple nor easily solved; they are wicked problems (Rittel & Webber, 1973).

A wicked problem is a social or cultural issue that defies typical problem-solving techniques. A wicked problem, unlike some scientific problems, is difficult or impossible to 'solve'. Lack of a clear solution occurs due to a number of factors including: the complexity of the situation; the presence of incomplete or opposing information; the involvement of number of diverse opinions or perspectives; the degree of integration between problems; or a combination of all of these elements (Camillus, 2008; Rittel & Webber, 1973; Sherman, 2016). Academics, practitioners, and policy makers have realized that traditional research methods are ineffective in solving wicked problems. Traditional inquiry methods struggled with the integration of research across disciplines, the translation of research into practice, and the engagement of all shareholders in the problem solving process (Fam et al., 2018). The realization that many societal problems cannot be solved by a single group of experts confined to one academic discipline has caused the acknowledgement that the collective effort of many disciplines, the shared expertise of a variety of stakeholders, academics, and professionals, and the merging of local, academic, and practical knowledge is likely necessary to tackle wicked problems. From this realization, the idea of utilizing a transdisciplinary process to address complex issues has emerged.

Using a transdisciplinary approach. A transdisciplinary approach refers to the use of concepts, methods, and questions that extend beyond traditional academic boundaries to deal with complex problems (Fam et al., 2018; Robinson, 2008). This approach evolved to address fundamental dilemmas in society that are not easily solved through traditional academic methods and discourse alone. It is concerned with creating useful forms of knowledge, reaching across disciplines for a particular purpose, and developing partnerships between academics and societal stakeholders to co-create and apply knowledge (Fam et al., 2018; Robinson, 2008). Although I differentiated mono-, multi-, inter-, and transdisciplinary in Chapter 1, in an effort to clarify the

difference between multidisciplinary and transdisciplinary, below is a concrete example of how these approaches might be used to address a similar issue.

Currently in the education system, multi-disciplinary teams are regularly established to provide support and recommendations for classroom teachers and parents supporting students who struggle significantly in school due to medical disorders. For example if a student with severe Developmental Coordination Disorder (DCD+) struggles across a number of domains in school, a multidisciplinary team may be convened that might include the speech and language pathologist whose purpose is to deal with language and articulation issues; the occupational therapist, whose goal is to deal with motor planning issues; the learning assistance teacher; who aims to deal with reading and writing issues; and the counsellor, who focuses on the social emotional issues. Each specialist on the team will address their aspect of the child's difficulty from their specialist perspective, completing independent assessments, and offering individual recommendations or interventions. Often these groups do not clarify vocabulary or share theoretical stances with each other. There is simply a bringing together of discrete disciplines rather than a combining of knowledge. The team provides information and suggestions to the teachers on how to better aid the student in learning. The teachers then take those recommendations and implement them.

A transdisciplinary team may meet to address the concerns of a student with severe DCD but this type of team would more likely be convened to help determine how best to support all students with complex DCD within the school district. The team would likely include parents, classroom teachers, educational assistants, and school administrators as well as the experts listed in the first example. The team may decide to develop a protocol to use with students struggling in this area, try to implement it, make observations regarding the implementation, re-unite to

discuss the results, and continue planning. The use of a transdisciplinary team is a social justice approach in which expertise of all members, is combined to address issues that surpass disciplinary borders. It is an ongoing problem-solving process which is action-oriented, members do not simply provide recommendations from their perspective, they engage in a joint problem-solving process as well as implementing the ideas generated from that process. The result of this approach reflects both multifaceted knowledge and practical application (Hadorn et al., 2008; Smith, 2007).

There are a number of reasons to choose a transdisciplinary approach. First, the real world is transdisciplinary. Disciplines are artificial categorizations that some humans have placed on areas of knowledge; therefore, real-life issues are seldom restricted to the boundaries of an academic discipline (Choi & Pak, 2006). Secondly, the transdisciplinary approach can provide different perspectives on a complex problem. We each examine the world through the lens of our experiences and expertise; therefore, we are limited by our histories and our assumptions. By examining divergent perspectives, new possibilities may become apparent (Gibbs, 2015). Thirdly, transdisciplinary teamwork may provide increased learning, better utilization of resources, improved job performance, increased networking, and new insights and skills (Choi & Pak, 2006). Finally, the socially collaborative aspect of learning through transdisciplinary inquiry requires an appreciative stance towards difference that can foster reflexivity. This collaborative effort enables a complexity of reflection that can accommodate deeper conceptual change (Mitchell, Cordell, & Fam, 2015).

Disadvantages of using a transdisciplinary team approach include difficulties with communication, time, trust, pride, and disagreement. Because individuals from different disciplines may use similar terms to mean different things and because they may not share

common theoretical beliefs, communication and understanding can be compromised as domain-specific jargon may be detrimental for developing a shared understanding of a complex issue (Choi & Pak, 2006; Scholz & Steiner, 2015). Another difficulty that can arise within a transdisciplinary team may be the pride individuals hold for their own discipline and its methods. This pride can lead to the feeling that the methods and rigour of other disciplines are less developed. To work together people must appreciate the value and limitations of their own and others' disciplines in order to trust each other and work collaboratively (Mitrany & Stokols, 2005). Additionally, academic researchers and non-academics often come from different social and educational backgrounds and these differences may create barriers in developing trust (Smith, 2007). As with all methods of professional learning, it takes time to convene a transdisciplinary group and time for the group to develop its ideas and implement them. Finally, various disciplines approach inquiry questions from different perspectives and these perspectives are shaped by previous experience; these differing viewpoints and approaches can cause friction and paradoxes to emerge which can cause disagreement within the team (Herrero, Dedeurwaerdere, & Osinski, 2018; P. Smith, 2007; Wickson, Carew, & Russell, 2006).

Specific studies examining transdisciplinary inquiry as a method of learning. There have been many book chapters and journal articles written describing transdisciplinary approaches both as a method of research and also as a method of addressing complex social issues (Fam et al., 2018; Gibbs, 2015; Lang et al., 2012; Mental Health Commission, 2006; Mitchell et al., 2015; Mitrany & Stokols, 2005; Scholz & Steiner, 2015; P. Smith, 2007; Wickson et al., 2006). Additionally, transdisciplinary learning has been identified as a possible tool for the professional learning process (Collins & Fillery-Travis, 2015; Gibbs, 2015; Payne & Jesiek, 2018). However, there have only been a few studies that actually examine the use of

transdisciplinary inquiry as a method of research as well as a method of learning. Most of these studies relate to university courses or programs that utilize transdisciplinary inquiry as a method of helping university students learn. A majority of the research examining the transdisciplinary approach for learning utilize a case study approach and a majority are found in the field of sustainability science and public health. I have summarized three studies that demonstrate the various ways that transdisciplinary inquiry has been investigated as a method of learning.

Transdisciplinary teaching and learning in higher educational institutions. Biberhofer and Rammel (2016) examined the potential benefits of transdisciplinary teaching and learning in the domain of urban sustainability in Vienna, Austria. This case study provided an example of how transdisciplinary learning and teaching could be implemented through Regional Centers of Expertise (RCE) in higher education settings. In 2010 the RCE Vienna, located in the Vienna University of Economics and Business, was certified by the United Nations. It provided a 'science-society interface' by bringing together four universities, university faculty, scientists, students, community members, organizations, and city administrators to establish a regional network for education and research. The *Sustainability Challenge* was created as a transdisciplinary university course coordinated by RCE Vienna to connect university students with each other and the community and to create a connection between education, research policy, and practice.

The case study described three different service-learning projects which developed from the *Sustainability Challenge*. All were aimed at fostering urban sustainability. The study examined how knowledge was exchanged and how societal learning took place. The case also demonstrated how transdisciplinary learning through service-learning projects facilitated the

creative potential of students as they worked collaboratively with other stakeholders, scientists, and academics.

The authors identified seven factors necessary for the success of transdisciplinary learning and teaching: development of a common interest; specific goal and clear roles; ability of students to develop project tasks in collaboration with community partners; engagement in real action and implementation; interdisciplinary student group composition; inclusion of reflection phases; and use of extended time frames. The authors concluded by asserting that in order to help students become future agents of change, higher education must provide a transdisciplinary learning space that fosters transformative learning and open dialogue between the academic and non-academic worlds.

Social learning through the use of transdisciplinary research. Herrero, Dedeurwaerdere and Osinski (2018) analyzed the social learning that occurred using a transdisciplinary research processes by analyzing 20 different projects in the field of sustainable development. To better understand the impact on social learning, the research team conducted semi-structured interviews across 20 research projects that were identified as 'transdisciplinary' by their primary investigators. The study examined how social learning occurred through interactions between new scientific knowledge, individuals' life experiences, and social interaction.

The analysis demonstrated that three factors played an important role in social learning: clarification of normative orientations, co-construction of the research question, and 'balancing power asymmetries'. It was found that social learning was promoted when partners openly discussed the goals to be pursued by the group. Clear goals made it easier for members to decide to be involved in the group and fostered trust between those who chose to become involved.

Secondly, the authors found that if individuals in the group were involved in framing the research protocol (determining the research question, methods, objectives and selection of additional stakeholders), they were more likely to contribute new perspectives that fostered social learning. Finally, in cases where one powerful individual drove the process, social learning was hampered. Methods used to address power imbalance included ensuring equal access to resources and time, utilizing a neutral facilitator, and co-constructing governance of the project. The study provided some insight on how to enhance social learning by attending to the design of transdisciplinary research.

Transdisciplinary learning in international health care. Ziegler and colleagues (2016) identified that new approaches to research and learning are necessary to address complex issues such as international public health care conundrums. The authors suggest that "to overcome inertia in public health paradigms and improve interventions, transdisciplinary studies may be an ideal way forward" (Ziegler et al., 2016, p. 317). Ziegler and colleagues examined how transdisciplinary learning provided new explanations and methods of dealing with persistent liver fluke infections associated to cholangiocarcinoma (bile duct cancer) in northern Thailand.

Liver fluke infection caused by *Opisthorchis viverrini,* a food-borne parasite*,* is a major public health problem in East Asia wherever raw cyprinoid fish are a principal part of the diet. Irritation and scarring of the bile duct caused by liver fluke infection can lead to cholangiocarcinoma. In the current study, researchers from diverse disciplinary backgrounds collaborated to design a homestay program for 72 university students to investigate the development of liver fluke infections. The students explored how local terrain, aquatic ecosystem, livelihoods, traditional food choices, and health education impacted liver fluke infection and potential cholangiocarcinoma development.

The research team involved academic faculty as well as representatives from the Thai Ministry of Public Health. The project united students with individuals having expertise from diverse research backgrounds including: parasitology, pathology, epidemiology, surgery, ecology, hydrology, community healthcare, history, ethnography and geopolitics. The study identified that a restricted view of the complex factors influencing infection may lessen the effectiveness of interventions. The authors suggested that transdisciplinary approaches may provide a greater depth and breadth of understanding as well as a sensitive awareness to complex public health issues when compared to research focused explicitly on epidemiology of a disease.

Transdisciplinary inquiry for professional learning: Is it possible in public education? It would seem reasonable that as educators across the world endeavor to meet the needs of diverse populations of students in an attempt to wrestle with some of society's most intricate problems within the classroom, that transdisciplinary inquiry might be a useful vehicle for the professional learning of educators. However, my library database searches of the academic research on the topic did not find any explicit examples of studies in which transdisciplinary inquiry was used as a method of professional learning for public-school educators. Therefore, as British Columbia's educators endeavor to engage with the transformed curriculum, to create inclusive classrooms and learning environments for all students, and to address the social, emotional, health and academic needs of their students, it seemed wise to conduct a study that would examine if and how a transdisciplinary inquiry approach to educator professional learning could be facilitated within the public-school system, and examine what could be learned from implementing such a project.

Chapter 3: Methodology

Inception

How did the idea for this case study emerge? Initially, when I was thinking about a topic for my dissertation, I wondered how I could help provide professional learning opportunities to educators in my school district that would be more meaningful, relevant, and enjoyable than the commonly used linear, transmission approach. I thought perhaps some of the techniques that I had used as a teacher with high school students might also be helpful in creating a professional learning opportunity for educators. As a biology teacher I had often used projects to help students learn not only content material but also how to organize information, communicate and work successfully with others, to explore diverse perspectives, and to reflect on their own learning. So just as I had used project work as a teacher to help my students learn, I thought that in this research I might examine how to use an inquiry project to help educators learn and grow professionally.

I was also familiar with the concept of uniting individuals with diverse perspectives to provide an environment that encourages divergent thinking and learning. I have sat on multidisciplinary teams, have worked on interagency projects, and have engaged in 'cross-training' in sport. So, my experience had demonstrated to me that there was value in bringing individuals with diverse perspectives together to learn. Additionally, and more to the point, at this time I had recently helped to facilitate a project in which a variety of educators (including the Speech and Language Pathologist, the Occupational Therapist, and Kindergarten teachers) engaged in early language stimulation with kindergarten students. When I reflected on this project, I realized how much I had learned both through my interaction with the students but also through my conversation with the other professionals involved in the project. I thought how

much more we would have all learned if we would have been intentionally attending to our learning. At the same time as I was engaged in this kindergarten project, I was completing reading about transdisciplinary research for the first class in my PhD program. Therefore, I started to think about how I could integrate these ideas and create a project that would use transdisciplinary inquiry to facilitate educator professional learning within the context of a public school. As I wrestled with how I might accomplish this, the current study was born.

Although I would like to say that the process of this research was conceived through extensive reading and deep theoretical knowledge derived from seminal researchers in the learning field, that would be a mistruth. In fact, the design of this case study was a pragmatic endeavor. The case study was influenced by knowledge obtained through reading in preparation for a university course. However, it was conceived from my personal experiences as a teacher and a learner and my desire to apply what I had learned in other contexts within my present situation as a school psychologist who is often asked to provide professional learning experiences for other educators.

As I began to investigate how to combine these ideas, I wondered if it would even be possible to use a transdisciplinary inquiry project as a method of professional learning in the public education system. From this wondering, I developed two primary research questions and they both relate to process. How might a transdisciplinary approach to collaborative inquiry facilitate embedded professional learning for educators? How might I, as a school psychologist, both initiate and participate in a transdisciplinary approach to professional learning?

Choosing a Case Study Approach

The development and functioning of a transdisciplinary group for the purpose of professional learning is a complex, natural phenomenon and it did not lend itself to be easily

studied using quantitative methodologies. This process occurred in a specific place over a period of time and required multiple perspectives and deep description in order to be represented and understood; therefore, I chose a qualitative approach. Because I was providing detailed observations and descriptions of a single phenomenon within the natural environment in an attempt to better understand educator professional learning, I chose to utilize a case study methodology (Merriam & Tisdell, 2016; Moore, Lapan, & Quartaroli, 2012; Stake, 2010).

Case study has been identified as both a product and a process. It has been defined as a rigorous, multi-faceted description of a single, bounded system or phenomenon, as well as a method of holistic, empirical inquiry that investigates and interprets a phenomenon within its natural context (Abma & Stake, 2014; Argyris et al., 2011; Crowe et al., 2011; Merriam, 1998; Stake, 2010; Yin, 1994; Yin, 2018). The current case was a product in that it offered a deep description of a bounded system. It described the actions and experiences of seven individuals over a period of six months as they endeavored to learn together within the context of their workplace. These individuals developed and utilized transdisciplinary inquiry to address an important issue whilst attending to their own and each others' professional learning. In addition to providing description, the current case study was also a process. It analyzed and interpreted the team members' learning and the working of the transdisciplinary team in an attempt to understand how the process occurred both from the perspective of the individuals involved as well as from a systems perspective.

In characterizing the current case, I would have to say it was emic, instrumental, and holistic in nature. It was emic in that I aimed to develop a better understanding of the professional learning process from the perspective of the team members (Stake, 2010; Yazan, 2015). Through use of interview and focus group data as well as positioning myself as one of the

team members, I attempted to provide an insider's view and description of the process. The current case study was also instrumental in that I was not simply interested in providing a description of the development and working of transdisciplinary inquiry as a method of professional learning, I also wanted to provide insight into how transdisciplinary inquiry might be used within the public education system as a method of professional learning (Crowe et al., 2011; Mills, Durepos, & Wiebe, 2010; Stake, 2010). Careful analysis of observations recorded in field notes, statements made during individual and group interviews, and personal and group reflections on the actions and interactions experienced by the team, helped me to develop a clearer understanding of the important elements needed for transdisciplinary inquiry to act as professional learning within the context of this case. Finally, the case study was also holistic in nature (Stake, 2010; Yazan, 2015; Yin, 1994; Yin, 2018). Through the description and analysis of the group processes and the group's interaction with its environment, I tried to develop a better understanding of the broader forces at work on our learning system and define system dynamics that supported our learning throughout the transdisciplinary inquiry.

In characterizing the current case it is also important to note that there is philosophical variation in the ways in which case study research can be employed; researchers can take a postpositivist, pragmatic constructivist, or interpretivist methodological position (Harrison, Birks, Franklin, & Mills, 2017; Yazan, 2015). The basis of this research was derived using predominantly a pragmatic, social-constructivist approach. This study encouraged an interactive method of inquiry and was developed through examination of multiple perspectives as well as the relationships participants developed. Within the case I endeavoured to understand and reflect individuals' experiences and points of view as well as document the learning that occurred from the team's perspective. I assumed that reality is constructed through the interactions between

individuals and the physical and contextual environment and that understanding is developed through social interaction, experience with the physical environment, and involvement with changing environmental contexts. Individuals were invited to participate based on their interest in becoming part of the project, their diverse backgrounds, and the location of their work. My intentions upon undertaking this study were to obtain: a better understanding of how to develop a transdisciplinary professional learning team, a rich, holistic description of using a transdisciplinary inquiry for professional learning in education, and the participants' perspective on their involvement in this new type of professional learning experience.

The case. My intent in the current study was to examine a process through which a collaborative, transdisciplinary, problem-solving team could be developed and used within a public-school setting for the purpose of educator professional learning. The case described how a disparate group of individuals with diverse disciplinary backgrounds came together as a multidisciplinary group and how this initial group transformed itself into a coherent transdisciplinary team sharing a common purpose and conceptual framework. The case documented the team members' reflections, actions, and interactions as they engaged in a collaborative inquiry project over a period of six months. Data collected from observations, individual interviews, a focus group discussion, and artifact collection provided a descriptive record of the development of the transdisciplinary inquiry process and its influence on the professional learning of the team members. Through careful analysis of the data, several elements emerged as having a positive impact on the team members' professional learning. Data analysis also provided information about the functioning of the transdisciplinary team as a complex system.

In addition to using a case study approach to examine the process of developing the transdisciplinary team for the purpose of professional development, I also closely examined my own perspectives, interactions, beliefs, and changes through the process. Because it would be difficult to interview myself on these topics, I felt that another way to collect data and provide information about my personal experience was to examine this process through the self-study lens. Self-study is inquiry-oriented and is typically initiated and driven by the practitioner's questions about themselves and their practice within a natural context with the goal of personal and professional growth. The researcher completes a systematic study of and reflection on of their own practice, collaborates with others, adjusts their frame of reference, and actively attempts to examine their belief systems and improve their practice (Laboskey, 2002; Ovens & Fletcher, 2014; Pinnegar & Hamilton, 2009; Samaras, 2011). Therefore, within the case study, I collected and presented self-study information in parallel with the case study information obtained from the other participants in the group including my critical friend.

My multiple roles and frames of reference. Throughout this case study, I was both facilitating the development of and participating in a transdisciplinary inquiry project. At the same time, I was the primary researcher examining how involvement in the transdisciplinary inquiry project occasioned professional learning in its team members. Consequently, I held multiple roles and examined the case from a number of frames of reference.

I examined the processes as both an insider and an outsider to the group. I was an insider in that I was a member of the team that engaged in inquiry examining how to help students understand and utilize metacognitive strategies for their own learning. I was a privileged insider as I was able to exhort significant influence as the facilitator of the transdisciplinary group; however, I tried to distribute this power throughout the team as the transdisciplinary process

became established. Finally, as the primary researcher in the in this complex case study, I had significant control over the investigation into how transdisciplinary inquiry could be used as a method of professional learning for educators. For example, I determined the location of the study, number of participants recruited, methods of data collection, and data analysis for the case.

Insider: Team member of the inquiry project. As a school psychologist and a participant in the study myself, I represented one of the academic disciplines that became part of the transdisciplinary team. In this role of participant, I had the least power. The knowledge and information that I offered to the team could be taken up or ignored just as that of any other team member. In this role, I wished to offer to the team:

- psychological knowledge and perspective in the broad area of learning;
- ability to access information from academic journals (from the university library) and the ability to synthesize information to provide a summary of current academic knowledge in the chosen area of inquiry;
- knowledge and awareness of 'evidence-based practice'.

In the role of participant, like the other team members, I inquired into how to help intermediate students (grades 4 to 7) understand and utilize metacognitive strategies to aid in their learning. I participated in the planning sessions, provided my insights into the issue, aided in creating lesson plans and materials, attended group meetings, reflected on my learning, and reflected on the groups ability to help students learn. In this role I critically reflected on both the inquiry and learning processes and closely collaborated with the other team members (Creswell & Miller, 2000).

Privileged insider: Facilitator of the inquiry project. Whilst I was facilitating the transdisciplinary inquiry project, I took a lead role in building and maintaining a transdisciplinary team particularly at the beginning of the process. I was able to reduce my control over the project as other members of the team began leading in their area of expertise. Although I did want the inquiry project to grow organically, I realize that even in making this conscious decision, I actively exerted influence on the process. As facilitator I attempted to use my influence to:

- provide as much choice and autonomy as possible to the team in regard to the topic for the inquiry project. For example, although I was responsible for bringing the team together to engage in an inquiry, I did not choose the topic in advance, but facilitated a group discussion helping the group identify a relevant topic;
- distribute power throughout the team so as to encourage a 'bottom up' system of inquiry that reflected the ideas, structure, and consensus of the team. For example, although I encouraged educators to implement the knowledge that was created by the group in their own practice in some way, I did not prescribe the method of inquiry to be used by the team nor how the team members would apply their knowledge.

I did face challenges in my endeavor to complete this facilitation in a collaborative manner. The primary challenge was to control my desire to organize everything in advance. However, with some discomfort, I refrained from dictating exactly how the team would be built, into what the team would inquire, how the inquiry would evolve, and what the team would create or implement. One example of how I tried to distribute power can be seen in that I initially invited team members to become involved in an 'inquiry project' rather than identifying a specific method such as an action research project or collaborative coaching project. I did this

mindfully and purposefully. In fact, we continued to use the generic term ‘inquiry project’ throughout the process because its structure morphed many times and I am not sure if we could have accurately categorized it if we had wanted to. Although I hoped that the team members would work together to help each other learn and address the issue and I hoped that whatever the team members learned they would have a chance to apply in their own practice in some kind of iterative manner, I wanted the team to choose what the inquiry would look like for themselves. These decisions, I believed, were necessary for the group to make together if it was going to become a transdisciplinary team.

Additionally, because of the unpredictable nature and context of school environments, it was wise that I did not try to pre-determine the process. At one point when one of the team members had to withdraw from the project due to family illness and another member experienced a concussion, it was still unclear to the members and me how exactly the inquiry would unfold and it could have easily turned into a discussion group with no active application component at all. So, although I influenced the team and tried to ensure some kind of application of knowledge within context, I did take steps to encourage the process to develop organically.

In retrospect, the inquiry process developed through this case shared some characteristics with action research. It was pragmatic in nature, combined theory and practice, focused on action and change, involved an iterative process, and was conducted with the educators not on them (Herr & Anderson, 2012; Jaipal & Figg, 2011). The cycle of inquiry within the project loosely included planning, acting, observing, reflecting and planning again (Kemmis & McTaggart, 1988; McAteer, 2013). However, each team member applied the learning in their own context and although they reflected on and reported back to the whole group on their

experiences, the team in my mind, did not strictly follow the multiple iterations of the action research cycle.

Outsider: Researcher of professional learning. It is important to note that unlike the transdisciplinary inquiry aspect of this case where I tried to mitigate my influence over the process, during the investigation into using this type of inquiry as a vehicle for professional learning, I experienced much more control. As the primary researcher, I identified a number of goals prior to the beginning of the project:

- development of a team of participants that represented, as much as possible, educators with diverse theoretical, experiential, and academic backgrounds.
- fulfillment of a dual purpose: to create environments, activities, or lessons useful in helping all students learn; and to develop conditions that would allow educators to collaboratively develop knowledge and skill within the context of their work environment;
- addressing an educational issue of concern to educators at the whole-class (tier 1) level using an inclusive lens by creating an inquiry project focused on student learning experiences accessible and applicable to a wide variety of diverse students;
- describing, presenting, and representing the process and the learning experienced by the individual members of the transdisciplinary team and the team as a whole;
- identifying and developing some understanding of the elements and processes that allowed for and supported the professional learning of educators individually and as a community.

In this role, I did provide participants some autonomy as to when the interviews and focus group would occur; however, the structure of these data gathering activities were created

by me, arranged prior to beginning the research, and listed in my research proposal. I created and conducted the semi-structured interviews; I transcribed and analysed these interviews; I kept field notes of conversations and group interactions and analyzed this data; and I maintained and examined copies of artifacts such as the electronic lesson plans and student resources created through the process. Although the other team members were welcome to keep and provide notes, make reflections on the process of the case, and were involved in member checking activities such as examining the quotations and themes that were eventually identified in the research, I held the role of primary researcher and completed the data analysis. Through this lens I recognized the power I held as the primary researcher; therefore, I was reflexive in my approach to the research and tried to disclose my assumptions and biases, I searched for converging ideas from multiple data sources and I also looked for disconfirming evidence in the data. Because of the primacy of my role as researcher, my observations, insights, and interpretations inevitably became entwined with the research data and process (Creswell & Miller, 2000; Creswell, 2009; Harrison et al., 2017).

Reconciling divergent roles. Because in two of my roles, team member and facilitator, I shared the decision-making with the team members particularly in how the inquiry process developed and was implemented, I felt that I was in a vulnerable position. Although I had complete control in initiating the project and deciding how to collect data pertaining to participants' perspectives on professional learning, I actually had little control over how the team decided to work through the collaborative inquiry process or how they related their actions and this endeavour to their own professional learning. With these diverse roles I was both powerful and vulnerable; an insider and an outsider; a researcher and the researched. From this position

within the team I observed, described, and struggled to understand the process that the group was undergoing as it used a cycle of inquiry.

Methods

Prior to formal participant recruitment, consent to conduct the proposed research was obtained from the Superintendent of the School District as well as the principal of the school site.

The site. The research took place in an elementary school within a small city on Vancouver Island, British Columbia. It was one of 22 schools in a school district that provided educational services for approximately 7,800 students. The school itself had a population of approximately 280 students from Kindergarten to grade 7 and had a staff of approximately 24 teachers. I had been providing school psychology services to this particular school for three years, so I was familiar with the location, students, and staff. Prior to formally beginning recruitment and initiating the research in the school, I explained the research study to the principal; she supported its implementation in her school.

Participants and recruitment. Six educators with diverse disciplinary and professional backgrounds volunteered to participate in the study. Four prerequisites existed for becoming a participant. Each participant had to: be based out of or at least spend some time in the chosen school site during their work week; be willing to work collaboratively on a group inquiry project, of their choosing, facilitated by myself, the district school psychologist; be willing to engage in three interviews, attend group meetings on the inquiry project, participate in a focus group related to their experience; and represent a unique academic discipline or profession. In the end the group included two intermediate classroom teachers, a special education teacher, a counsellor, an occupational therapist, a special education teacher for students who are deaf or hard of hearing, and the school psychologist.

The recruitment process was completed in two stages. The first stage focused on teachers who were working only at the school site and the second stage included recruiting itinerant educators who attended the site on a regular basis and who had expertise in the area of inquiry that was chosen by the first group. Because, I wanted to ensure that the topic of inquiry chosen by the group would be addressed through an inclusive lens, meaning the learning of all students would be deemed important, and because I already had a good working relationship with her, I started the formal recruitment process with the special education teacher. Together we reviewed the idea for the project and I obtained informed consent from her. We discussed other teachers who might be interested. Eventually, we approached four teachers about the project. Of those approached, one teacher declined because they felt the time commitment would be too great and three became part of the project and provided informed consent. The initial team, after the first round of recruitment, included three intermediate teachers, the special education teacher, and myself. This group determined the initial broad project topic: helping intermediate students identify and use cognitive self-regulation for learning (this topic did evolve as the transdisciplinary team began to take form). This group also determined which other educators would be invited to become part of the project. Unfortunately, after the broad topic was identified, one teacher in the team had to take a leave of absence due to a health issue in the family and withdrew from the project.

The second stage of recruiting was completed at the beginning of the next school year. Because of their area of expertise in regards to the initial topic and because we now knew the composition of the intermediate classrooms for the year, an occupational therapist, the teacher of children who are deaf and hard of hearing, and the school counsellor were approached to participate. They all agreed to be involved in the study and provided informed consent. Because

of the size of the school district and nature of the project, all participants understood that it would be impossible to completely protect their identity. All participants in the study provided informed consent; in fact, all participants wanted to use their real name and have quotes and ideas that they made attributed to them. Therefore, the names of the participants have not been changed.

It is important to note that as a school psychologist, I belong to the teacher's union and am identified at a teacher's level on the organizational chart for the school district. I am not a supervisor or an administrator, nor do I have a position of authority over any of the teachers or educators involved in this study. My close colleagues are the other school psychologists within the district and they were ineligible to participate in the study because I wished to have diversity in the group.

Procedure. The project was quite complex and extended in time from the middle of June 2018 to the beginning of January 2019. It actually incorporated two parallel enterprises into one large project. These intertwining enterprises included:

- creation and development of mini-lessons and activities on metacognitive strategies for intermediate classrooms that were inclusive and accessible to all students;
- purposeful and mindful reflection on individual and group professional learning.

During a six-month time period, the team was recruited, determined the topic of the inquiry project, and planned how the inquiry would progress. The team developed a series of mini-lessons and activities focusing on helping intermediate (grades 4-7) students use metacognitive strategies for learning; some members of the team tried some of the mini-lessons, and all team members reflected on the process. Simultaneously, the team was interviewed and reflected on their own and the group's professional learning. The following chart provides a temporal reference for the major events that occurred throughout the process (Table 1).

The initial planning phase took approximately three months. During this time the initial team was recruited and interviewed, the team began choosing the broad inquiry topic, research into the inquiry topic was conducted, the whole group united and solidified the inquiry topic of metacognitive strategies, the team began to determine how to develop the topic within the intermediate grades, discussions commenced on how to create lessons that would be accessible for all students, and lesson planning was initiated. It is notable that the topic chosen was a complex one but is summarized here as "metacognitive strategies for intermediate students".

Table 1. The Procedure

Procedure	Date	Activity Engaged	Team Members
Team Development & Planning (~3 mons.)	June 15	Initial Meeting	Special Education Teacher & School Psychologist
	June 25	Teacher Meeting on Site	Special Education Teacher, 2 Classroom Teachers & School Psychologist
	June 27	Initial Interviews	Special education teacher, Classroom Teachers & Occupational Therapist
	June 27 – Sept. 4	Research & Thinking	All except Special Education Teacher for Deaf and Hard of Hearing
	Sept.14	Initial Interviews	Counsellor & Teacher for the Deaf and Hard of Hearing
	Sept. 20	1st Team Meeting	All
Executing & Reflecting (~3mons.)	Sept. 20 – Oct. 10	Creation L1 to 4	All
	Oct. 15 – 30	Using L1 to 4	Grade 4/5 Teacher, *Grade 6/7 Teacher & Teacher for the Deaf and Hard of Hearing**
	Oct. 31	2nd Team Meeting	All
	Oct. 10 – Dec. 1	Creation L5 to 11	All
	Nov. 1 - 9	2nd Interviews	All
	Nov. 26 – Dec. 14	Using L5 to 7	Grade 4/5 Teacher (*Grade 6/7 Teacher, Counsellor**)
Reflecting (2 weeks)	Dec. 19	Final Focus Group	All
	Dec. 20 – Jan. 4	Final Individual Interviews	All

**Used some aspects of the lessons in their practice but not systematically*

The second phase, although it still involved planning, included the implementation of the inquiry project. This involved the collaboration between team members to create the mini-lessons, the use of some of the mini-lessons by the classroom teachers, reports to the team regarding how the mini-lessons were implemented, and improvement on the original plans. As the process evolved, educators who were not intermediate classroom teachers either used the ideas from the mini-lessons that were created in their practice or planned to do so in the future. This was an unexpected and unplanned outcome. At the same time as the lesson plans were being created and applied, team members were reflecting on their own learning process and the learning of the team. This occurred both formally during the interviews and informally during small group discussions and individual reflection. Some key elements of the process (which will be discussed more fully in the Analysis section) that allowed the team members to work together, sustain momentum, and learn from each other were: the presence of multiple perspectives; the implementation of the project; the development of relationships; and the active facilitation of the project.

The final phase included individual and group reflection and discussion of the process after the mini-lesson project had ended. This served to pull together some of the ideas that had surfaced during the process. Individuals and the group reflected upon what had been learned, feelings and opinions of the process were shared, challenges to the process were examined, and plans for the project continuing into the future were discussed.

Data collection. The primary method of data collection that I used throughout the study was individual, semi-structured interviews. These interviews served both to obtain data and to aid the individual participants in reflecting on their own and the team's professional learning. I interviewed the participants three times throughout the process: prior to engaging with the team;

approximately halfway through the team's inquiry process; and after the initial inquiry process was completed. Each interview lasted between thirty minutes and one hour; interviews were video recorded and later transcribed. Each transcription occurred prior to the next interview to allow for member checking and clarification of statements on subsequent interviews. Interviews inquired into the participants' background, history with professional development, experiences of the transdisciplinary inquiry process, and reflections on professional learning throughout the process. A sample of the semi-structured interview questions can be found in Appendix A.

In addition to interviews, I collected artifacts, reviewed records, recorded observations in field notes, conducted a focus group and kept notes on discussions with my critical friend. I collected numerous photographs of temporary artifacts, kept hardcopies of documents created for meetings and lessons, photographs of hand-written documents and notes from meetings, saved email communication, and retained copies of all PowerPoint slides and handouts created for the mini-lessons. I reviewed and recorded: archival information about the age and location of the research site, demographic information about the school district, and physical descriptions of the site itself. I kept detailed field notes on my conversations with and observations of my interactions with the team members. I video recorded the final focus group as the team members reflected on the process and their learning. The focus group discussion topics can be found in Appendix B. The focus group acted to mitigate my power over the participants and provided me with the opportunity to observe the interactions between team members as they directly discussed their experiences of and attitudes on using transdisciplinary inquiry for the purpose of professional learning (Barbour & Kitzinger, 1999; Hollis, Openshaw, & Goble, 2002). A final method of data collection was my personal reflection journal, audio recorded monologues and recorded conversations I had with my critical friend who was also a member of the team.

Data analysis. The current case study includes a descriptive, categorical, and systems-level analysis. The first level of analysis was primarily descriptive in nature. At this level, I created a chronological narrative, from my perspective, and then re-organized the information into a non-linear description of the essential aspects as they pertained to the research question. At the second level, I used the constant comparative method to examine direct quotes from the individual interviews and focus group session; I identified recurrent themes in participant reflections and statements about the process and their learning. Ideas that were often expressed across a number of participants were identified as likely being important overall elements in this particular professional learning process. The final level of analysis examined the case from a systems perspective and focused on the learning community as a whole. I examined the characteristics of our transdisciplinary team in relation to that of a complex system.

Descriptive analysis. The case was quite complex; it did not simply examine: a process that already existed, participants' experience at one point in time, a process that had been imposed on the participants, or an individual's inquiry. Instead the case detailed a number of interconnected processes occurring over time. In this study, copious amounts of data were collected that deeply described the:

- development of a new transdisciplinary learning team from a multidisciplinary group of individuals;
- team's identification and investigation of a joint issue of interest: Helping intermediate students identify and use metacognitive strategies;
- team's creation, utilization, and reflection of lessons and activities to address the area of need;

- team member's reflections on their own professional learning and the learning of their colleagues.

I began the descriptive analysis by ordering the conversations, artifacts, field notes, and interview chronologically to create a calendar of events. Next, I developed a comprehensive, linear narrative of the process. In an effort to focus my analysis, I transformed my initial narrative chronology of all events into a more concise topical description of the events that directly pertained to the research question. These topics included: the context; building the team; engaging in transdisciplinary inquiry; and the resultant professional learning.

Categorical analysis. After describing the pertinent aspects of the study from my perspective, I closely examined the statements made by the team members to gain a better understanding of their experience of the transdisciplinary inquiry process as a method of professional learning. I looked for common elements in the individual team member's statements and in my observations made in field notes. I coded this information by looking for statements or short phrases that embodied a critical feature of each datum. Next, I combined the coded data pieces into categories, identified similarities within the categories, looked for data that were non-examples of the categories, and identified emerging elements (Argyris et al., 2011; Saldana, 2013; Yin, 1994; Yin, 2018). I coded and analysed the data in four stages without using commercial software.

Stage One. This analysis occurred throughout the data collection phase as I started to notice recurring ideas and words when I conversed and interviewed individual team members. I was aware that I should be listening for repeated ideas in the participants discussions and interviews. I was careful not to use these words or ideas directly in my questions to the participants, but when they spontaneously made comments on these areas, I would ask them to

explain their ideas more fully. Because the interviews were semi-structured and transcribed prior to the subsequent interview, I was able to return to prior statements participants made both during the interviews and the project planning sessions to seek clarification and exemplars.

Stage Two. At this time, I had already listened to and transcribed all of the interview and focus group data, so I organized all of the artifacts, reflections, field notes, and transcript summaries into a chronological description of the case. Next, I recorded my personal reflections on possible themes and created a flow chart representing my thoughts based on my holistic experience with the study prior to any organized data analysis. Some of the primary elements that seemed to be emerging were communication, relationship, learning, emotion, and perspectives. Some subcategories also seemed to appear.

Stage Three. I went back through all of the interviews line by line and identified statements and parts of interviews that recurred grouping similar information together by using a constant comparative approach (Glasser & Strauss, 1967). Specifically, my process included highlighting phrases, statements, and comments that recurred throughout the transcripts and notes. As I identified these phrases, I wrote them on Post-It® Notes and started to place them on the white board under tentative categories. I used different colored Post-It® Notes for each stage of the data collection in the event I needed to differentiate the comments by time. As a rule of thumb, if five team members commented on some element at least once, I grouped the ideas together as possible elements. Although I recognize that there were some individual comments and ideas that surfaced which were significant, for the purpose of organizing the copious amounts of data, it was easier to have a pre-determined rule or structure to work to begin with.

I organized and re-organized the Post-It® Notes until I was satisfied that I had exhausted all of the possible categories. I was also careful to ensure that the categories were congruent with

the research questions, comprehensive, and unique. Through this process the team's experience was described from their perspective using their own words and tentative categories with subcategories were identified. I created another set of documents with lists of quotes and information that I had obtained from each individual team member. These documents were single spaced and varied from 4 to 6 pages in length. Each team member was provided with a copy of their information asked to read over the information and to ensure that I had represented their ideas correctly before I completed the analysis. In the end, three participants provided edited versions of the documents back to me and three participants stated that the documents were accurate as they were and did not need to be changed.

Stage Four. During the initial drafting process as I was recording my ideas in connected text, I returned to and re-read the interview data, my field notes, and examined artifacts to see if there was any additional information that to better represented the participants' experiences of the process. I looked for information that I might have previously overlooked that might support or refute the tentative categories. At this time, some categories were reorganized or re-named. I combined this information identifying elements and sub-elements and created a diagram representing the relationship between each of the elements and in relation to professional learning. I shared this diagram with each participant individually as a method of member checking. All members indicated that the elements accurately represented their experiences.

Self-analysis. Finally, because one of my original research questions asked if and how I as a school psychologist could facilitate the transdisciplinary inquiry process as a means of professional learning, I took a reflexive stance toward my own thoughts, actions, and learning. With the assistance of Shelley, a critical friend, who helped me to uncover some of my motivations, biases and characteristics that both enabled and hindered my ability to facilitate the

process, I engaged in a process of self-reflection in which I identified personal and situational characteristics that influenced my ability to facilitate the inquiry (Samaras & Freese, 2006).

Systems level analysis. To gain a deeper understanding about the group learning process that occurred throughout the transdisciplinary inquiry, I wanted to examine the transdisciplinary team as an example complex system due to its self-organizing, self-determining, and ambiguously bounded nature as well as the fact that it existed in a state of disequilibrium (Byrne & Callaghan, 2014; Sanford et al., 2015; Stacey, 1996). Once establishing the transdisciplinary team as a complex system, I was able to identify the three primary forces necessary for learning to occur in this case: cohesion and diversity within the system and flow of information through the system.

Trustworthiness

To be of value, qualitative research must answer the question: Can the findings of the research be trusted? The presence of a number of criteria can help to establish the rigor of qualitative research. These criteria include the components of: dependability, credibility, confirmability and transferability (Argyris et al., 2011; Lincoln & Guba, 1985; Merriam, 1998; Shenton, 2004). The trustworthiness of the current case study was established by ensuring that it contained these components.

Dependability. Dependability, the degree of stability present in the inquiry process over time, was established through: the development of clear and concisely defined research questions, the use of a well-developed and rigorously applied methodological approach, the comprehensive and transparent description of the attainment and analysis of data, and the demonstration of reflexive awareness throughout the process (Argyris et al., 2011; Creswell & Miller, 2000; Korstjens & Moser, 2018; Lincoln & Guba, 1985). The current case study

established dependability through the use of simple and concise research questions: How might a transdisciplinary approach to collaborative inquiry facilitate embedded professional learning for educators and how can I, as a school psychologist, participate and facilitate this type of professional learning? In addition to a concise research question, the current study established a well-defined bounded case: the single process of developing a transdisciplinary team to address an educational issue for the purpose of professional learning. The time-line began at the inception of the team in June and was completed after the final interview in January with the exception of member checking. The explanation of the data collection procedure and the analysis of the data that lead to the development of elements and themes were described in a complete and transparent manner. Finally, I demonstrated reflexivity throughout the process as I participated in the project, collected data, analyzed the data and developed findings and identified my own reflections and feelings throughout the process.

Credibility. Credibility, the degree to which the account is believable and reflective of the perspective of those under study, was created through the use of well-established and diverse research methods, prolonged engagement, iterative interviewing, and member checking (Argyris et al., 2011; Creswell & Miller, 2000; Lincoln & Guba, 1985; Merriam, 1998; Shenton, 2004). The diverse methods included detailed description, iterative interviewing, focus group reviews, field notes, and artifact collection. Detailed description of all procedures and analysis was provided to ensure that readers of the research would be able to develop a complete understanding of the steps taken. Artifacts, which recorded the process of actions taken, communication between the team members, and data analysis, were included as evidence that the described process was followed. Iterative interviewing and questioning were used to ensure that the perspectives of all of the members of the team were accurately represented. The project

extended over half of a school year, with member checking continuing to the first half of the next school year. This duration provided sufficient time to ensure accurate representation of the perspectives of all team members. The multiple interviews were supplemented with a focus group discussion to try to mitigate any power imbalance that I may have had during the interview process. Finally, I typed out a list of individual quotes and descriptions and provided this information to each team member to review and edit to ensure that the information provided accurately reflected their intentions. Any changes or additions made to this list, was reconfirmed with the team member providing the information. I also checked with the team members after the analysis was complete to review the themes that surfaced.

Confirmability. Confirmability, the degree to which results can be corroborated from multiple perspectives, was enhanced by utilizing multiple sources of data and methods, checking and rechecking data with participants, and identifying researcher bias (Argyris et al., 2011; Shenton, 2004). I critically reflected and exposed, to the degree that I was able, my own bias on the research topic. Additionally, prior to the formal data analysis, I recorded my general belief regarding emerging themes prior to initiating formal data analysis. The research method included the recruitment and engagement of multiple co-participants with differing perspectives and representing different academic disciplines. Multiple sources of data were tapped, this data was triangulated so that different dimensions of the same information could be captured. This process also established the cross verification between sources. I also engaged in a member checking and re-checking process with participants throughout the course of the research to ensure that the statements they made were not misconstrued, descriptions of their backgrounds were accurate, and that the final elements that emerged were consistent with their experience with the process.

During data analysis, I actively looked for negative instances of categories. For example, when examining the comments from team members that the process was time efficient in most cases, I did find quotations from Caroline, the school counsellor, on a few occasions that the time-line was too condensed for her and that the electronic communication made it less efficient for her. Therefore, I re-read the transcripts looking for non-examples of efficiency. Through this process I noted that many members wanted more time to work on the project but did not have it available due to overwhelming workload. This resulted in the development of a new category, *Challenges to Professional Learning*. This category addressed these ideas of Caroline's and found other comments referring to overwhelming workload and the difficulties with communication.

Transferability. The transferability of the current research was enhanced by providing information that would aid in the current study being applied in different contexts (Korstjens & Moser, 2018). In-depth description of both the process and the context of the current study were provided including cultural and social contextual information. Care was taken to provide explicit description of the participants and the setting of the research to support the readers of the study in determining if the project could be applied within their own context. Upon reflection, five out of the six team members spoke about the importance of using this type of learning experience and how this project altered either the way they thought about their own professional learning or how they thought about providing professional learning experiences to others.

Chapter 4: Presentation of the Data - Case Description

My original research question asked if and how a transdisciplinary inquiry could be developed and used within the public education system as a method of professional learning. To provide for a complete understanding of the current case and to answer this question, I offer information across a number of domains. I describe the important actions taken to transform a multidisciplinary group of individuals into a transdisciplinary team and how that team engaged in the inquiry process; I present quotations and observations from the team members to demonstrate that they experienced professional learning through transdisciplinary inquiry; and I provide information to suggest that the transdisciplinary team acted as a complex adaptive system moving toward emergence.

It has been my experience that when educators unite to work on a project of inquiry, they tend to focus primarily on student learning. Throughout this case study, educators were asked to engage in an inquiry project focused on student learning, but just as importantly, they were asked to be mindful of and intentional in their own learning. In fact, this case united two processes that were distinct but related, occurred simultaneously across a six-month time-frame, and resulted in the creation of an adaptive complex system:

- The process of developing and using a transdisciplinary team to engage in an area of educational inquiry, developed by the team.
- The process of encouraging the educators in the inquiry to be purposely mindful of their own professional learning and the learning of their peers throughout the inquiry project.

The Context

Two important aspects of the provincial context in which this research was conducted, and likely influenced the current study, are the implementation of a new provincial curriculum and the commitment of the Ministry of Education to an inclusive education system. The province of British Columbia, in collaboration with British Columbian teachers and the British Columbia's Teachers Federation, redesigned the educational curriculum for the province with the implementation of the new curriculum beginning in 2015 and has continuing to the present day. This curriculum focuses on core competencies including 'communication', 'thinking', and 'personal social' competencies in the endeavor to ensure that all students have the opportunity to learn, be supported in their learning, develop their potential, and obtain the knowledge and skills needed to be successful citizens (Province of British Columbia, 2018). It was designed to help teachers facilitate student learning in core areas such as *communication, positive personal and cultural identity*, *positive personal awareness and responsibility*, *creative thinking*, and *social responsibility*, (Province of British Columbia, 2018). It also provided space for teachers to provide instruction in areas such as metacognitive strategies as well as the more traditional skill-based strategies for reading, writing and math.

Concurrent with the development of the new curriculum was the movement of the province toward an inclusive education system as defined in the new curriculum. The Ministry of Education stated it actively promoted inclusion, meaning the government was committed to providing all students with equitable access to learning, ability to experience growth, and success within their educational programming (Province of British Columbia, 2018). By bringing inclusion to the forefront, the ministry and the administration in the school district were encouraging teachers to utilize inclusive teaching practices at all grade levels.

The school site itself and the location of the case study was situated at the edge of a small city and was bordered by farms and forest. The original school was built 1957, with additions to the structure added through the 1960s and 1970s (Yates & Thorn, 2010). During the 2018-19 school year, this school, like many in the district, appeared to be bursting at the seams, making space a scarce commodity. Two factors contributed to this overcrowding. First, there had been an increase in student population in the district with new families moving into the valley from larger metropolitan areas in BC as well as from out of province. Secondly, because of the Supreme Court Ruling in November of 2016, the government of BC was required to restore the class size, composition, and staffing levels that had been unconstitutionally removed in 2002. Therefore, even if the student population had not increased in the school, more classrooms and teachers were required to service the same number of students.

At the beginning of the 2018 school year, the school had a population of approximately 280 students. Approximately 35 students were identified as students with special needs through the BC Ministry of Education guidelines. Because of the increase in the student population and the reduction of class size, in September the school was waiting to obtain a portable so that it could house all of the divisions. At the beginning of the school year, every available room was occupied and even rooms that had historically been used as music rooms or learning assistance rooms, were repurposed as classrooms. Needless to say, space was tight. This lack of space made it difficult for teachers and teams to find meeting and work spaces within the school.

There were 24 teachers working at the school from Kindergarten to Grade 7 with one principal and a secretary. A counsellor worked in the school two days a week as did a speech and language pathologist. Finally, an itinerant early literacy learning teacher also attended the school to work with students. The school had one full-time special education teacher and three part-time

learning assistance/special education teachers who also had other teaching assignments. The school had access to itinerant district staff including but not limited to the special education teacher for deaf and hard of hearing, the occupational therapist, and a school psychologist.

When asked to describe the school in their first interview, team members who worked at this site full-time all reported that the school was a good place to work. They described it as a very busy place and the educational staff as cooperative and supportive. The teachers enjoyed their students and the community although teachers identified that there were many and diverse student needs. The grade 4/5 teacher reported that the school was like a second home to her. She felt the staff were very supportive and felt that she could easily ask questions of the staff members and not feel uncomfortable or intimidated. The grade 6/7 teacher stated that he liked his students, they came "without pretense" and without feelings of "entitlement". He noted that sometimes he was amazed at how well some of the students did in school despite the challenges they experience in their lives. The special education teacher noted that the school was not too big and therefore the teachers were able to get to know each other easily. Because of the school's smaller size, she felt that it was easier for the teachers to get to know the students and their families. She stated that many of the students came from a lower socioeconomic background and had many needs. In an interview, the special education teacher commented that the teachers were often:

> caught between what we are told kids should be able to do and what we know our students can do – we have to find a good fit for them. It is a struggle for us to meet their needs but also meet the expected pieces from the Ministry of Education.

The Process: From a Multidisciplinary Group to a Transdisciplinary Inquiry

Teambuilding. The first important process that occurred in this case was the building of a multidisciplinary group that grew into a transdisciplinary team. The educators were recruited in two stages. First, I invited the first set of educators, teachers from the school site, to become involved. This included in order of recruitment: Shelley (special education teacher on site and my critical friend), Graham (grade 6/7 classroom teacher), and Carolyn (grade 4/5 classroom teacher). This group met, determined the broad topic of the inquiry, and determined the other educators that would be invited into the group: Susan (occupational therapist), Fiona (special education teacher for the deaf and hard of hearing) and Caroline (school counsellor).

For myself, as the facilitator of the process, this meant initially I needed to: identify educators with diverse disciplinary backgrounds who would be interested in engaging in an inquiry at a school site and invite them to be part of the team; try to develop rapport and relationships between myself and the team members as well as assist in the development of relationships between team members themselves; recognize the learning needs of the individuals in the group so that I could design a situation that would meet these needs; and identify team member strengths and areas of expertise so that I could encourage them to lead in the areas that they were both comfortable and knowledgeable in. As the team moved from a multidisciplinary group into a transdisciplinary team, I was able to distribute these responsibilities across the group. By the last month of the study, various individual team members were leading in their areas of expertise and power was more evenly distributed. Additionally, there was a redundancy in roles such that when the Ministry of Education conducted a surprise audit of all special education categories within the district and four of the team members were required to

participate, the transdisciplinary process continued and mini-lessons continued to be created and implemented but at a slower rate.

Because the individuals were meant to develop into a transdisciplinary team, initially I, and later the team, took care to invite individuals with diverse academic backgrounds. In the interest of brevity and space I will not delve deeply into the discussions between the initial team members that took place in determining who to invite into the team, but it is important to emphasize that members were chosen because of their interest in the study, the diversity of their academic and professional backgrounds, and the range of the perspectives they would bring to the group. The complete group, in the order they were recruited, included: Shelley, the special education teacher; Graham, the grade 6/7 classroom teacher; Carolyn, the grade 4/5 classroom teacher; Susan, the occupational therapist; Fiona, the special education teacher for deaf and hard of hearing; and Caroline, the school counsellor. It is also important to note that the team members chose to use their own names and did not use pseudonyms. For this reason, two of the team members have very similar names.

Each individual member brought expertise from at least two diverse academic disciplines and in some cases more than two. This was important for a number of reasons. First, having individuals with diverse academic backgrounds provided the group with a wide range of expertise and knowledge from which it could draw. Secondly, I believe each team member looked at the project from widely different perspectives and this allowed for consideration of multiple possibilities, multifaceted discussions, and creative problem solving. Finally, because the purpose of the project was to develop and examine the functioning of a transdisciplinary team, in order to answer my research question, it was necessary for the team to be comprised of individuals from diverse academic disciplines.

Fiona, the itinerant special education teacher for students who are deaf and hard of hearing, obtained her first degree in the academic discipline of Agriculture, and later she completed her graduate degree in the discipline of Special Education with a specialty in working with students who are deaf and hard of hearing. **Shelley**, the school special education teacher, studied and obtained her first degree in the Fine Arts, and later she also completed graduate studies in the discipline of Special Education focusing on students with learning disabilities. **Carolyn**, the grade 4/5 classroom teacher, studied initially in the disciplines of the Humanities and Psychology. She then studied in the field of Massage Therapy and also completed studies in the field of Education. **Graham**, the grade 6/7 classroom teacher, studied in the field of Education and then completed his graduate degree in Coaching Studies. **Susan**, the occupational therapist, completed her original degree in Occupational Therapy and Physiotherapy, she also completed studies and research in the field of Neurology, finally she completed her graduate degree in Educational Leadership focusing on working with students with Autism Spectrum Disorder. **Caroline,** the school counsellor, completed her initial studies in Psychology, then continued on in the field of Early Childhood Education and completed her graduate degree in the field of Counselling with a focus on trauma. I, **Rhonda**, the district school psychologist, completed my initial degree in Biology Education, then studied in the area of Criminology and Police Sciences, I completed an honors degree in Psychology focusing on Biopsychology and completed two Masters degrees one in Curriculum and Instruction and one in School Psychology. For a more complete descriptive summary of the background of each of the team members and their perspectives on professional learning please see Appendix C.

Building relationships. Prior to beginning the study, some of the team members already had relationships with each other. For example, the three teachers at the school site (Shelley,

Graham and Carolyn) had been working with each other for over a year and knew each other fairly well. I shared a positive collegial relationship with Shelley as we worked closely together on a program four years ago and since that time had remained good colleagues and friends. Shelley had worked with both Fiona and Susan over the years in her capacity as a resource and learning assistance teacher. I had a collegial relationship with Graham because I had completed psychoeducational assessments on some of his students and had interviewed and observed him on a number of occasions about these students. Caroline had been the counsellor at the school for one year already. So, there were relationships of various forms already present before we started the research. I knew that in order for the project to work well and provide a safe environment for learning, we would all have to get to know each other much better.

Certain aspects of the inquiry process actually supported the development and maintenance of relationships between the team members. For my part, I tried to facilitate the development of positive relationships because I believed that good relationships would provide a safe and supportive environment for professional learning to occur. For example, I actively tried to support positive relationships by checking in at least weekly with team members to see if they needed anything and to find out how they were feeling about the project, but also in other aspects of their lives. I also tried to be open and flexible in working with the team and welcomed both assistance and criticism. I tried to avoid making unilateral decisions and attempted to be respectful and open in my dealings with the team. Upon reflection, I feel that the most important team building actions and occasions included: initial interviews, casual conversations, group meetings, and sub-group activities.

The initial interview that I held with the team members provided me with much more than information about demographics and professional learning, it also provided me, as the

facilitator, with time to discover who my colleagues were as people. This is something we don't often have the luxury to do in our busy lives. It was a privilege for me to get to know about their histories, beliefs, strengths, and concerns. Through this sharing of personal information and beliefs, our relationships began to be forged.

Similarly, casual conversations that became part of the organizational structure and planning of the lessons helped team members to get to know each other and provide support to one another. On a number of occasions, pairs and small groups of team members met either after school, in the hallways, during breaks, and in the mornings to talk about the project and support each other. These face-to-face connections were important to the process even when we were not talking directly about the project but if we were just checking in to see how each other were doing.

The group meetings provided the time and space for all of the team to sit together and discuss important ideas. All of the group meetings were held in the small resource room office around a little round table. There was one window and little space. In September, during the first group meeting, we all came together and introduced ourselves and began the process of group team building as we discussed how to help our students learn. There were many interruptions and we didn't have very much time (2.5 hours) or space but we were face-to-face and we had lots to talk about such as concerns about student learning, how to better understand and support struggling students, and what important topics the group should focus on. I believe that the few times that we were able to meet as a group were important for sharing ideas but also for forging relationships.

Cooperative learning occurred within sub-sets of the group as time went on, as we started to plan out and implement specific lessons, and as small sub-sets and individuals began to lead in

their areas of expertise. For example, Fiona and Carolyn worked together on helping students understand the importance of using all of their senses when they are listening and trying to understand. They ended up revising and team teaching a lesson on this topic. Shelley, Graham and Carolyn regularly provided support to each other with short chats in the hallways, talks in the staff room, and generally checking in with each other on a regular basis. I also worked in pairs with Caroline on a set of lessons focusing on helping students understand how to 'listen with their hearts' listening strategies to figure out how others are feeling. I worked with Shelley and Susan on another set of lessons on how to recognize confusion and employ effective help-seeking strategies. Carolyn, Shelley, Graham and I worked together prior to the first lesson implementation to ensure the materials and technology were ready to go. Susan and Fiona visited the site on other matters but made time to touch base with the team members. All of these small interactions helped to build and maintain relationships. Although we communicated in many ways throughout the process such as email, PowerPoint slides, text messaging, and telephone calls, for me it was the face-to-face conversations and interactions that helped to forge caring and supportive relationships. Each of the team members also identified on numerous occasions that the group meetings and the conversations were important.

Individual learning needs. After informally speaking with and formally interviewing the individual team members, it became clear that each educator brought a different perspective on what defined an effective professional learning experience for them. The ideas about what constituted effective professional learning opportunities were as diverse as the team members and included: mindful conversation about educational issues; reading research; listening to experts; engaging with peers; creation of lessons, activities, and resources; experiential learning; mentoring others; and effective learning environments.

Shelley highlighted the importance of real-time conversations with colleagues where issues of importance were addressed within the context of her work. She identified the fact that she enjoys reading research herself and being able to access online resources as a source of knowledge, as well as the ability to go and listen to experts talk about their work in areas of interest to her. She reported that she enjoyed helping to mentor other teachers and educators and realized that she learned herself from these experiences.

Graham focused on the usefulness of being engaged in learning with a small group of peers and the motivational factors of working together and creating something tangible. He emphasized that having the opportunity to exchange ideas with his colleagues and discuss concerns and ideas that he had was both enjoyable and instructive. He felt that he was an 'idea person' and he noted that learning takes time.

Carolyn identified her need to learn by doing; she emphasized that talking about something was not as helpful to her as actually experiencing a real-life situation. She referred to her internship and acknowledged that it was helpful for her to observe others and then try a process for herself. Experiential learning for her appeared to be key. She also noted that it was very important for her to be organized and structured.

Susan reported that there was not a lot of choice for her regarding hands-on practical professional learning, because of the nature of her job. She was interested in learning how to teach adults to shift their practice in little ways to embed some of her OT strategies into their daily work. She noted that good professional learning for her had to include learning information that aligned with her personal beliefs about teaching and learning.

Fiona emphasized that for her, the learning environment was paramount. She explained that because of her hearing loss, she was unable to learn effectively if the environmental factors

were not supportive. For example, she stated that it was very difficult for her to learn anything or even participate on District professional learning days if staff members were required to gather in a gymnasium and listen to a guest speaker. For her smaller groups, with discussions taking place in a horseshoe shaped environment with good acoustics and lighting was very important. Ideally having visual information provided in the form of Communication Access Realtime Translation (CART) or at least a written agenda to follow was important for Fiona.

Research articles typically identify what is similar and necessary for the general learning needs of the people involved. However, in this case, each of the team members identified different requirements for their learning needs to be met. I realized that it would be necessary to differentiate and personalize the types of activities in which the group engaged to provide a supportive learning environment for all. So just as I had wanted the topic of inquiry to utilize an inclusive lens, I found that as I was working with diverse adult learners, I also needed to focus on inclusivity and try to develop an environment that would allow all of us in the group to learn.

Individual expertise. Another important aspect to the first set of interviews and the first group meeting was the fact that individuals' roles in the group began to develop. During the first interview, I asked the team to identify their strengths as educators. Shelley stated that her strengths included observation, making teachable moments count, and pinpointing students' present knowledge whilst keeping in mind how they could grow. Graham reported that his strengths were his ability to connect with his students, his patience, and his willingness to examine his own preconceptions and biases. Carolyn identified classroom management as a strength. She felt that building relationships was an important part of teaching and she was conscious of trying to keep her students engaged in their own learning by incorporating hands-on activities. Susan felt that her areas of strength were problem solving, collaboration, navigating

difficult situations, and future planning. Susan stated that her personal OT mantra was: “active engagement and meaningful activity for physical and mental wellbeing”. Fiona felt that her strength was in her advocacy for her students, ability to be a good role model, capacity to provide strategies that are beneficial to all learners, involvement in mentorship groups, and connection to research. Caroline felt that her strength was her ability to combine book knowledge and experiential knowledge. As the multidisciplinary group developed into a transdisciplinary team and the power and organizational structure was distributed among the group, each of the individual team members began to lead in their area of expertise so that no one person was the manager. By the end of the study the group was managing itself.

Regarding roles within the group, each team member shared important aspects of themselves for the benefit of the group. Shelley provided us with resources and strategies and was instrumental in providing emotional support to teachers and students within the building as well as organizing the site and the team members for our meetings. Susan was able to connect diverse ideas and had lots of experience in helping adults understand metacognition. Fiona helped us all to understand what strategies might assist students with hearing loss and provided simple strategies for us to use such as showing us how to use closed captioning for video and suggesting we use a visual platform for our lessons. Graham asked questions and tried to get all of us to think outside of the box. He also brought his expertise with technology and literacy as well as his knowledge of high school students to the discussion. Carolyn brought the knowledge of her intermediate grade students, an open mind and a brave heart as she was willing to implement many of the lessons with her class. Caroline brought her knowledge of interpersonal interactions and willingness to team-teach in the classroom if the possibility arose. I think I brought the importance of being explicit when we teach and create lessons. I also brought

structure and an ability to combine everything into a coherent lesson plan so it could be used.

As the multidisciplinary group became a transdisciplinary team each member or agent played a part in the team's learning. Differences in perspectives between team members were discussed and knowledge that each individual brought to the team was integrated until a joint understanding developed of what was needed to help intermediate students understand and use metacognitive strategies. This understanding was initially represented and then re-developed through the creation and re-creation of the mini-lessons.

Engaging in transdisciplinary inquiry. Once the multidisciplinary team was established, the process of developing the diverse group of individuals into a cohesive transdisciplinary team with a joint focus that could integrate information across domains, develop a shared conceptual framework, and implement ideas within the context of the real world was attempted. The first step in developing a transdisciplinary inquiry was to identify an issue that all group members wanted to inquire into.

Identifying an issue. Consistent with both the social constructivist and enactivist theory about the importance of learner autonomy, I supported learner and team agency in that I did not dictate to the group what the area of inquiry would be. Instead, one of the first tasks that the team worked through was determining the issue to investigate. It is difficult to pinpoint exactly how decisions were made because deciding the topic of the inquiry was an organic process that grew and changed over a three-month period. Although non-linear in nature, it is easier to describe its development in stages: individual topics were solicited from the on-site teachers, a partial group discussion and consensus occurred between me and the first four on-site educators recruited, and further discussion and consensus on the specific inquiry topic by all members of the transdisciplinary team then took place.

I knew that it was important for the team to decide on the topic of inquiry, even though the initial participants involved said that they thought that as the researcher, I would likely provide them with the topic of inquiry as this had been the case in other professional development/research situations with which they had been involved. So, to ensure that the process was a group decision (I say group and not team because the team had not yet completely developed at this time), I initiated the decision process by obtaining some initial ideas for topics of inquiry from the individual on-site teachers during and shortly after the first set of interviews. Several ideas were suggested to me by different individuals in the group and were discussed at our group meeting. They included: social emotional learning, helping students to express ideas, critical thinking, inclusion, helping students make good choices, written expression, literacy beyond mechanics and grammar, social/behavioural self-regulation, technology, and helping students understand ideas.

With some possible topics identified, I arranged the first team meeting with the on-site teachers in June and the group came to a consensus on a broad topic of inquiry. In the initial small group meeting Graham, Carolyn, Shelley, (the teacher who would later withdraw from the study), and I were present. I provided some possible topics as examples from the list I had compiled from the interviews. A spirited discussion ensued as the group tried to decide if any of the topics or perhaps a new idea might be best. The discussion lasted over one and a half hours and various viewpoints were argued for and considered. An example of conflicting ideas could be seen between team members. Initially one of the topics that I presented was about written expression. I was in favor of the topic because I had recently completed quantitative research in this area during the completion of my Masters of Arts in School Psychology. Carolyn seemed eager to work on writing because it was an area of concern for her. She stated that when she

heard writing was a possible topic she thought, “Perfect writing has been a beast that I have been trying to tame”, suggesting that she was struggling to find effective ways to help her students learn to write.

Graham, on the other hand, had been working with students in language arts for a long time and was not as interested in focusing on writing and was more interested in finding out how to help students successfully understand basic instruction and complete assignments. He felt that students wanted to learn but sometimes just didn’t know how to accomplish it, suggesting that Graham was very concerned about helping his students gain a better understanding of developing and regulating their own learning processes particularly in the area of listening and understanding directions as well as how to help themselves if they become confused. Shelley was concerned that writing was a narrow, skill-based topic, and was more interested in helping all students learn across subject areas. The other teacher involved was less interested in writing and more interested in social emotional learning and behavioural self-regulation. Through the sharing of examples, discussions of educator concerns and reflections on student reaction to instruction, the idea of helping students understand how to learn surfaced and the idea of ‘cognitive self-regulation’ seemed to describe the broad topic in which the group was interested.

After the broad topic was determined, the team discussed other educators within the district and tried to determine who might have expertise that would be helpful to our professional learning. The team decided that Caroline, the counselor, Susan, the occupational therapist (OT), and Fiona, the itinerant special education teacher for the deaf and hard of hearing, would be invited to join the group. Caroline, Susan and Fiona agreed to join and the team was developed.

The seven members of the team met in September of the next school year. The purpose of the team meeting was to focus the topic and begin to plan our inquiry focus. Again, spirited

discussion ensued. This time there were more diverse viewpoints, opinions and understandings about how students learn, what motivates students to try, the best environments to learn, how to be inclusive, and student choice in strategy use. Terms had to be defined and agreed upon and there was some disagreement particularly about definitions or meanings of words. Differences between terms such as self-regulation, executive function, and metacognitive strategies were discussed. Finally, everyone agreed that by 'cognitive self-regulation' we really were describing metacognitive strategies that could be used by students as they try to learn. The important metacognitive strategies on which the group decided to focus were strategies that would help students to: listen effectively, use self-talk successfully, develop persistence, and access assistance when needed. We recognized that not all strategies would be helpful to all students, so we needed to find a way to introduce the students to a variety of strategies and then have them personally reflect on which ones would be useful. Additionally, consistent with the BC curriculum (Province of British Columbia, 2018), the group wanted these strategies to be useable across subject areas (cross-disciplinary), individualized (personalized), and presented in a way that was accessible to all (flexible learning environment).

Building a shared conceptual framework. The mini-lessons that were developed by the team emerged from the combined knowledge of the team members and what they learned during the inquiry; the mini-lessons represent the shared conceptual framework developed by the group through the transdisciplinary process (See Appendix D for selected slides of these mini-lessons). The team developed a joint framework representing how to help intermediate grade students (grades 4 to 7) understand and utilize metacognitive strategies to support their own learning. To develop this framework the team engaged in a number of activities including: face-to-face discussions on metacognitive strategies, reading academic research on the topic, creating outlines

of lessons for the grade 4/5 class, providing specific activities and information to the PowerPoint outline, using group feedback to improve the lessons prior to implementation, implementing the minilessons within the grade 4/5 class (and later with other students and in other formats), and re-vamping the lessons based on the implementation and how students received the lessons. Through this iterative process the team developed and recorded a joint conception of how to help intermediate students learn about and use metacognitive strategies to support their learning. The final slides were not considered a final product, but rather a work in progress and were provided to all educators involved in the study; team members could share them with whomsoever they want to share them with.

The joint purpose of helping students to think about their thinking was a topic developed by the team and helped keep the team focused and united. Each member of the team articulated the purpose at some time or another. Fiona stated that the purpose of the team was for, "a group of people with different specialties that all came together to create a series of lesson plans on a topic that is so important for all of our children, metacognition." Carolyn described the team's purpose as "it was a project to help kids learn some metacognitive tools to start thinking about their thinking and tools to help them moving forward." From Caroline's perspective the team was, "teaching children in intermediate grades metacognition connected to listening and other skills." Susan reported the purpose of the project was, "about exploring learning opportunities to teach metacognitive strategies to facilitate self-regulated learning." Developing a joint purpose was the first step in developing the shared conceptual framework.

Developing, using, and reflecting on the mini-lessons. The team focused on how to create lessons and activities that would be engaging, provide support, be accessible to diverse learners, and allow for student choice. The primary medium for the development of the mini-lesson

occurred quite serendipitously. During our first whole group meeting, Fiona was able to describe, from the perspective of deaf and hard of hearing children, what the best type of lesson structure might be for the student lessons. This included visual text and visual representation of information as well as oral explanation. As the group was thinking about how to include visuals in all of the mini-lessons, the idea of using PowerPoint presentations for all mini-lessons developed and this along with email communication ended up being the group forum for our online collaboration between all members. In this way all members could access the lessons, provide feedback using comments, ask questions, and provide input. This was supplemented by the use of email as well. However, some people were more comfortable with electronic communication than others. Therefore, electronic communication was supplemented by quick hallway conversations, face-to-face chats, and face-to-face whole group discussions.

Eleven mini-lessons were created in a PowerPoint format that provided visual as well as auditory information in an organized fashion to aid in presenting information and organizing whole class instruction in an accessible manner. The PowerPoint slides acted as a method of communication between team members, a running record of the team's idea development, and a representation of the team's joint conceptual framework for teaching metacognitive strategies to intermediate grade students.

Each mini-lesson included a review of the previous lesson, activities to encourage active student engagement, a short video or activity that encouraged students to observe the use of a metacognitive strategy, opportunity for students to try the strategies themselves individually, in pairs, or in groups, and encouragement to reflect on their use of the metacognitive strategy. Activities embedded within the lessons were designed to help students learn how to: gain information from all of their senses, be prepared to listen in different ways (including listening

for how someone else is feeling), use positive self-talk (self-instruction, verbal rehearsal, positive reinforcement, etc.), identify negative self-talk, identify confusion, persist, and effectively seek help. Students were encouraged to determine which strategies worked for them and build their own metacognitive tool kit.

Initially, the group focused on creating a set of mini-lessons that could be implemented weekly in the grade 4/5 classroom. The mini-lesson on a particular strategy was taught and then reinforced by the teacher throughout the week during other classes. The mini-lessons were designed to be accessible to a wide variety of students including students with learning disabilities, fine motor difficulties, social emotional struggles, and hearing impairment along with other exceptionalities.

The mini-lessons were jointly created by team members with various individuals providing ideas and activities. While reflecting on some of the best ideas they provided the group, Shelley stated, “I contributed *Sesame Street* and I feel good about the development of that.” Here Shelley was referring to the *Sesame Street* video clips that are accessible on YouTube. We used some of these videos to demonstrate metacognitive strategies such as focusing attentions, whole body listening, and self-talk. Susan stated, “I have given you things that I have created in the past and told you how I would change them to work in this situation and you recreated them…I suggested ideas to explore like the tool kit and the thumbs up/thumbs down”. Fiona reported that she brought awareness of how to support a deaf and hard of hearing child in the regular classroom; for example, she showed the team how to use closed captioning on YouTube videos. Fiona tried to ensure that all of the mini-lessons included strategies that would be helpful to all students and that there was both a visual and audio component in each mini-lesson. Graham reported, “I was trying to get an idea for what we were trying to accomplish

and make sure the activities we were creating matched with the ideas we were trying to put across. When we were looking at stories, I suggested Book Creator as an option, I suggested Plickers as an option, I tried to figure out what our technology options were." Caroline stated that she had been the leader in planning lessons on 'listening with the heart' and looked forward to team-teaching the lesson with Carolyn in the classroom. However, she did feel that she needed help putting her ideas in a PowerPoint format so she was happy that the team worked together. For my part, I provided activities for recognizing confusion and listening with the whole body. I also collected all of the ideas and combined them into the first rough PowerPoint draft.

After the joint planning meeting, where the team identified the topics to be addressed, all team members sent me resources, activities, and ideas and a rough-draft electronic copy of the mini-lesson was created. The draft was sent to all members and they provided feedback from their perspective and the draft was improved until a final set of mini-lessons was sent out and team members could choose to try some of the activities. After using the mini-lessons or aspects of them, team members provided their reflections to the group so the content of the lessons could be adjusted and the team could learn from the feedback and observations. Caroline noted that developing and planning the mini-lessons was a positive process for her especially when "we are continually changing, reflecting, doing and revising" although she found the timeframe a "little condensed."

Implementation in context. Six of the eleven mini-lessons were systematically used by Carolyn in a grade 4/5 whole classroom setting; some of the activities and parts of the lessons were also presented less systematically by Graham in a grade 6/7 whole class setting; and some parts of the lessons and activities were used by the rest of the team with students in the context of our daily work. For example, Fiona taught one activity with Carolyn in the grade 4/5 classroom,

Caroline used some of the ideas from the lessons when she was counselling small groups of students, and Shelley planned to use some of the mini-lessons with a small group the students she worked with in a special education class. Although I did not use the lessons in direct instruction, I used some of the ideas developed from the lessons in my recommendations to teachers in my role as school psychologist.

From my perspective I felt that the mini-lessons represented a good integration of the ideas, knowledge and skill brought together by the whole group. In an audio recorded conversation with Shelley, my critical friend, I stated:

> The mini-lessons were well thought out with specific information related to the idea and supplemented with an activity as well as visual information and usually some find of video purposefully brought together. Lots of people provided support. An individual teacher would not have had the time or perspective to do all of this.

In a separate interview, Shelley remarked that the mini-lessons were straight-forward, the activities for students were connected and pulled together with specific language, information was accessible to most students, and the lessons were focused with a beginning, middle and end. Susan identified that a task analysis had been done by the team and the ideas had been broken down into small chunks to create lessons. Things were embedded into the lessons for the teacher to play with instead of requiring the teacher to create lessons from the team's suggestions. Susan felt that this likely made it much easier for the teachers to implement. Susan also noted that the core competences from the BC curriculum had been threaded through the lessons.

Graham reported that he had integrated some of the ideas and activities developed by the team into his instruction with the grade 6/7 class. He stated that even though his class was older, the videos and activities were engaging. He liked that he was not required to implement all

aspects of the mini-lessons. He stated, “The lessons were pretty structured in Carolyn’s class. In my class, I was welcome to try things, but I wasn’t told I had to.” Graham enjoyed the flexibility to try the activities and resources that he felt he could easily work into his lessons.

Carolyn, the grade 4/5 classroom teacher, liked that the lessons were well organized for her in advance with all of the materials she needed, ready to go. However, she also liked that she had the flexibility to build on or change any part of the lesson as she felt she needed. Carolyn stated that she brought her knowledge of what would work with a whole classroom of diverse intermediate students. She stated,

> I think knowing what would work and what wouldn’t work with grade 4s. Just individually with my class. The delivery and what they will understand and respond to. I feel that my knowledge is still somewhat limited compared to a teacher of 20 years. But I know these kids really well.

She also acted as a conduit between her whole class and the transdisciplinary team, providing important feedback regarding how she felt implementing the lessons as well as how her students received and worked with the information and activities. Carolyn’s ability and willingness to use the lessons with her whole class and provide feedback about how the students received these lessons was crucial to the group’s understanding of how to help students learn metacognitive strategies. Her information was also vital as we tried to create lessons and activities that would be inclusive of all students.

The process of discussion, lesson planning, lesson creation and editing, lesson implementation, lesson review and planning continued iteratively throughout the inquiry process. Although the formal research into the professional learning of the educators involved in the inquiry was completed in January of the school year, the inquiry process into how to teach

metacognitive strategies was not complete and likely will continue in some form or other. There have already been plans for team members to share the ideas with other educators and there is a possibility for continuing the project in future years with a different set of intermediate students and teachers.

Professional Learning Through Our Transdisciplinary Process

Simply bringing a group of diverse individuals together to discuss a topic does not guarantee that learning will occur. However, the members of our transdisciplinary inquiry were able to describe and demonstrate that the inquiry process helped them to engage in professional learning. Because of the structure and nature of the current research, educators were asked to be mindful of their own professional learning as they engaged in the transdisciplinary inquiry. Additionally, due to the method of data collection, I regularly checked in with each educator and asked them to reflect upon and discuss their own learning and the learning of their peers. In this way, the idea of thinking about their thinking was infused throughout the inquiry process. So rather than only considering how to help students learn metacognitive strategies, which is often the case when educators are involved with inquiry projects, the educators were also reminded regularly to reflect on their own learning. The three areas of learning most commonly discussed were: inclusion, evidence-based practice, and metacognition.

Inclusion. Inclusion was one topic that all team members commented that they reflected on when they thought of their own learning. All team members commented at one time or another about how Fiona's perspective of teaching students who were deaf and hard of hearing influenced their learning and their practice. For example, ensuring that students are placed so they can hear the discussion and see expression and lip movements, reducing cross-talk, using closed captioning on videos, using a sound field system, identifying who is speaking, and many

more techniques were shared by Fiona with the group. She also made us much more conscious of the room acoustics. Shelley noted that Fiona always helped to clarify her thinking and provided strategies that would be helpful all students in a classroom. She stated:

> Fiona and I have worked together and lots of times she will be aware of something (that I hadn't thought of) and she clarifies it and puts an example to it always because of her lens of students who have hearing impairments. What she does for her students usually would work for all students so I always feel that she clarifies information for me.

Graham also stated, "Fiona talking from the perspective of the hard of hearing or deaf students and just what their experience was of how information could be delivered by me was very helpful".

Other topics such as including students with social emotional struggles, students who struggle with social thinking, students who are gifted, and students with learning disabilities were discussed and considered as the inquiry progressed. In fact, Graham stated that it was good for him to understand how students' emotional responses to things that happen outside of school can influence their learning and impact what he is trying to accomplish as a teacher. He stated:

> To hear from the counsellor and OT that a student can come in and they are ramped up (because of something that happened outside of school); the student is way up here and in no position to take in the information I am providing.

This perspective helped all of us as educators be more patient with students and be more aware of visual cues that might indicate that students were upset or stressed.

Shelley noted that she learned from Caroline, the counsellor, strategies for building relationships and listening with the heart. Additionally, Shelley commented on the wealth of materials and resources that Caroline had and was willing to share. Shelley stated:

> Caroline is really helpful because I am not the counsellor type. I am not very cozy; I am pretty cerebral. Caroline brings other strategies such as developing relationships first, keeping it simple, about what matters most is that someone is happy or has a strategy to figure something out for themselves. She has a wealth of resources.

Caroline, as the counsellor, commented on how hearing different views broadened her awareness of how to support students with diverse learning needs in her context as a counsellor.

> Also, we have the OT because again that really addresses the different needs in the classroom. The perspective of the hearing-impaired teacher who has brought to light some ideas about trying to use different modalities… but now this is even bringing more of an awareness.

Carolyn, the classroom teacher, noted how helpful it was to understand how the various associated professionals in the district could help her meet the needs of her students. She stated:

> It has been super helpful. From an OT perspective I was not even sure how an OT worked in the school…so what kind of things does she handle? How could she help me and my class? So that was very informative and Fiona with the deaf and hard of hearing especially since I have two students who have hearing issues… and from the counsellor's side of it because we have lots of kids that have things that they are struggling with in their lives so to have her perspective, I am going to learn more.

It appeared that by meeting the different associated professionals and having a connection with them Carolyn was better able to know where to go and who to ask to find out information about supporting her students. Additionally, to be working with and in conversation with these people on a regular basis helped her to understand her class better, but she also helped the associated professionals know what types of information was helpful to her and her students.

Fiona, as a teacher of the deaf and hard of hearing, was always advocating for the inclusion of all children in the regular classroom setting. She stated that she learned something important about inclusion too, “I have learned that people were very much interested in being as inclusive as can be and they are willing to learn different strategies which I find exciting. That to me is the biggest learning part.” So, although in her role, she sometimes feels push-back from teachers regarding the strategies she advocates for, in this case, by working closely with the various educators she felt that her knowledge was valued and that everyone was interested in including and meeting the needs of all children.

Lesson planning for diverse students, was a topic that most of the team members commented on regarding their learning. All educators were presented with and developed lessons that focused on the active engagement of students. Lesson planning with the use of PowerPoint was explored. How to incorporate student choice within structured lessons and purposeful activity use to improve student understanding of concepts were investigated. Finally, the team learned about and developed new assessment tools including measures to help student see their own growth in the use of metacognitive strategies.

Awareness and utilization of evidence-based practice. As part of my role as the school psychologist, one of my jobs in most team learning situations is to examine academic research that has already been completed in the area of interest and share it with educators so that research evidence as well as evidence of student learning help inform instructional decisions. In our inquiry, I took on this role; however, Fiona, Caroline, Shelley and Susan, also chose to review research and contact various experts on different aspects of the project as part of their learning. By examining and discussing information from peer-reviewed journals and texts, reaching out to other experts in the field, and reviewing resources that we already had in our possession, the

team was able to broaden its academic knowledge regarding metacognitive strategies. Additionally, the team combined this information with the knowledge and experience the members already possessed and systematically applied this information using a problem-solving feedback loop during the course of the transdisciplinary inquiry project.

By engaging in inquiry in this way, the team enacted the fundamentals of evidence-based practice (EBP), an interdisciplinary approach to clinical and professional practice which attempts to reduce the use of ineffectual practices by combining three differing aspects of knowledge: available research evidence, collaborative professional judgement, and client needs/values (Claridge & Fabian, 2005; Sackett, 1997). By including aspects of EBP to the transdisciplinary inquiry, members already familiar with the concept were able to increase their experience and skill in this area and members who were unfamiliar with the concept were able to gain an understanding and observe modeling of how to include EBP in their own professional practice.

Fiona demonstrated her use of EBP as she reviewed research articles and resources to have a better understanding of how deaf signers can use self-talk (Zimmermann & Brugger, 2013). She also contacted people in her mentorship group about the topic. Fiona reported:

> I have been pouring through my books trying to find certain articles especially on self-talk and I contacted colleagues, some people that I called upon, for extra articles. I have been busy. You want to be the best in your field when questions are asked and I can't give a straight answer right away, I am going to look it up. I am going to see what other researchers have found.

She went on to explain:

> I love the research-based aspect. I think that is just who I am. I wanna strive to be the best I can and contribute the most I can. The last two years of being a teacher here in this

> district I had the opportunity to be part of the provincial outreach program for deaf and of hard of hearing, (the mentorship program), and so a lot of what that program was (doing) was meeting three times a year as teachers of the deaf with specialists in the area. And we would bring in specialists from all over North America and we home in on the research that is out there for deaf and hard of hearing. The research is very slim because we are talking about a very small population. However, as low prevalence as it is the needs are so high. So, we are always delving into whatever research is out there. So self-talk did come up in our conversation. So not only did I do my own research, I also contacted some of my colleagues just to see if they could home in on the exact research that dealt with that.

Similarly, Caroline reviewed her university course notes on self-regulation and metacognition. Susan accessed information from her specialist association and other academic and electronic sources on self-regulation, executive function, and cognitive behaviour therapy. Shelley obtained and read journal articles about metacognition and provided resources on social thinking and understanding confusion. In our own ways Fiona, Caroline, Shelley, and I all brought research information to the group and also applied it into our practice.

Caroline articulated her views of the importance of evidence-based practice to the group. She stated that examining "the research of others is necessary for me because that keeps me accountable and offers us opportunities to feel validated. When what something I intuitively believe or have seen in practice is able to be backed by (academic) research". Caroline's interest in using and understanding academic research to inform practice was echoed by Shelley, Carolyn and Fiona suggesting that educators are very much interested in accessing and utilizing information from academic research to inform and support their practice.

For my part, I accessed academic literature through the university library to clarify terms such as executive function, metacognition, and self-regulation. I actively researched and provided summaries of research on the topic of self -regulated learning and executive function (Greene & Azevedo, 2007; Howard-Rose & Winne, 1993; Panadero, 2017; Whitebread & Cárdenas, 2012; Zimmerman, 1990, 2002). I read journal articles in the area of child development and metacognition and shared information in an effort to ensure that the strategies we were planning to teach students were as developmentally appropriate as possible.

For some members of the team, learning didn't occur through the application of the process of EBP but rather they developed an awareness that EBP existed and that not all practices used by educators were evidence-based or even evidence-informed. For example, Carolyn, the grade 4/5 classroom teacher, reported, "It was a surprise to learn that there are things we are teaching that are not evidence-based. I just assumed things were based on research…I am just starting to wrap my head around that and why it is important."

The group discussed the lack of reliance on EBP in education and identified possible reasons for this: as educators, we often learn from the practice and experience of other educators; unless we are taking university courses, we do not have easy access to university libraries and peer reviewed journals; and there is seldom excess time available to sift through and read academic research. Therefore, it is not surprising that research evidence from academia is not often incorporated into lesson planning activities. However, most of us agreed that educators do use student response to instruction and measures of student skill and knowledge to help determine if the lessons or strategies used by teachers are helping students learn and this is an aspect of EBP.

At one-point Graham suggested that it would have been a good idea for the team to have a collection of hard copies of articles or article summaries for people to access to pull that information into the group discussion as well. Graham agreed that it was important to understand if and how things worked and expressed and wondered how we would know if the effort of our team and the mini-lessons created were effective in improving our students' understanding of metacognitive strategies. He also noted that beyond using academic research we could look for evidence within our practice to confirm if our instruction is effective. He noted: "We (educators) have to be deliberate about things. We should be purposeful. If what we are doing isn't working, we need to figure out why." All of his comments demonstrated a developing awareness of the importance of being intentional about the activities with which we engage students.

The team made decisions on instructional practice based on academic research and student response to instruction. This demonstrated significant learning and required change in the way some educators typically engaged in their work. The team talked about EBP, some members were actively examined academic research and shared it with the team, and the team used observation and reflection on student reaction to the mini-lessons to guide mini-lesson creation. All of these actions, along with recognition by some members evidence-based practice is something they now consider when they teach, suggest that the team members engaged deeply in learning about both metacognition and their professional practice.

Learning about learning. Finally, there was much discussion about student learning but also talk about learning in general. The primary area of professional learning identified by participants was on the topic of metacognition: helping intermediate (grades 4-7) students learn about their own thinking and learning. All team members commented that they felt the project

helped them to be more aware of thinking about thinking, including developing a better understanding of active listening, self-talk, persisting, and help-seeking strategies.

Struggling to create mini-lessons on metacognitive strategies. Through our discussions we realized that part of our struggle to develop mini-lessons on metacognitive strategies was that we had not ourselves been taught about them in elementary school therefore we had no real model to follow. For example, when our teachers asked us to listen, they assumed we knew what they meant and that we naturally were able to actively listen. Most of us, in early primary school, equated listening with sitting quietly cross-legged with eyes on the teacher, 'criss cross apple sauce' as the saying goes. As students we did not experience instruction in critical thinking or metacognitive strategy use, instead we were trained to produce certain acceptable behaviors. Therefore, when we became educators, the models we tended to follow reflected they types of training that we experienced ourselves as students.

Graham, the grade 6/7 teacher, confirmed that being involved in the inquiry project caused him to think not only about how to teach metacognitive strategies to his students, such as self-talk and active listening, but it also made him recognize that as an elementary student himself, he was not introduced to these ideas. He noted that the thinking strategies weren't taught like reading, writing or math. He had experienced learning about these subjects when he went to elementary school, but hadn't been introduced to thinking about thinking until he was in university. He pointed out that the curriculum content and methods of instruction used today in elementary school are in some ways quite different from the content and methods he experienced as an elementary student. He stated:

> I went through drill and kill in school. Math was do questions. I went into my English room and grammar would be written on one board (*indicating the board*), two boards

> (*indicating another board*), three boards, four boards and I was told to start there (*pointing*). Science was transparencies on an overhead and 'start writing'. It (learning and teaching) was very different back then… Not until 5th year university did I even know what the word metacognition meant.

Like Graham, Carolyn, the grade 4/5 teacher reported that she had not been explicitly taught about metacognitive strategies when she was in school, so she originally saw the topic as something peripheral to the curriculum. She stated that the topic, "was different; it is not like curriculum really. It is not like paragraph writing. This is a little more obscure, but the skills are just as important." Because she herself had not experienced learning it in school, nor was she explicitly taught how to teach it, she found it more difficult to think about how to explain metacognitive strategy use to students.

Fiona, like Graham and Carolyn, was aware, however, that teaching the topic of metacognition to intermediate students is not an easy or common practice. She believed that teachers might not know exactly how to teach students about metacognition, even though they recognize these are important skills. She stated:

> Metacognition has sort of been a conversational topic among teachers now for a good 8 years we have been talking about it. But I don't really see it happening in the classroom so this was a great opportunity to figure out how can it go in the classroom. I can see so many benefits to those kids and for adults too.

So, we all realized that times had changed, the education system had changed, and now the curriculum specifically includes metacognitive strategies as a topic of instruction. So, our team set about trying to determine how best to help students learn about metacognitive strategies. To begin with we started to think about our own metacognitive strategy use. As adults we

realized that there are actually many things happening simultaneously when we engage in active listening. We examined how active listening involves the whole body. We might use our eyes to watch facial expressions, gestures, closed captioning, and images; we might use our hands to doodle, take notes, or make diagrams; and we may need to use our hearts to try to understand the emotion behind what someone is saying; we need to use our brain to think about, organize, and remember the information provided or to think about questions about the information. As a team we examined the different purposes for listening (listening for gist, description, directions, and facts, etc.) and decided that knowing what type of listening one is trying to engage in helps to prepare for and remember what we listen to. Through these explorations we developed lessons and activities that we hoped would help students have a better understanding of the active process of listening and thinking.

In addition to developing ways to teach metacognitive strategies for listening, the team explored self-talk and how it could be used to help us remember, regulate emotion, congratulate ourselves, or instruct ourselves. We created lessons on how to use verbal rehearsal to remember by verbally repeating the items we wanted to remember. The lessons provided examples and videos of how self-talk could be used to problem solve, to talk through the steps of a process, or self-question to help with understanding instruction and text. Part of the lessons showed that self-talk could be used to calm. Finally, the lessons touched on the idea of recognizing negative self-talk.

The team discussed how important it is for students to know how to access help, not only by putting their hands up and saying they don't understand but also by asking for a demonstration, working with a buddy, asking to see a completed example, watching others demonstrate, requesting repetition, along with other strategies. We had discussions about how

students can access YouTube and other resources to demonstrate how to do something. The lessons we created tried to provide explicit demonstration, instruction, and activities to allow students to better understand active listening, self-talk, persistence, and help-seeking and choose the strategies that worked for them.

Through the process of discussing metacognition, reading research, developing activities and resources for students, creating mini-lessons and implementing them, our team members reflected on their learning.

Graham's learning. Graham reported, "The biggest take away was the visual and listening and thinking about how we (as teachers) send out information." He also reported that he learned some new vocabulary to describe thinking about thinking and felt that the project helped him develop some new ways to help his students learn about their own thinking. For example, in the past he simply assumed that students knew what they needed to do in order to listen actively. Graham stated that he was able to pull some of the ideas that were discussed during the project into his daily work and he used some of the resources to more explicitly help his students think about their listening skills. He was also more aware of how he as a teacher can help his student prepare to listen.

Additionally, Graham stated that he had already used some ideas and resources from the project. For example, he stated, "I used the things that Shelley pulled in like Cookie Monster and the videos. Also (I thought) about how you can put things out in a humorous way and address them." The videos Graham referred to were short parodies created by *Sesame Street* that were incorporated into lessons to help demonstrate effective listening strategies as well as self-talk strategies for listening to directions, remembering, and persisting. Graham reported that he also intended to use some of the activities the team created to demonstrate to students the importance

of using all of our senses when listening. He reflected that the emotional metacognitive strategy of having students identify and try to change their self-talk from negative to positive was one he would use. He stated, "even the 'red thought' and 'green thought' ideas were helpful for me."

In addition to providing Graham with ideas and activities to try with his class to help them understand metacognition, Graham identified that the inquiry process had made him be more aware that some of his students might not have the well-developed metacognitive skills in areas of listening, self-talk, and help-seeking that he assumed they should have given their grade. For example, they may not know that in order to understand directions best, they should listen and watch during demonstrations because we obtain a great deal of information from our eyes when we are listening. He stated:

> I think a lot of the whole-body listening information was helpful. I come from more of an older teaching background; it is expected that kids know how to do some of these things whether they do or don't. A lot of these things I took for granted.

Carolyn's learning. Carolyn, the grade 4/5 teacher, recognized and reflected on her own learning about metacognitive strategies in a number of ways. First she felt that she learned that it was a topic that could be taught to intermediate students, secondly, she learned about the importance of explicitly naming the strategies for the students and thirdly, she realized that by preparing to teach her students about the topic and walking them through the various metacognitive skills, she learned more about metacognition herself.

Carolyn noted that the beginning of the inquiry she wondered if the students would understand the concepts or if they would be scared by the new vocabulary words. However, after she started to work with her students about the topic she noted:

> It is going really well; better than I first thought it would. They understand it more than I thought they were going to. I originally thought you throw a big word like *metacognitive* at them and they would be like deer in the headlights – (and not understand). They were (confused) at first, but once we talked about it and they worked through some of the activities, then they realized that they knew what it meant.

I think it is not uncommon for our students to surprise us as educators. I know in my experience; my students were often able to understand and recall more complex information. Sometimes the more complex and interesting information is what they were most interested in.

When she reflected on her own knowledge about metacognitive strategies and her knowledge, Carolyn reported that she was not familiar with very much of the vocabulary and she had not thought that the topic was something you would actually teach.

> I was probably like the kids that I didn't know that everything had a label. I didn't think that it was something that you had to teach. I knew in kindergarten you learn what a good listener is; you know 'criss-cross apple sauce' so your hands aren't fidgeting. But I didn't know there was so much more and to give it a name like metacognition… and then to get the kids thinking about their thinking; I didn't know what kind of impact that would have.

Carolyn commented that had she simply been told to teach metacognitive strategies and had not been supported through the process, she likely would not have tackled the topic because she is so busy in the school year teaching other curricular concepts. When Carolyn reflected on lessons that were challenging for her to teach, she reported that one of the activities didn't work as well as she had hoped. It was an activity that she worked on jointly with Fiona, the special education teacher for the deaf and hard of hearing. Carolyn had students in her class who were on Fiona's caseload.

In this activity students were asked to complete some two simple tasks. The first was jumping up and down on one foot and the second was to draw a happy face on their paper with a red pencil. However, before the directions were provided the teacher had the students cover their ears in the first instance and their eyes in the second. The activities were designed so that by taking away one of their senses it made it almost impossible for the students to complete a simple task. After the activities the students were asked to think about and talk about how they felt. As it happened the 'no ears' activity in which the students wore earplugs, was not a success because the students could still hear the instructions. The 'no eyes' activity was successful because none of the students could understand the simple directions and they became frustrated because they couldn't use their eyes. The moral of the story was that we need all of our senses when we are listening. For a short example of the 'no eyes' activity to get a better understanding of the instructions given to students, the actions in which they engaged, and the reflection students were asked to complete during this activity see Appendix E.

Regarding the things that didn't go well with this activity, Carolyn reported:

> The no ears (activity) didn't go very well because they (the students) could hear through the earplugs. They felt very pleased with themselves that they could still hear. But the no eyes activity went really well because they couldn't see and it was the reaction that I expected…I think that as kids they probably didn't think about how important their eyes were for listening.

She reflected that when she did the activity again, she would talk more quietly during the 'no ears' activity to ensure the students couldn't hear. These comments demonstrate how educators learn about their own practice and the activities they create by reflecting on how materials and ideas were received by students during implementation. Carolyn went on to say that in retrospect,

although it didn't run perfectly, she felt the activity helped students to understand how important all of our senses are to our listening and understanding. She also felt that the activity helped students develop empathy for individuals who don't have full use of one of those senses. Without the project Carolyn would not have thought about engaging students in an activity that would build empathy as well as teach about metacognition.

Carolyn also talked about her own learning about metacognition and how she learned some new terms to describe thinking about thinking and learning. Like Graham, she recognized that as adults we often take metacognitive skills such as active listening, self-talk/self-coaching, recognizing confusion, and effective help-seeking for granted because we use these skills without thinking. Because of this, we sometimes assume that students possess and understand them. She stated,

> So, a thing like self-talk, you just kind of think everybody has that little voice in their head. But maybe the students don't know that, just like they don't know that you set up a paper with the holes on the left-hand side when you begin to write. So, these tools, just because I use them as an adult, it doesn't mean that they don't have to be taught and they can be helpful.

Carolyn also commented that her engagement with the project caused her to be more observant of her students' abilities to use metacognitive strategies. She reported that she more often found herself "just noticing that the ones who are academically a little more successful; they do seem to have more of those metacognitive tools." At the end of the project, when asked what she learned about teaching metacognitive strategies to intermediate students Carolyn stated, "Metacognitive strategies are things you can intentionally teach. They are skills that you can't assume that every child has."

Fiona's learning. Fiona, the special education teacher for students who are deaf and hard of hearing, reflected that the project helped her to think about different ways to approach teaching these strategies to students, she discussed her own research and learning in the area of metacognitive strategy use, and she identified what she learned by actually working with Carolyn in the grade 4/5 classroom. When Fiona reflected on her own learning, like both Carolyn and Graham, she noted that by hearing the perspectives of all of the other team members and by working in the classroom, "you have got to realize that these are really important skills because they are built on as the student moves up through the grades. They are necessary skills that are important to think about and teach."

Fiona, like Carolyn and Graham, talked about the importance of language and reiterating vocabulary, giving students the language, they need to think about and talk easily about the strategies they used. She observed that when she was present in the classroom for an activity, Carolyn did a review of terms and ideas. Fiona noted, "When I came in to the lesson, there was just a simple review. They (the students) knew all the definitions." Fiona felt it was important to help students learn helpful language such as whole body listening (what each part of the body can do to help us attend and understand), types of listening and strategies to use for them (listening for details, gist, directions etc.), active listening (making connections, recognizing confusion, noting unknown vocabulary), self-talk (instruction, reinforcing, calming, remembering), persistence, help-seeking, to describe their learning and thinking.

When reflecting on the activity that she co-taught in the classroom with Carolyn, Fiona noted that because Carolyn was familiar with all of the students in the class and Fiona was mostly focused on the few students on her own caseload, Carolyn "picked up on a few things that went unbeknownst to me." This made Fiona think about the importance of understanding the

backgrounds of all of the students in the class because there are multiple exceptionalities in the regular classroom. Here experience in the classroom made her reflect on how, as educators we can be sensitive to all student need:

> Also, when we actually did the lesson, I had some afterthoughts; I had wished I had known a bit more about the composition of the class and not been so concerned about my deaf and hard of hearing students. There are a lot of other needs that we also have to keep in the back of our minds. How can we be sensitive to all of the needs?

Fiona also reported that engaging in co-teaching with Carolyn in the whole class and seeing the reaction of the students to the activity provided her with feedback about the students' understandings. Like Carolyn, Fiona reflected on her experience in the classroom and planned how she might change the activity when she uses it again. She said that the team-teaching experience "gave me a chance to reflect on how I would probably approach the activity a little bit differently in the future".

In addition to learning about how the students would react to the topic of metacognition, Fiona actively increased her own knowledge about metacognitive strategies. She reported reviewing the literature on the topic and also contacting colleagues who might provide more information about teaching metacognitive strategies to students who are deaf and hard of hearing.

> I have been pouring through my books trying to find certain articles especially on self-talk. I have got some key books that I constantly refer back to and some people that I can call upon for extra articles. I have been busy.

Shelley's learning. Shelley, the school special education teacher, reflected that the project intersected well with her own work, provided her with some ideas and materials that she

would use in her practice, caused her to examine her own views on metacognition, gave her another reason to read and research about teaching metacognitive strategies, and required her to think about how to share the information developed in the group with other educators to shift practice. Shelley noted that her involvement in the project was helpful to her because she was easily able to combine ideas and activities developed by the team with her own daily work. She stated:

> I always have my own projects on the go; being in the group has helped me with some of my own things. The example is working with 'what is confusion?' (combines well with my work) with autism trying to clarify strategies for them (students with autism) …

On another occasion she reflected how work on the project and her own practice intersected. For example, she stated, "I was looking at metacognitive strategies and (combining it with) my work with the five-point scale for help-seeking, support, and self-advocacy." By combining her practice with some of the ideas generated from the project, Shelley was able to create new materials and think deeply about her own practice.

She stated that the project helped her better understand how to embed a metacognitive skill into instruction. Shelley noted that having time to organize the materials into purposeful teaching activities was helpful to her because there is so little time to plan. She stated:

> I use the *Sesame Street* parodies in my other program, but I love how (in this program) we have not just used the video but that there was an activity paired with it. I just never have time to do that. That it is such a solid resource. I love being purposeful, using the activity not just watch something but make it into something (a purposeful activity).

Additionally, Shelley reported that she was definitely planning to use the materials and set up some small group instruction cycles that focus on metacognitive strategies for students in her resource groups. Regarding the materials created for the project, Shelley stated:

> I am looking forward to using the slideshows. I have a group that I will have contact time with and I am going to use the slides. I will use all of them but not in a linear (fashion). Some of the videos I haven't used and I will use them more intentionally.

In addition to obtaining resources and ideas to implement in her own practice, Shelley related that she felt being involved in the inquiry caused her to think about her own views regarding the ability to help students develop metacognitive skill. It also caused her to consider the cause and effect relationship between educator assumptions and their interactions with students. Shelley reflected:

> Metacognitive skill and executive function can be seen as growable… I always thought of them as developing through maturation. Other educators might not have thought of that on such a long continuum. What is delayed vs. deficit? The simple thing to say is that they (students) have a deficit but the complex thing to say is that they have a delay. Delay means that if we change what we do, they may develop and change, whereas deficit is like is oh well there is nothing we can do.

In addition to examining the effect of educator assumption on practice, Shelley commented that her work with the inquiry also provided her with motivation to do research about teaching metacognitive strategies even when she was doing her own reading. She reported sharing the information she finds with others and she also demonstrated how she was able to combine the work on the project with information on the internet to develop and recognize strengths in her own practice. For example, during an interview in the middle of the inquiry she

stated spoke about use of ‘wrappers’. By using a wrapper, the clear explanation of a self-monitoring or metacognitive strategy, just prior to instruction can help remind students to use these strategies. For example, prior to providing directions for a complex task, the teacher can remind students about active listening, identify the type of listening the student will be doing and give them pointers on how to for example remember the order of the directions in this example. Wrappers only take a few minutes and remind students about strategies that they know but may not apply if not reminded. Shelley stated:

> I was looking for, what was the quote I sent you? I was looking at metacognition and I found information about providing a ‘wrapper’. I really loved it because it summed up what we were doing, which was choose a cognitive skill and embed it into an activity. When I read it, I thought, ‘Hey I thought I am a good wrapper’.

This comment is a good example of how our inquiry as a transdisciplinary team, the group discussions and joint lesson planning on helping students understand metacognitive strategies, enhanced educator professional development. In this quote Shelley has demonstrated that she was reading academic research on a related topic for lesson-planning purposes, came across information in that article which caused her to reflect mindfully on her own practice and provided validation for something she was already doing. Her reading provided her with the vocabulary to identify the practice she was already using and caused her to use her own self-talk to congratulate herself on her practice (something we were encouraging the students to do). Additionally, because she was now an integral part of a transdisciplinary learning team, she shared this information with the group by communicating it with me so we could identify the process to the other group members.

Finally, part of Shelley's learning about metacognitive skills entailed thinking about how to share information with other educators to shift practice. She suggested,

> There is a lot of shallow information available to people and I see them (educators) using the shallow stuff. Part of what this group is about is getting that deeper piece. How does this group when we leave here, how can we shift even one other person in the building?

In this statement the 'shallow stuff' Shelley is referring to is the seat work and activities that educators sometimes access through the internet. These activities are what we might call busy work. They require students to engage in activities that do not require a great deal of thought or planning, do not require the educator to have a sound knowledge base on the topic, but do keep students busy during class time. Shelley would like to see educators be mindful of the activities with which they have their students engage and ensure that these activities are well thought out and based on sound pedagogical practice. This type of lesson and activity planning requires deep thinking, research, discussion, and collaboration between educators and does not occur by downloading quick lessons or activity sheets from internet sites.

Susan's learning. Susan, the OT, reported that her learning in the project resulted from her own reflections about teaching students about self-talk as well as hearing others' perspectives and thoughts about metacognition. Susan noted that September and October are very busy for her as the only OT in the district, however, because of this project she stated, "I definitely have had the opportunity to do more reading and to reflect on the broader grouping of metacognitive strategies that complement each other."

Susan reflected on how she helps students use self-talk in her practice but she also focused on how to describe self-talk to other professionals. Susan reflected, "I have used self-talk in certain ways but what does self-talk mean? and how do you effectively describe it to someone

else?" These are some of the questions she was asking herself. Susan also noted that she was quite comfortable helping students use self-talk for motor planning purposes. She also used it to help students change their perspective. According to Susan, helping children change red (negative) thoughts to green (positive) thoughts is an evidence-based practice for helping children with motor planning and coordination challenges talk themselves through the motor activity. She was quite comfortable with this idea but was very interested to hear how other professionals may help students use self-talk and for what purposes. She stated,

> Looking at it from each different lens was interesting…Looking at it (using self-talk) from you and Shelley's lens of helping a child with a learning disability or from Fiona's lens of helping a student with a sensory impairment, and now the classroom teacher with behavior management in a larger group…

The project also helped Susan to think about how to express information clearly to the educators she works with and supports. Susan explained that as an associated professional within the school system, she often helps educators understand aspects of metacognition and self-regulation. She felt this project helped her learn how much and what types of information would be useful for her to share with educators as they struggle to find ways to share this information with students. She stated:

> Thinking about thinking, there is so much to know there. And to know how to help students and teachers understand it; to kind of get feedback about how much was enough information yet not too much information, how to help them apply it and how much time to reflect on the information before you provide more.

Susan also reported that the inquiry made her reflect on how busy classroom teachers and other educators are and how much they are expected to do.

> I think that teachers are overwhelmed with all of the things that are coming at them. Changes in the curriculum, competencies and district driven learning opportunities that may not feel as meaningful to them. It would be great to try to figure out how to get other teachers excited and supported in how to weave those strategies in. I have been thinking about that.

Caroline's learning. Like Susan, Caroline, the school counsellor, was quite familiar with the concept of metacognition particularly as it pertains to adults. She had a degree in psychology so much of the information was a refresher for her. However, determining how to take this knowledge about metacognition and turn it into activities and lessons relevant and accessible for intermediate students was something that she found challenging. She was eager to share what we learned with other colleagues of hers in the classroom. In regards to her own learning she stated: "One thing I did do is look back on some resources that I had. It refreshed my memory on what metacognition was and how you would work with that with children." She also noted that she had never thought about using self-talk with students who are deaf and hard of hearing before so she was grateful for Fiona's ideas and research on the subject. Finally, she stated: "This project helped to bring the idea of metacognition into my practice now as a counsellor and I am able to use these ideas and activities with the children I work with."

Caroline noted that being involved in the inquiry has caused her to reflect more on her own practice and add some of the ideas about metacognition into her work with her students. She stated, "I try to use different modalities in my classroom but now this is even bringing more of an awareness." Now when she works with students in small groups, she includes some of the ideas that the inquiry group had been talking about:

> What has been an exciting part is not only has this extending into the (4/5 and 6/7) classroom but it also extends into my awareness and it extends into my awareness of children when I am doing other lessons say on responsibility and say even when I am doing one on one or small group work. That has been really helpful.

Like the other members of the team, Caroline had been planning and reflecting on how to use some of the resources that were created in her own practice.

> Some of the videos with the Cookie Monster I've been thinking about. I have been looking over the lessons as they have been sent. I have looked at them and made connections about what I could use with different students too again with that psychoeducational piece.

In addition to utilizing the ideas and resources in her own practice, Caroline noted that the inquiry process has caused her to reflect more often on metacognitive strategies in general.

> Well I've incorporated it into my own journal. I have a practice of journaling so when some of these things (ideas about metacognitive strategies and how to teach metacognitive strategies) have come up, I have been noting it down in the journal. I have personally kept a journal for ten years.

Caroline went on to discuss how through the inquiry process she was "reflective about what worked and didn't work. I have been working on the compassionate piece and not getting down on yourself. It is learning and it is sometimes uncomfortable."

Rhonda's learning. From my perspective, I knew about metacognition from my study of psychology as well. However, this topic usually focused on more advanced strategies such as goal setting and planning or specific strategies related to reading. Creating the lessons and activities with the intermediate students in mind was enjoyable but also challenging. Unlike

reading and writing, there are very few resources or ready-made lesson plans to help teach metacognition for listening, remembering, or help-seeking. And although there may a great deal of academic literature on these topics, this information has not found its way into the hands of educators in a workable way.

At one point I was looking for metacognitive strategies for listening and I was becoming frustrated because there were many resources which noted that the student should use their eyes to look at the speaker, their brain should be thinking about what is being said and their body and hands should be quiet. I felt that although this might be a good place to start, it really wasn't that much different than 'criss-cross apple sauce'. I had to delve into research on second language learners and clinical counselling to find information about what we can actually think about as we prepare to listen for gist, or for steps in instructions, or for how others are feeling. I wrote in my journal:

> No wonder not very many teachers are explicitly teaching metacognitive skills for learning, it is hard to find any resources other than very surface ideas about what we do when we listen. I know when we listen, ignore distraction, understand the vocabulary, hold information in short-term memory, connect new information to information we already know, use our eyes to watch for expression and gesture, use our ears to listen for tone, formulate questions, use our hands to doodle or take notes and so many other things. I know that each person will only find some of these things helpful. How can we make this very complex process more transparent for students in a way that doesn't overwhelm and allows for choice? I hope we can actually do this.

The lack of practical resources available makes it more difficult and time consuming for educators who want to focus on this important area to create resources, lessons and activities.

This is a good example of the research-practice divide that is cited in the literature that may be a result of the transmission style professional learning that many educators have experienced.

Like the other members of the team, I had not been explicitly taught about metacognitive strategies in public school. I developed these skills through trial and error. In university, I took many courses both in psychology and education, in undergraduate and graduate levels, and developed a good knowledge base on metacognition. However, I have never taken a class that provided any information about how I might specifically teach metacognitive strategies to students. Additionally, with the exception of my MA project in School Psychology regarding the Self-regulated Strategy Development Model of writing instruction, I cannot recall learning about or observing an educator work with a whole class regarding explicit metacognitive skill development beyond some explanations of how to think when reading or completing math computations.

Therefore, I did quite a bit of learning about what types of strategies might be useful for this age group of students, what resources were available, how to create active learning opportunities in these areas, how to create self-assessment tools for students, and how to aid educators measuring student growth in these areas. It required me to delve into the new BC curriculum, look at educational resources, and examine my own use of metacognitive strategies.

An example of how I extended learning in assessment can be seen as I struggled to develop some kind of easy self-assessment measure that the students could use to think about their metacognitive strategy use. I decided to create a visual analogue measure. I was first introduced to this type of measure when studying about the healthcare system and how some researchers had used a linear analogue to help patients identify how much pain they were feeling. It required the patient to draw a line that represented the pain level and the researchers could then

measure the length of the lines over the course of the treatment to get a numeric measure rather than using a Likert scale. I adapted this so that students could color in bars to represent how much they used a strategy and updated it based on team feedback. Carolyn used it in class encouraging students to use pencil crayons to color the bars in (See Appendix F for a copy of the third iteration of the self-assessment that was used in Carolyn's class). More color represented more use. Students could watch their strategy use grow over time and identify which strategies were more useful for them in a way that was more enjoyable and visual than simply answering questions about their strategy use.

Team professional learning. The learning that occurred about metacognitive strategies, EBP, and inclusion for the team appeared to fall into three distinct categories: increasing educators' understanding of inclusion, EBP and metacognitive strategies; changing practice to help all students learn about metacognitive strategies; and helping other educators understand metacognitive strategies. Each team member at some time mentioned learning something that they didn't know about metacognition and inclusion. In some cases, educators simply learned new vocabulary, for example one educator had not heard the term 'verbal rehearsal' as a means of self-talk before. In some cases, educators learned about a process. For example, none of us had thought about self-signing, using sign language as a form of self-talk for deaf and hard of hearing students, until Fiona told us about the research on the topic. Some team members, particularly those who worked directly with students, talked about how the inquiry changed the way they thought about their practice. Many educators in our team noted that they now knew they could actively teach metacognitive strategies and that students are interested in the topic. Most educators in our team noted that the inquiry helped them to think about how they present information to students and how to be more inclusive. For example, at least four commented on

how important it was to be intentional about the activities they have the students engage with. Finally, all team members talked about how to help educators outside of the team better understand metacognitive strategies.

Although some of the learning that the team members describe is simple skill development or vocabulary growth such as how to use closed captioning when showing a video or what 'verbal rehearsal' means, much of the discussion on their professional learning extended well beyond simple pieces of information and knowledge. Much of the learning included transformative shifts about teaching metacognitive strategies and creating inclusive environments. This type of learning is transformative and cannot be distilled down to individual component parts.

Transdisciplinary Inquiry: Describing a Complex System Moving Toward Emergence

Our transdisciplinary system represented the antithesis of the typical transmission models of professional development. Typical stand and deliver presentations and workshops, even those that extend over a number of instances, utilize a simple, relatively closed, hierarchical, linear system and expect a cause and effect relationship to occur. Traditional transmission models attempt to transmit pre-determined, information from an expert to novices. This transmission occurs without interaction with the external environment, with little interaction between the learners in the system, without strong positive relationships being forged, and often with diverse knowledge being suppressed. Unlike a simple closed system, the data from this study suggests that our transdisciplinary process actually developed into a complex autopoietic system that was self-organizing, self-sustaining, ambiguously bounded and far from equilibrium (Begg, 2013; Boden, 2000; Kolb & Kolb, 2009; McMullin, 2006; Ward et al., 2017). Learning in this case was both simple in nature as knowledge was acquired by the learners but also transformative.

Self-organizing and self-determining. Complexity theory posits that complex systems have a number of specific qualities. These interconnected attributes of a complex system could be seen in our transdisciplinary team throughout the inquiry process. First, our team was self-organizing (Barab et al., 1999; Heylighen, 2008) as individuals chose to be involved in the group, helped choose the other members of the group, had choice in how much and in what way they would contribute, and determined whether they would remain in the group. Secondly, the power in the team was distributed and the structure was non-hierarchical. Thirdly energy from the process sustained and interactions with the environment allowed the group to develop and evolve.

Autonomy: Unlike some professional development opportunities that are provided by school districts, this project was voluntary, and participants had autonomy in their learning and chose to be part of the learning community. Shelley commented:

> Everyone was there of their own free will and interest, which is not usually the way things work. There is usually a quid pro quo. I think this made it easier for people to leave their roles to the side when they came because it was not strictly mapped out as it is sometimes.

The other members identified that providing educators autonomy helped to develop enthusiasm, commitment and feelings of autonomy. Graham stated: “It was effective because it was a volunteer project from the get-go…everyone had the feeling if this really isn’t working for me, I don’t need to be here.” Susan noted, “I think that the nice thing about our group was that (people) came together willingly who were interested in broadening their views on things.” In addition to having a choice of whether to be involved in the group, the team members also had autonomy in what and how much they would contribute to the group. In fact, members of the

team themselves helped to determine what role they would play in the project. Carolyn wanted to be really organized and was willing to try many of the mini-lessons in her class. Therefore, she implemented many of the lessons with her students.

Shelley noted, “Part of the success was that it started from us. It wasn’t top down.” She identified that this is not always the case when professional development activities are imposed on staff members and they are required to attend. Susan went on to state, “if you are going to get buy-in for anything, the people have to be able to choose. You can’t direct.”

Team members also chose their roles and the amount of time they would commit. Susan, the OT, had thought about working with students in the classroom, but they considered that it might take too much time for her to prepare. Susan stated:

> At one point we did talk about me doing a lesson in front of the class and although I don’t think it would be outside my comfort zone, it would be stretching me.

Instead of working with teachers and students in the classroom, Susan worked hard behind the scenes. She helped with resource creation, strategy development, and suggestions for student self-reflection. Susan’s actions demonstrate the idea of self-organization as the members of the group determine their own roles.

Fiona helped us all understand how to support deaf and hard of hearing students, helped with activity planning, and participated in team teaching. She described her role:

> I brought more awareness of how to include a deaf and hard of hearing child in the regular classroom. Maybe I was able to demonstrate some whole class teaching strategies to another colleague and educate the children at the same time: No cross talking, one person speaking at a time, hands up so we can see who is talking. Those strategies…

Caroline was interested in the social-emotional aspect of the lessons and wanted to create and team teach lessons on listening with the heart she stated:

> I'm bringing the expertise of knowing the connection between mind and body; how the brain works in social situations and with behavior…it is a very understanding approach … the social emotional components that students bring every day into the classroom.

Shelley wanted to support the classroom teachers, utilize some of the ideas in her resource groups and act as the site manager organizing space, release time, and materials; and I started the discussions and made tentative outlines of the group meetings, gathered materials and ideas and created initial outlines of lessons, and ensured that everyone had copies of the PowerPoint and materials. These roles weren't assigned they simply developed as people volunteered or stepped into positions. Each person contributed to the group in some way and each contribution was important.

Caroline commented:

> We were allowed to lead in our area of specialization, and we came together and used our specialization in a leadership role. You were encouraging us and gave us opportunity to use the capacity we already have in our district. Which rarely happens… This gave me the actual opportunity to experience leading in my specialization not just from a philosophical perspective. And it can be done; it works well; and it is not a lot of extra work. It was even better than I thought it could be.

Power distribution. The self-determining nature of the team is demonstrated in the fact that the power for decisions was distributed amongst members as was the workload. One example of this ground-up decision-making can be seen as the team describes how the topic of metacognition was established. One person did not determine the topic and in fact, the topic

itself actually changed many times as the team worked through the inquiry together. Graham described the process well when he said that it morphed from more traditional topics such as paragraph writing or reading comprehension strategies to the possibility of teaching skills such as listening and self-talk that students could use in their daily lives outside of school and regardless of their academic ability as well as across subject areas within school. Graham noted that even after the initial topic was decided upon, how we decided to address the topic was in a continual state of design and redesign.

Shelley also described this organic, self-determining process:

> It (the topic) didn't end up being what we first thought it would be. I think we were able to do what we hoped to accomplish through the process though because we weren't looking simply at writing or improving a specific academic skill; the lessons in the end became about learners. That is a deep thing to do. We started with some shallower (problems)…how could we make this specific thing better, but in the end, we took all of the disciplines and put them at the same table, we were looking at the whole learning, not just the parts… If we would have focused on writing it may have turned into a single use strategy. Whereas what we worked on can be applied across (curriculum and grades). You start to see it in all areas.

The final example of the team being a self-determining structure is the fact that the collective was not hierarchical. Many members of the group commented on this attribute of the team. Susan talked about the importance of respect and the dispersal of power within the team on numerous occasions. "There were no hierarchies which are sometimes present when you work in a group or a feeling that there is a hierarchy. And it (this team) didn't have that," Susan stated. Graham observed that no one person really took over the process but that power was shared

among group members. Caroline noted that each team member was encouraged to lead in their area of expertise. Shelley noted that the team worked effectively as a collective with no one person trying to gain notice or credit for the work we were doing.

Over the course of the six months, the participants in the study were responsible for developing a transdisciplinary team, the team and inquiry developed without being dictated to by an official leader, without a preordained plan, and without a pre-decided outcome. The process grew organically and demonstrated self-organization and self-determination. Team members began to lead in the areas of their expertise, decision-making, lesson-planning, and resource creation was dispersed throughout the group. The team adapted to the environment as mini-lessons were implemented and adjusted based on their implementation. As unexpected challenges occurred in the environment, such as lack of TOCs and the special education audit, the team adapted and obstacles were overcome.

Ambiguously bounded. Another condition that our transdisciplinary inquiry shared with that of complex systems is that both are ambiguously bounded. The team was a bounded entity in that it developed a shared purpose, strong relationships, and a shared conceptual framework. All of the team members united in the same goal, to help students understand metacognitive strategies to help them learn. Additionally, the team membership remained constant over the six months except for one team member who had to take a leave at the very beginning of the study due to health issues in her family. This consistency provided time for the team to develop strong relationships with feelings of trust, support and commitment which were discussed in the last section so I will not re-iterate the comments from the team here.

Although it maintained an internal consistency in that the team members retained a stable purpose, membership, and framework; the group did not represent a closed system. Instead

the team's boundary was semi-permeable in that selected information, material, and actions were exchanged with other systems external to the group and the external, physical environment. Team members obtained information and materials from academic journals, other professionals, and students; additionally, they acted on their working environment by implementing their ideas and interacting with their peers, students and parents outside of the team.

For example, Caroline talked about how she discussed the information she was learning about through the inquiry with members outside of the group. She stated, "I have talked to some colleagues of mine… and I was also talking about it to people in our school-based teams." Graham spoke about how he shared ideas and resources with other colleagues. Fiona discussed talking to people in her mentorship group supported by the Provincial Outreach for Deaf and Hard of Hearing as she was looking for research on metacognition for students who are deaf and hard of hearing. She also mentioned speaking with the District Special education teacher for Vision Impairment and Blindness about the project. Shelley spoke about discussing the project with her colleagues and with administration in her building. Susan accessed resources from her provincial organization. Carolyn spoke about the project to other educators as well. Additionally, input about student reaction to the activities and lessons was obtained by those involved in the project and discussed by the group as well as parent feedback regarding some aspects of the lessons. Finally, many group members had looked at research, located resources and obtained information from various outside agencies and journals. Thus, the transdisciplinary system, that developed from a multi-disciplinary group, was selectively permeable and there was definitely a selective flow of information and material into and out of the system.

Far from equilibrium. The team underwent change in the beginning as new team members came on board and later as new information was obtained, new activities and ideas

were being experimented with, mini-lessons were implemented and adapted and differing perspectives were discussed. The team was constantly receiving positive feedback from the environment that disrupted some of the team member's assumptions, such as the realization that learning something new is frustrating and that even in grade 7 students may not know exactly how to listen effectively. These new experiences and information moved the team towards innovative understandings and ways to work with students. This feedback helped the team to function far from equilibrium and in a non-steady state. There were feelings of confusion and lack and uncertainty that is typical when a process is not homeostatic. This seemed to occur in our case because the inquiry was not progressing in a linear fashion and was not dictated from above but was negotiated through a non-hierarchical structure. Carolyn, the grade 4/5 teacher, identified the discomfort caused by the ambiguity of the developing process when she talked about how difficult it was for the group to decide into what exactly it was going to inquire. She stated,

> I am not going to lie, it was super daunting at first because I was really unsure about what our focus was…at first I thought it (the topic we would work on) might be writing and I thought perfect because been a beast that I have been trying to tame, how to attack writing… And then it changed and I was like now I don't have any idea what we are doing. Now metacognition. I had a general idea about what it was but I learned that it meant lots of things so then I really didn't know (what we were doing) but now I am much more comfortable.

Shelley also described the organic nature of the project and how it developed in a non-linear fashion as she described:

> It grew as we went…Everyone was there through their own free interest and will which is not usually the way things work. There is usually a quid pro quo. I think that made it easier for people to leave their roles to the side when they came. Because it was not strictly mapped out as it is sometimes. It developed as we went.

Graham commented a number of times about the changing nature of the project and how it morphed and was definitely not in a steady state of balance. He stated that he likes to be involved with projects that change and develop because it is exciting for him; he noted that life in the classroom is changing and chaotic some of the time and one of his strengths is being able to adapt to changes and encourage others to think outside of their comfort zone. For him the fact that the project was open to new ideas was a positive attribute because although the non-linear, non-homeostatic nature of the project may have been less stable, it meant the team had agency and was learning:

> I have mainly positive thoughts, if it shifts directions it doesn't mean that its bad maybe we get a chance to step back and say I kind of wish we could have done more on that but in the moment you kind of take it where it goes and make the best of what we have we kind of redesign… I do think that is how I work best, by feeling that I have some thing to say over what is happening. I also believe that you don't learn something in one day, so traditional Pro-D of sit listen and then go away and expect to have (and use) it for me it doesn't transfer. If I am at least not thinking about it and working it out in my head and coming back and touching base and trying things, I just don't see it as permanent learning for me. I think you really need to do things and work with them and have some ownership in order to actually feel good about it.

In addition to the fact that the transdisciplinary inquiry was in a constant state of change and developed as it grew, another aspect of the team that helped to maintain a state far from equilibrium was the diverse perspectives and knowledge that each individual brought to the group. The differing perspectives caused dissonance, disagreement, and discussion and helped to disrupt assumptions that can easily be made. This dissonance upset the equilibrium of the group and made space for new ideas and thoughts to emerge. Graham described this dissonance within the group:

> Disagreements were expressed…Different viewpoints and different acknowledgements – not necessarily full disagreements but done in a positive and productive way...it (was) effective (for learning).

Graham, Shelley and Susan all noted the importance of hearing different points of view and how this stretched thinking. Graham stated:

> I value hearing different points of view and not necessarily having to agree or believe but just realizing the complexity of everything.

Shelley reflected: "I think the real key piece to it was just putting some great minds in a room together, even if they don't always agree…it makes you think and review your perspective."

> Susan stated, "I actually feel that the most valuable framework is to have many different viewpoints to all come together rather than just one perspective…that's how we learn."

Therefore, by the team members having a common purpose, building positive relationships and interacting with each other, they were able to utilize the differences in viewpoints and really listen to each other in order to create space for new learning to occur. This disruption of balance in the presence of cohesive forces seemed to be important to the learning of the team.

Finally, the team received feedback from the environment which allowed it to pursue its iterative goals. Carolyn described the iterative process and developmental nature of the team's leaning as it created, used and received feedback on the lessons. She stated:

> We were a transdisciplinary group meeting and talking about our plan, implementing it in the classroom, and coming back and talking about how it worked, changing it and meeting again … all while thinking about our learning.

Feedback came to the group from the reflections of individual team members, from the students that the members were involved with, from other professionals outside of the team, from the physical environment and even from some parents. As the project moved in an iterative fashion and the educators tried various things, discussed their work, adjusted their ideas and tried things again, the project moved and shifted forward allowing the group and individuals to gain knowledge and change as the project evolved.

Learning and emergence. Knowledge developing from an adaptive complex system demonstrating emergence is non-reducible, meaning it is different than the parts that generated it. This new knowledge represents a transformative kind of learning that is generated by bottom-up knowledge production and occurs through the interaction between new experiences and new knowledge from the environment combined with interaction between diverse individuals or agents within the group that pushes the system towards a new path and new possibilities (Brailas, Koskinas, & Alexias, 2017; Swartz & Sprow, 2010). In our transdisciplinary team, deep learning (as described in the previous section on professional learning) was demonstrated and described numerous times by the team members. Deep learning occurred within and between team members that resulted in fundamental shifts in conceptual understanding, philosophy of learning and pedagogy. Team members did not obediently accept information presented but rather

reflected on diverse ideas, became aware of implicit assumptions, and interpreted and applied the new knowledge. The transformative learning in this case is likely a result of the complex adaptive system's movement toward emergence.

Connecting the Data to My Research Questions

My original research question queried whether transdisciplinary inquiry could be developed and used within the public education system as a method of professional learning. In this chapter the data presented suggests that a transdisciplinary inquiry was established, the team members did engage in professional learning (both simple and transformative) and the transdisciplinary team acted as a complex adaptive system moving towards emergence (which likely allowed for transformative learning to occur).

In transdisciplinary inquiry, collaboration occurs between individuals from different academic disciplines. It takes place over time; includes clarification of language, development of a joint conceptual framework as well as interaction between the members, society, and environment; involves the co-creation and application of knowledge; and addresses a complex, societal issue (Fam et al., 2018; Klein, 2018; Min et al., 2013; Robinson, 2008; Stock & Burton, 2011; Toomey et al., 2015). In our case two classroom teachers, a special education teacher, special education teacher for the deaf and hard of hearing, OT, counsellor and school psychologist did collaborate in a public school for over six months (diverse academic and professional stakeholders working together in context, over time). During this time the team was able to: identify a joint issue (helping students better understand and think about their learning); clarify goals, ideas, and language in the group whilst developing a joint conceptual framework (in the form of mini-lessons and resources on metacognitive strategies for intermediate students); interact with each other and the environment (including other professionals, students, academic

research, and the physical site); and applied the co-developed knowledge (by implementing the mini-lessons in context whilst discussing and reflecting on the process). The team produced and applied academic, experiential, and local knowledge and expertise within the context of society and was therefore engaging, at least to some extent, in transdisciplinary inquiry.

The case description also revealed that the team members in the transdisciplinary inquiry were able to identify their own learning, both simple and transformative (Mezirow, 2003; Simsek, 2012; Swartz & Sprow, 2010). Simple knowledge acquisition was described as team members spoke about their growing awareness of the roles of district personnel, their knowledge of simple inclusion strategies such as use of visuals and closed captioning on video recordings as well as straight forward knowledge acquisition of vocabulary terms such as 'metacognition' and 'verbal rehearsal'. Transformative learning occurred as the educators questioned and altered their own practice, implemented new ideas in the classroom, discussed evidence-based practice, and revised their own beliefs on teaching and learning particularly in the areas of metacognition and inclusion.

The data and information presented in this chapter also suggests that utilizing a transdisciplinary inquiry as a method of professional learning resulted in the creation of a complex adaptive learning system that likely facilitated transformative learning (Davis, 2008; Davis & Sumara, 2006; Morrison, 2008; Ovens et al., 2013; Ramiah, 2014; Sanford et al., 2015; Swartz & Sprow, 2010). The system was self-organizing (the team managed to develop and grow without the need of an administrator), decision-making and power were distributed (non-hierarchical). The system was ambiguously bounded (obtaining information and material from other professionals, the students, members of the community, books and journals, electronic resources and any other aspects of the context or environment), existed in a condition of

disequilibrium (team members felt confused, struggled with ambiguity, and experienced a feeling of in-flux or change, particularly during times in which new learning was occurring) and the system moved away from the status quo and towards a state of emergence (learning was transformative and the knowledge construction was far beyond the capacity of the individual agents).

Therefore, the data and information presented in this chapter suggest that transdisciplinary inquiry can be successfully used as a vehicle for educator professional learning in the public education system.

Chapter 5: My Perspective on the Case

Another question that I hoped to answer through this research was more personal in nature: How could I (as a school psychologist) both initiate and participate in transdisciplinary inquiry as a method of professional learning? To answer this question, I need to describe my experience from three different perspectives: a participant, the facilitator, and the researcher. Through the case description I have already explained my learning and my experience as a team member regarding metacognitive strategies and to a much lesser extent as a facilitator. In this chapter, using excerpts from journal entries, discussions with my critical friend, and personal reflections, I will identify the most important ideas that I learned. Having Shelley as one of the team members, but also as someone who would act as a critical friend, helped me to reflect on my own learning and my facilitation of the group. Shelley asked me questions, made observations, and provided me with insights that I would not have encountered on my own.

Team Member

From the perspective of a team member, the two most important things that I learned actually can be combined: 'bring an empty cup' and actively seek out differing viewpoints. The first statement here, 'bring an empty cup' I had written down at least four times in various places in my research diary and I even doodled in on the agenda of the first team meeting. The idea behind this phrase was actually reinforced for me during this process and it comes from a philosophy I encountered during my 20's while I was training in martial arts. I had already trained in Tae Kwon Do and Karate (black belt in one and brown belt in the other) when I wanted to extend my cross-training so I decided Aikido would be a good addition. The first day I met with Izumi, Sensei, he recounted this story that I have retold here:

A sensei agreed to accept a skillful student with previous martial arts experience into his school. The student was athletic but prideful and difficult to teach. The sensei was very wise, but when he offered instruction or suggestions to improve the student's practice, the student would complain,"I know that already" or "but we did it differently in my old style". The sensei worried that the student would not learn with this mindset, therefore, one day he suggested they take tea.

The sensei gave the student a cup of tea but before the student could drink, the sensei began to pour more tea into the cup. Pulling the cup away, the student exclaimed, "Sensei, I have a full cup; there is no room for more tea". The sensei replied, "Correct, you cannot accept more tea when your cup is full…just like you cannot accept more knowledge if you believe you already know everything. You must come with an empty cup if you hope to learn more than you already know".

This story has always resonated with me and it does so even more now. As a school psychologist in a school district, I am often viewed as an expert or specialist and I do come with a great deal of experience. It is easy, therefore, for me to believe that all of my ideas and knowledge are correct and the suggestions I make or the way I do things are the 'right' things to do or ways to them. However, if I go into learning situations believing I am an expert and I already know more than others, then I will never learn more than I already know. I must come to each new learning experience with an empty cup and be prepared to encounter new ideas and new knowledge if I hope to be a lifelong learner. Izumi, Sensei passed away in 2013, but I still remember this story and I do believe that it is a parable that we all can apply in our lives.

Regarding the transdisciplinary approach to learning, I believe the process works if the participants, who all bring a great deal of knowledge and expertise, also come with empty cups.

So, as I participated as part of the team and heard viewpoints and knowledge presented by others that was sometimes contrary to my own beliefs, I remembered that I needed to bring an empty cup to all the sessions. After this experience I find myself actually going a step further and actively seeking out people with ideas and backgrounds that are different from my own, as I feel that this is a great way to stretch thinking, spark creativity, and continue learning.

Facilitator

From the perspective of a facilitator, the three important things that I learned during this process were: how to provide some organization yet relinquish control and trust the team; the importance of unconditional positive regard within a diverse group; and the danger of assuming others understand what you mean.

Distributing power and control. Because I had not facilitated this type of group before, because it is in my nature to be very organized, and because I enjoy having control over situations, I believed that it would be difficult for me to let go of control over the group process. I knew, however, that it was necessary for the power to be distributed across the members in order for the group to develop into a transdisciplinary team. In my journal, before the first meeting that I had with the teachers at the elementary school in June, I wrote:

> I really hope that I haven't over-organized this first meeting. I have an outline and some possible topics and how we might inquire into them. I hope this is enough yet not too much. Wow, it would be way easier just to stand and talk to the group about what I think the team should do. I hope that I can do the transdisciplinary process justice.

After that first meeting I wrote:

> I think things actually went pretty well. Everyone listened to what I had to say but my explanation of what the study was about only took a little bit of time. Everyone seemed to

> think that I was going to assign a topic of inquiry to the group, but when they discovered that it was up to the team to decide…that is when the conversation and ideas really started to ramp up. We didn't really come up with a solid topic…something about cognitive self-reg. But I think it is a good start…it definitely **isn't** going to be writing.

Upon reflection, it was at this first group meeting that I actually started to give up control. I could have easily talked the group into an inquiry on helping students write as it is an area of interest for me. However, in the meeting, it was clear that the biggest concern was not written expression but rather helping students learn and think about their own learning. In retrospect I am very happy that I did not control the group decision because the topic of metacognition likely required me to learn and stretch a lot more than writing would have.

Shelley brought to my attention that although I originally organized the process, the group eventually determined its own timeline and other educators began to share the leadership role. In a recorded conversation with Shelley before the first whole group meeting, I stated:

> A lot of my professional learning in this process is being focused right now on how to work within a group that is so diverse and allow the group to direct where we go and what we inquire into. It is scary for me to come in like this. I am not going to tell them what to do and I am **not** going to steer the process toward something I have knowledge about. I am going to try to manage a group of people in a way to be sure each will feel heard and yet I still need to somehow be able to make sense of the stuff going on. It will be interesting.

At one point I stated that I felt that perhaps I was being too domineering with the group. Shelley stated that she did not necessarily think that I was being bossy, but she believed that I was having

to give up some of the control with which I am most comfortable. I think that she was very observant and likely saw the care I was taking to try not to be bossy.

Shelley also talked a little bit about the importance of being organized yet flexible; how important it was to come in with a plan but not dictate to the group, allowing the group to discuss and decide. Upon discussing my role, in the focus group interview Shelley observed:

> I think that part of the success of that was the clear vision from Rhonda about how she was planning to manage the group and the flow of the discussion and coming prepared but flexible, not taking over. Having materials ready, being aware of the ideas that were talked about but still being able to have flexibility at the time to move the discussion along in the direction that the group needed.

Graham, closer to the end of the study, spoke about the importance of individual choice and how although someone had to facilitate, no one really took over the process. I was happy to hear his perspective on this because I was trying very hard not to tell people what to do and not to be too opinionated. In an interview with me Graham spontaneously observed, "you are very aware of how people feel. Even if you were to have told me exactly what you thought should happen, I would not have thought that it was an overpowering thing."

Another worry that I had, associated to my lack of control, was the fact that group members could withdraw at any time from the study. During one audio recorded conversation I had with Shelley, at the beginning of the project, I expressed concern about if and how I would be able to build cohesion in the group that would work together for four to six months:

> The other part that scares me is that it is one thing to work collaboratively with three people, it is another thing to do that with seven people and have all the voices be heard…a lot of my learning is how do I help run this? How do I start something that is

open enough but also has enough boundaries to be comforting to people and ensure that something is actually accomplished? What can I do to ensure that every member has what they need to learn? I worry that the whole thing will begin and then just come crashing down. There is nothing holding people in the group.

However, as the project unfolded and I started to learn about and rely more on the members of the team, I realized that there really wasn't anything about which to be fearful. The feeling of belonging that I developed as part of the team and the distribution of responsibility throughout the team really acted as a protective factor for me personally. I began to realize that no matter what the outcome of the process, it would not be viewed as a failure. I found that as the team members became trusted friends as well as colleagues, I had no need to feel embarrassed if I made an error, and I found that as we explored the unknown ideas as a team, the whole process was quite exciting. So, for me becoming part of the team was actually an antidote to the fear I was feeling about the whole process.

Unconditional positive regard. As already alluded to in the last chapter, one thing that did help to hold the group together and provide a safe space to disagree was the development of positive relationships between the members. As the facilitator, I recalled something that I had learned during university classes in counselling: 'unconditional positive regard'(Rogers, 1951). The term, coined by Carl Rogers in the context of client-centered therapy, means to accept and care for individuals regardless of what they say or do. As I interacted with the team members, I tried to remember to not only be open to new ideas, but also to demonstrate genuine positive regard for my teammates even if their ideas conflicted with my own. To extend this, I also tried to be appreciative and point out strengths that I witnessed in each of my teammates. Typically, I might have had thoughts in my own head such as, "wow, Carolyn is really brave to try all of

these new ideas and lessons with the class" but I would not have acted on these thoughts or stated them aloud. During the facilitation, I made sure that I actively told people what I saw as their strengths and how much I appreciated them. I believe this caused a chain reaction because the more I expressed appreciation for my team, the more they seemed to appreciate me and each other. At one point in my journal writing I wrote: "Looking for the positive in others is contagious; I need to do this more often." In fact, at the end of the project I reflected:

> I received many gifts throughout this research study. I was better able to understand professional learning for educators, help students learn about themselves, and learn about myself in the process. The gift that was the most meaningful to me personally was having the opportunity to come to know and appreciate my fellow educators. I believe that often we are too busy and too disconnected to really know the people we interact with in our work places. We always talk about the importance of building relationships, but I wonder how many of us build meaningful relationships with our colleagues beyond what is necessary to do our jobs.

Now, whenever I am asked to collaborate with a group, one of the first things I do is take the time to get to know the team members as people by taking a genuine interest in their personal stories and I try to make sure to look for and acknowledge strengths whist responding to differences with unconditional positive regard. Sometimes I have found this to be challenging, but it has been very much worth the effort.

Importance of language. One of the other important things I learned as I facilitated this diverse group of individuals is how dangerous language can be. Historically, I just assumed when I spoke, the person listening to me would hear my words and automatically share my understanding, at least for the most part. However, through this process of working with

individuals from different disciplines and professions, I realize how dangerous this assumption is. This became clear to me when my critical friend, Shelley and I had a disagreement about the term ‘master teacher’ during a whole team meeting. At one point in a group discussion she stated that I was a ‘master teacher’ and I almost took offence. In her defense, she intended it as a compliment; that I had lots of experience, expertise, and skill as a teacher. Hearing the term, I took it to mean someone who dictated to others and felt superior, which is exactly the opposite of what I was trying to do. She could tell by the expression on my face that I was not pleased with the term and a clarifying discussion ensued in front of the whole team. If we had not taken the time to clarify meanings and if we did not have a strong positive relationship, the misunderstanding could have been problematic and lead to hurt feelings.

I noted this incident in my journal and went about looking for these misunderstandings in my professional life and found many examples of them. I learned that we interpret the words and statements of others based on our own history and experience. When individuals with different experiences are brought together it is important to clarify meaning and ensure that what is said is interpreted in the way it was intended. This has caused me to paraphrase important information back to individuals when I am unsure of meaning and before I get upset by a meaning that I attributed to their words that may or may not have been intended. It has also made me watchful for such instances when I am facilitating a group.

Researcher

From the perspective of a researcher, I observed the importance of face-to-face communication, the difficulties that technology can present, and that many educators actually yearn for opportunities to engage in deeper learning.

Importance of face-to face communication. Because of the prevalence of technology in our daily lives, before this study I assumed that computers and electronic communication made our lives easier. As I became engaged in this research, I found that the opposite was true. Surprisingly, some people are not comfortable with electronic communication. For example, in our case some people did not know how to use PowerPoint, others knew how to use it but only had Pages installed in their computer and could not access PowerPoint. Therefore, every time we sent out a copy of the mini-lessons out on PowerPoint, we also had to send out a PDF with the same information.

In a similar vein, the school district used Apple TVs as screens in the school; however, some teachers used their own personal PCs in class and were unable to airdrop data. On numerous occasions members of the team reported being unable to glean tone from emails and two educators in particular stated that they often misunderstood the meaning of emails if they were too detailed. Add to this the fact that I observed the most creative ideas surface from the group when we were engaged in face-to-face conversation. Team members became animated, elaborated on other's ideas, shared 'ah ha' moments, and used humour when they were face-to-face. We were better able to read other's expressions, understand meaning, and build relationships when we sat together. Plus, it was more enjoyable and I certainly felt more connected when we were together as a group. This leads me to observe that although electronic communication may be a helpful addition to the collaboration process, in my opinion it should never replace the actual face-to-face interaction of people.

Educators yearn for deep conversations and learning. Throughout this project I spent a great deal of time wondering why the educators bothered to work so hard on the project, over such a long period of time, or even become involved in this project at all. At the beginning of the

study I was worried about even inviting people to be part of the team because the topic was so ambiguous. I wrote:

> It is not typical for a researcher or potential professional learning facilitator to approach people they don't know well and say, "I want to do a study about a group of professionals learning something. I am not sure who will be in the group or what the group will be learning; the group will decide. I will be asking you to do this mostly in your spare time and I am not sure how long it will last, perhaps to next December. Oh yes, in addition to being involved in the inquiry. I would like to videotape an interview with you on three separate occasions. This will likely have to be after work. I also would like you to be involved in a focus group. Of course, this is completely voluntary. Would you like to be part of it?" Who would volunteer for this; will this even work??

However, the team members did volunteer. They spent their time before and after work, in the hallways, on the weekends, and during lunch time connecting with each other, discussing the project, and learning from each other. They did this whilst saying they enjoyed it, felt energized by it, and would do it again. This made me realize that many educators yearn for deep learning, conversation, and connection; it made me realize that people will work hard on a project they believe in. From this experience, I believe that professional leaning can be more than an add-on in which educators feel obligated to engage; it can be exciting, uniting, fascinating, and exhilarating. This type of professional learning develops pride, synergy, deep learning, and encourages educators to become powerful agents of change in the world.

Chapter 6: Analysis

In chapter 4, I described the development of the transdisciplinary inquiry process, demonstrated that the participants' involvement in the transdisciplinary inquiry resulted in professional learning, and that through the process the transdisciplinary team did develop into a complex adaptive system. In chapter 5, I presented what I learned and noticed during the process and added information to address the second research question regarding how I as a school psychologist could participate in and facilitate a transdisciplinary inquiry for the purpose of professional learning. However, to develop a more complete understanding of how the inquiry occasioned professional learning, it is important to analyze the process from more than one perspective. Therefore, in this chapter, the process will be represented first from the perspective of team members involved in the inquiry and then from a holistic perspective, that of an adaptive system.

Individual Team Members' Perspectives

By using a categorical analysis of interview and focus group transcripts as well as field notes of conversations, I have attempted to provide an inside look at the transdisciplinary inquiry process. Team members identified five key elements they believed to be important to their individual professional learning. Although each of the elements was unique, they were interconnected. Therefore, I have represented them in an organic, overlapping image (Figure 1). The professional learning that occurred through out the process has already been discussed and is represented by the center of the diagram. All identified catalyzing elements feed into and are connected with the professional learning experienced by the group and include: application of knowledge, experiencing multiple perspectives, developing positive relationships, experiencing positive emotion, and active facilitation.

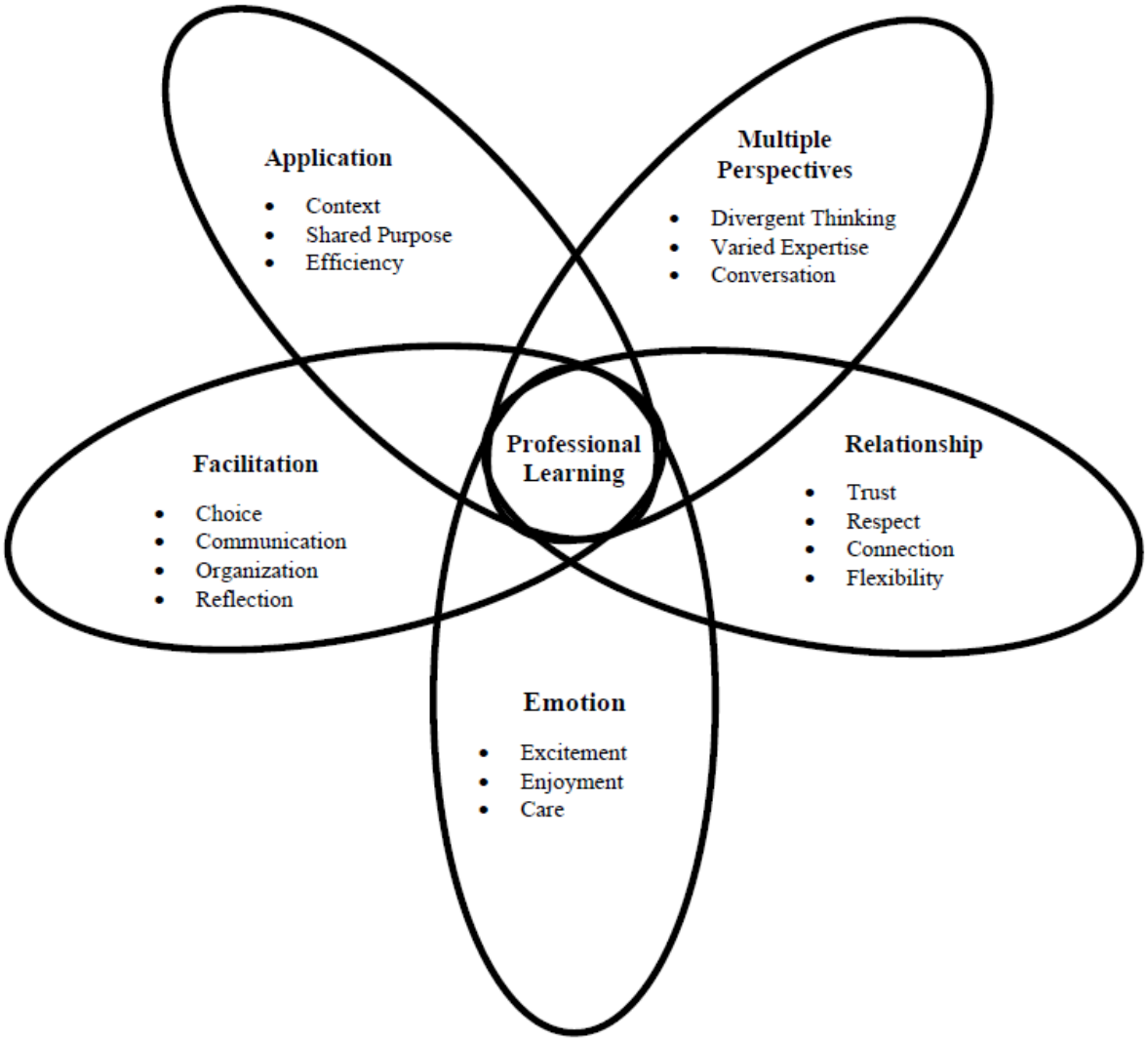
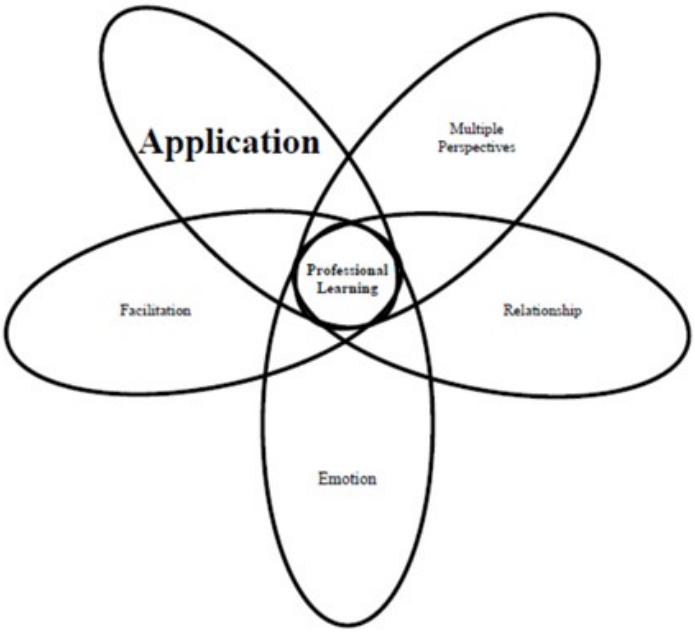


Figure 1. Essential elements experienced during transdisciplinary professional learning



Application. Application is the act of putting a plan or idea into action. Carolyn, Fiona, Graham, and Caroline all mentioned that applying their knowledge in the context of a real classroom helped them to better understand the information discussed by the group. All team members noted that knowing that the mini-lessons were going to be applied with students in a class, helped them to put the information they learned into action, motivated them to learn about metacognitive strategies, and encouraged them to develop mini-lessons to help students learn about these strategies. Implementing the mini-lessons in the context of the classroom provided a shared purpose for the group and momentum for the project. The importance of knowledge application to the learning process is consistent with both enactivist and social constructivist theory which suggest that individuals typically learn more effectively when they are actively engaged in relevant learning activities within the social and physical environment. Additionally, by doing two things at once, reflecting on their learning and applying this learning in the creation and implementation of mini-lessons, educators were able to used their time efficiently.

Context. The use of some of the mini-lessons by the intermediate teachers allowed the team to prepare for and see how their ideas and plans fared in a whole-classroom context. Since a primary goal for the professional learning of educators is to help students learn, it was important

for members of the team to use some of the mini-lessons and activities with their students and reflect and act on feedback regarding the students' reaction to the lessons.

Carolyn, the Grade 4/5 classroom teacher reported that using the lessons allowed her, and the group through her reports, to know whether the ideas and activities were interesting, understandable, and relevant to the students. In fact, at the beginning of the inquiry she wondered if the students would understand the concepts or if they would be scared by the new vocabulary words and complex ideas. The only way to know if the information was interesting and understandable was to try them in context. Carolyn stated, "Putting it (the mini-lesson plans) into play is the only way to know if it will work."

Also, the implementation allowed Carolyn to develop a deeper understanding of the subject matter as she worked through the ideas with her class. She reported, "I am a learner by doing. You can talk to me but until I do it, I don't fully understand it. So, I was learning at the same time they (the students) were." Additionally, upon reflection she felt, "Until I actually executed it, it all went in one ear and out the other. Once I had the first mini-lesson under my belt, I knew where we were going and it was more relevant to me." Carolyn observed that by working with the information on metacognition, discussing it with students, working through activities with students, and reflecting on student reaction, she learned more than she would have if she had simply listened to a presentation on, or read a text about the topic.

Graham, the grade 6/7 teacher, felt that application of ideas rather than simply discussing ideas was important to his understanding of the topic. He noted, "This could have all been a theoretical discussion which I don't think would have been as good." He went on to say that for him practical application is necessary for understanding and skill development because "teaching isn't a theoretical pursuit" it was very much applied. He stated that he was able to experiment

with the activities and ideas in his grade 6/7 class and share some of the resources with other teachers outside the project. Graham explained, in an individual conversation I had with him, that seeing the student's reactions to his lessons and activities in class provided important learning for him and that context matters. He reported that in his experience, he has used the same lessons in two different classes. With one class of students the lesson went over really well and with the other class it was not received well. Therefore, he felt that trying lessons or materials in class helps him to figure out if and how it will work with a group of students. It also provided him with information about what conditions need to be present for students to experience success with the material in each context.

Regarding how he had applied the information in his classroom, he stated that he had used the mini-lessons less systematically than he would have liked:

> I have used the Cookie Monster videos in my class and talked about them. I know a few other teachers and I shared it with them. It is a fun way to get a topic across. I have also brought up how they (students) acquire information. I hope to use the earplug activity.

He also planned for next time, "If I was to do it again, I would frame it (the lessons) in my class a bit more. I would shift some of the things I am doing to implement the strategies a bit more." In having an initial experience with the lessons and the information in his class with his students, Graham was already changing and improving how he would implement the lessons in future classes suggesting that he felt the information produced through the inquiry process had value. He cautioned, "You can't just do it in one day and it is never perfect; it is never clean; it is always messy and sometimes things don't work with a particular group and sometimes it does."

It was not only Carolyn and Graham who used some of the mini-lessons or ideas developed in the project. As noted previously, Caroline, Fiona, and Shelley had all either

implemented some parts of the project in their own contexts or were planning to use them in the near future. Caroline, the counsellor, felt that the big benefit of being part of the team was having discussions and access to the materials created, she was able to extend the lessons and adapt them in her own context. She stated:

> What has been an exciting part is that it (thinking about thinking) is not only been extending into the classroom but it has extended into my awareness of children when I do other lessons say on responsibility or when I am doing one on one or small group work!!

Shelley, the special education teacher, also planned to use some of the lessons. She was already using some of the videos but reported that this experience had made her decide to use them in a more intentional way. She was planning to set up a small group intervention based on the metacognitive strategy lessons. She stated, "I feel that it (the set of mini-lessons) is something that I will apply."

Susan, the OT, noted that applying knowledge and building skills in a real-world context is difficult when educators are often not provided the ongoing support needed to implement new ideas comfortably. If a new concept is only shared by educators through a transmission model, she felt that it would be difficult for them to translate it into practice. Susan observed:

> A lot of times information doesn't get applied because the people who are going to apply it are either overwhelmed or don't quite understand all of the aspects of it and haven't had a chance to play with it. Reading a book or going to a very short workshop isn't necessarily the way to support people in applying knowledge in their day to day world. And the classroom is very complex. So being able to work with teachers who are actually in the classroom and able to also ask questions and adjust their practices and to support

them in actually trying something that you hope based on your theory and knowledge and research is going to be helpful.

Additionally, Susan felt that obtaining the classroom teachers' feedback was very valuable in improving her own practice. She reported that, "It is one thing to have ideas; it is another thing to have them implemented. And when the role is more consultative it is harder to work through the implementation." Susan noted that as an associated professional she does not have daily contact with classroom teachers and often she will provide teachers with resources or strategies only to return a month later to find that none of the strategies, actives or resources were actually used. By having more constant contact with the classroom teachers in this process, by having time to explain and discuss why the strategies are important, and by providing the teachers time to experiment with and then ask questions about he mini-lessons, activities, and strategies, she felt that this method of providing support resulted in the actual use and implementation of the ideas and strategies she suggested.

Fiona, the special education teacher for students who are deaf and hard of hearing, acknowledged that applying ideas in the real-world context is important, but it doesn't always happen, referring to the research-practice gap in education. She pointed out that if the ideas are never implemented, the students cannot benefit from them, no matter how good they are. The team members hypothesized as to why good ideas are not always implemented. Lack of: time for preparation, instructional time, resources, support, confidence to try something new were all ideas that surfaced as possible reasons for not implementing good ideas.

Unlike, traditional transmission models of educator professional development, this project allowed a number of educators to work together to come up with and in some cases try specific mini-lessons for a topic that has been deemed important for a number of years but was

also quite complex and not typical subject matter such as reading, writing and mathematics. Although we hear a great deal about the importance of teaching critical thinking, problem solving, and social emotional skills, many educators are still struggling to cover the traditional subjects in the traditional ways.

Shared Purpose. According to most members of the group another advantage of planning to use the mini-lessons with students was that the process provided an authentic purpose for all of the work that was being done and it added momentum to the project. Fiona reflected, "The fact that the lessons were being implemented gave us a meaningful purpose. It wasn't just this fluff which so often we are listening to these days. I get a bit frustrated with the fluff." By 'fluff' I believe she was referring to traditional professional development training sessions, where educators have been subjected to grand philosophical theories from external experts. Often these ideas have little relevance and serve to promote a political agenda rather than helping teachers help students learn in the context of the real word. Fiona also commented on how wonderful it was to have such a variety of people together to work toward a common goal: "This has been an awesome experience with different grade levels, different focus areas all coming together around one table and it has really opened my eyes to the different perspectives, and yet we are all connected."

In addition to providing a common goal and purpose for the team to work together, the fact that the group was co-creating mini-lessons that would be used with real students provided an authentic audience for the work. Fiona reflected, "We knew it was going to be implemented. I think we needed expectations like deadlines. If we don't have deadlines for these things (contributions) some of these things won't actually happen." Fiona also felt that the fact that the lessons were going to be presented to students increased the team's commitment to produce

quality work. This speaks to the motivational effect that having an authentic audience for our work provided. She stated:

> It was important to set the bar high and it gave a sense of commitment to the project. If you were just there to pass time away, get out of the classroom and have a little chit chat with some colleagues, it was not the purpose for this type of group, and it was not the focus either.

Carolyn, the grade 4/5 teacher, discussed her commitment to the project: "I am a fairly new teacher and I feel overwhelmed with the FSAs, District Assessment of Reading Team, and District Wide Write" but because she knew that she could use the lessons in her practice and because she knew that everyone had put a lot of work into the project, she "made it a priority and slotted the lessons in" to her busy days.

When Carolyn reflected on professional development experiences that she has had in the past, she noted that she hadn't every really applied anything from them. But she never had a team support her in doing so either.

> I can think back to Pro Ds I have done, and I can't remember ever really implementing anything from a Pro D – I hate to say. But you sit and listen for hours. That is not how I learn, and I don't think that is how a lot of kids learn either.

Here Carolyn is reflecting on the nature of learning and questions whether anyone ever learns anything deeply when they are simply being talked at. In her characterization of typical professional development, Carolyn suggests that a transmission paradigm is ineffective in helping educators develop knowledge and shift their practice. Her comments support the use of embedded professional learning.

During the focus group Graham, Carolyn, and I discussed the positive pressure that existed due to the implementation process. We identified that in our desire to support each other and because we knew the students that would be experiencing the lessons we were creating, all of the team put in extra effort to create interesting and well thought out experiences for the students:

> Graham: She (Carolyn) had some pressure too. There is something pushing you because you ran the lessons in class.
>
> Carolyn: I need pressure.
>
> Graham: So, pressure isn't necessarily a bad thing.
>
> Rhonda: Yes, nobody out there is putting pressure on us. But I felt responsible to all of us and to students. We could also have come up with boring stuff for students, but we didn't want to do that. So, I think pressure was good. It made me productive.

Susan felt that the fact that the lessons were actually going to be used motivated educators to take the time to learn together and gain a better understanding of metacognitive strategies. Susan stated, "I think this process has empowered the adults to think about thinking because they have to think about thinking enough to coach their students on how to do it." This statement supports statements made earlier by Carolyn, the grade 4/5 teacher, as she reflected on her own learning. She echoed Susan's sentiment that educators increase their knowledge of a topic through joint creation with other educators as well as active engagement with the topic and their students as lessons and activities are used in the classroom.

Efficiency. The nature of the transdisciplinary process made it quite efficient. Typical transmission models of professional development require time be taken away from the students and classroom as an expert lectures to educators on a topic. Then the educator must try to translate the transmitted information into activities or lessons useable in their own classrooms or

contexts, which is often quite different from the context presented or experienced by the expert lecturer. Often the educator, after leaving the lecture or workshop, lacks access to all of the resources and knowledge that the lecturer possessed. So, either the educator becomes frustrated and does not use the information, or they spend inordinate amounts of time clarifying information, completing their own research, uncovering resources, creating activities, and developing assessments methods before they can start to try to implement the ideas in a classroom. Furthermore, because the educator tries to complete this in isolation, the process is particularly difficult because they have little emotional or informational support.

By utilizing the transdisciplinary inquiry process, the development, creation, and implementation of the lessons occurred through the actions of the team and was developed within context and at the same time that the information was being developed and shared. The team members provided both emotional, informational, and technical support to each other. Therefore, by its very nature, the transdisciplinary process, although it takes a little time from each of the members, is likely more time effective and efficient overall.

Carolyn, the grade 4/5 teacher, reported she was initially worried about the time commitment especially because she was a newer teacher. However, other than coming to the meetings, some chats after school, and making time to try and put mini-lessons into her schedule, it really didn't require her to spend that much time preparing because a lot of the planning had been done already. She stated:

> I was nervous going in because I was worried about what it was going to do to my workload; it didn't really add. It was a lesson I was delivering… I would review the PowerPoint for about 15 minutes and make sure I understood. I would watch the video.

> The handouts had already been copied for me. Setting up the Plickers was maybe half an hour.

It is notable that Carolyn did not consider the time she spent in discussion with the rest of the team members or the time that she collaborated with individual team members in lesson creation as being part of her preparation and planning. Perhaps she considered this time collaborative and enjoyable so it did not feel like an addition to her workload.

Shelley, the special education teacher, was also thinking about the amount of time the process required as she did not want to take too much time during the school day away from her students. After school she was often busy with IEP meetings and meetings with external agencies so she had little time to prepare lessons. Shelley recognized that the transdisciplinary inquiry took extra time to collaborate on the lesson planning, however she believed it was worthwhile because the planning and her learning was applicable to her daily work beyond the project and the products created were useful to her in other aspects of her work. Additionally, her learning and planning often happened simultaneously:

> I am someone who (continually) processes stuff. I am someone who doesn't shut my mind off, right. So, I can be doing the dishes and grocery shopping and lots of other things when I am thinking. It is not sitting still thinking. I just fit it in. It has applied pieces of my own work so I really haven't had to do anything separate.

Shelley felt that the time set aside to meet with the whole group was valuable. "I think it was very important that we had time where we could stop thinking about everything else and just sit in a group together." She felt that more group meetings would have been helpful. She reflected, "We were so rushed; it's still a side project even though we have some release time; it is still something on the side."

It is important to note that all of the itinerant educators scheduled the three team meetings into their daily work schedule. The two classroom teachers were given half day release time by the district administration for the whole team meetings, however during one of the half-day meetings they were also engaged with Individual Education Plan meetings so they had to enter and leave the team meeting occasionally. Finally, the special education teacher was supposed to have release time, but often there was not enough TOCs to cover her position so although she was at the meetings, she could have been called away at any time.

Caroline, the counsellor, felt the most restricted by the time and was concerned that it negatively impacted her ability to be effective in the group. Caroline felt that because she was only scheduled at the site two days a week and because she did not work out of Student Support Services, it was harder for her to connect with the team. She stated:

> In an ideal world if things were unlimited to allow release time for us to all sit down and not feel rushed and more often. I would feel more able to be in the loop. This being at different schools. I f I was at the same school that would be good as I would have more time and feel more connected to what is going on… That would be the biggest thing for me… I would have appreciated more time with everybody.

Unlike many of the other team members who felt that although time was limited, they were still able to use it efficiently and be productive, Caroline felt that the lack of time available was detrimental to her and the project. To compound this, she did not feel as comfortable communicating electronically, so she felt that more face-to-face time and more time in general would have helped her be more productive and feel more a part of the team.

> That restrained the whole process. If I had more dedicated time it would be better, being there, at the school only two days a week, so when you put something else (the project)

> that takes that time away (from my typical work with students). I don't know if it was a barrier, the thinking of the slides and doing it on the internet, might have been because I am not savvy on the internet…it would have been easier to clarify if we were face-to-face.

She reported, "I found the time line a little condensed for me."

Fiona and Susan both felt that it did take a little extra time to attend the meetings, but much of the lesson planning was done on a flexible schedule so people could choose when they wanted to engage with the project. Additionally, they commented on the fact that we had many informal hallway talks or impromptu casual conversations that all served to move the project forward but did not take that much time. Susan stated, "It didn't take a lot of time – the face-to-face meetings. I met with you more often like hallway conversations quite regularly and would touch base with Shelley when I was at the site for another purpose." Susan went on to say that she made the time to work on the project because she thought it was an important endeavour. However, she was conscious of maintaining a work-life balance. She stated, "I am invested enough to want it to be successful and valuable but not enough for me to spend all of my evenings and weekends on it." Susan felt that working together was efficient because team members help each other fill gaps in skill and knowledge allowing for the development of a plan that could be implemented and a set of mini-lessons:

> I have read through the lesson plans; I had printed them off so I could read through them… I have given you things that I have created and told you how I would change them to work in this situation. At my level of time and also my level of technical expertise or lack there of I have worked in partnership with other professionals who are really good at that and I lean on them to do that. So, I will have a lot of ideas but actually

> have them come out into a finished product is sometimes a barrier for me…I have given suggestions.

Fiona stated, "This has taken more time – just meeting, but I justify it that some of my students are in the class we are working with. I am not directly working with the students, but I am working with the team."

She went on to say that the time investment:

> was worth it because I got to know fellow colleagues better and on different levels. I have had the opportunity to impart some knowledge on deaf and hard of hearing and it has given me a chance to get into the classroom and work with a classroom teacher that I didn't know before.

Fiona identified that the process was efficient because we accomplished a number of things at the same time:

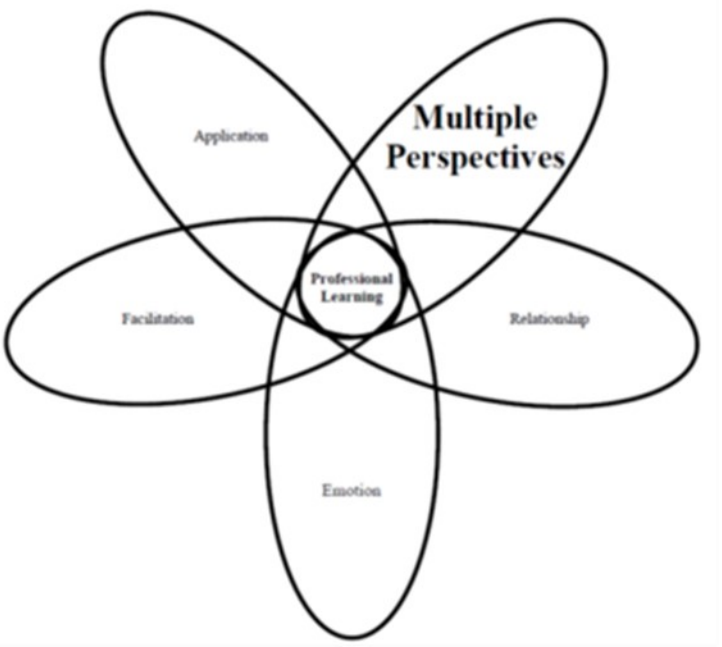
> I would do it again. I think it is a great way to bring key people together and share knowledge. You end up with a product (the lesson plans, activities and resources) and you build relationships at the same time. It is important now but also moving forward because you may be working with those people again in the future.

From my perspective as a school psychologist, I felt that it did take some time away from working with students, but since I regularly was at the school and the site and the Student Support Services office, the same office that Fiona and Susan work out of, I was able to connect easily and quickly with people. In the focus group I reported, "Because we were doing two things at once, building lessons and focusing on our own learning, I think we got a lot accomplished in a short period of time." I feel that if I was facilitating this group as part of my job rather than as part of a research project, I would have felt less guilty about taking the time

away from the acknowledged aspects of my work. However, I did feel that this was a much better use of my time than preparing to do a stand and deliver presentation to a group of teachers about metacognitive skills. This process allowed me: to build stronger relationships with teachers, to develop a deeper understanding of metacognition, to co-create a product that could be adapted and used by many educators, to actually hear and see how my input was influencing the learning of teachers and students, and to feel a sense of belonging to a team working on an important topic.

Everyone agreed that we got a lot accomplished; more that we thought we could have managed individual and more successfully than if we just attended a workshop. We learned about metacognitive strategies, created lessons and activities about what we learned, and were able to implement these ideas in our own individual contexts all within the span of a few short months. However, we would have all liked to have had more time to spend on the project.

Multiple perspectives.



Often when we think of professional learning for educators, we think of bringing a group of teachers together to learn more about their craft. Although a group of teachers can also have diverse professional backgrounds, they are likely to be more similar to each other than they are to the Occupational Therapists and School Psychologists both in knowledge and philosophy, partly because their educational backgrounds and work lives are dedicated to

slightly different things. For example, I have become aware of the difference between the perspective of a school psychologist and that of a teacher many times during discussions pertaining to topics such as standardized testing, identifying students with special needs, and cognitive testing. Because of differences in: knowledge levels and backgrounds regarding measurement; experience with numbers and quantification; vocational training and purpose, there will likely always be a tension between school psychologists and educators in those areas even though both professions have the best interests for students in mind. To be able to fully understand all perspectives an individual would have to be trained in, have experience in, and live as both a school psychologist and a teacher.

The beauty of a transdisciplinary approach, unlike traditional disciplinary approaches where the belief is that one world view is correct and others are inferior, is that one perspective does not hold superiority over another; in fact, different perspectives are encouraged. The goal is to use divergent perspectives to push boundaries, develop broader understandings, and imagine creative solutions to complex issues. This goal is consistent with complexity theory in which emergence or deep change happens through the interaction of agents that demonstrate both diversity and similarity. Unlike a typical professional learning community, which is often comprised of only one type of professional, our team included professionals from a variety of disciplines and experiential backgrounds. The composition of the team, therefore, is consistent with a complex system comprised of an interconnected network of perspectives and relationships with the whole becoming greater than the sum of the parts.

Varied expertise. The project allowed for the diverse expertise that already existed within our school district to be tapped and utilized, whilst uniting and connecting individuals rather than isolating them as 'experts' in individual fields. Since each of the educators in the group had

different areas of expertise, it seemed that there was a huge variety of knowledge and skill to learn from just in our small group. The sharing of expertise between individuals in the group, rather than relying on outside experts was appreciated by Shelley, the special education teacher, when she reflected:

> The whole thing of someone coming and fixing us as opposed to us creating from the ground up what is the best fit for (our school). It is such a struggle. We have people here that know what the problems are and what to do about it. We just need the time and we need everyone to get out of our way and let us do what we can do.

Fiona, the special education teacher for students who are deaf and hard of hearing, like the rest of us who had never been involved with this type of inquiry before, was unsure if the transdisciplinary inquiry was going to be able to be developed, maintained, or be effective. But as the project started running and people became invested in it, we all discovered together that it could really be done. Fiona explained:

> In the beginning I wondered, hmmm, how is it all going to work? Then as the meetings progressed and we all came from different perspectives, but we all have the same goal; there are different ways to come at something…I think the transdisciplinary approach is a great way to have professionals come together and share their knowledge…I think in the end we felt that we all contributed, and we all did play an important role.

Susan agreed that bringing colleagues with different expertise together and building a team may be a more effective method to promote learning than traditional transmission models of expertise:

> Bringing a diverse group of people together with different perspectives to guide and coach each other is great. Top down doesn't work because you will have people say "you

> can't tell me what to do" others are overwhelmed. It is important that people become part of the team and feel included.

Another aspect of sharing expertise that came to light as Caroline, the school counsellor, talked about her learning and the process of sharing knowledge. She noticed that as the project progressed, the control and power was being dispersed:

> You were asking us to lead in our area of specialization and we came together and used our specialization in a leadership role. You were encouraging us and gave us opportunity to use the capacity we already have in our district. Which rarely happens…This (project) gave me the actual opportunity to experience leading in my specialization not just from a philosophical perspective. And it can be done; it works well; and it is not a lot of extra work. It was even better than I thought it could be!

Caroline also noted that the transdisciplinary inquiry project brought people together and that the team was supporting her in in meeting her goal of helping the children she works with:

> I came into this profession to begin with to help kids. I wanted to make a difference in the lives of children. And realizing that we can't do it alone – it makes it more enriching personally and professionally if we work together.

Divergent thinking. The variety of perspectives that individuals in the group brought together naturally caused divergent thinking to occur. Unlike 'groupthink' which can occur when similar individuals are trying to gain consensus, divergent thinking can generate creative ideas by exploring many possible options and can occur when individuals are not afraid to express different views (Hargreaves & Fullan, 2012; O'Grady, 2013). In order to support divergent thinking, individuals need to feel respected enough and safe enough to express diverse viewpoints. During our meetings, team members were able to express a diversity of ideas in a

safe space because all team members respected the opinions of other team members. The idea of diverse opinions was addressed at the beginning of the project in group discussion with the expectation being that there would be differing opinions and that our differences could make us stronger. Therefore, from the beginning everyone was prepared to hear a variety of perspectives.

The space became safer as time progressed and the team began to forge stronger relationships. As we started to consider each other friends, it was easier to be open to differing opinions without taking offence. Perhaps because we were talking about how to help our students listen to diverse opinions with open minds and how to listen with their hearts, we as a group modeled what we were trying to teach. Graham reported, "Disagreements were expressed. I haven't taken anything personally and I don't feel like at any point there has been a huge thing. It was a nice group to work with." He reported that different perspectives help us understand the depth and layers of some topics:

> I don't like talking only to teachers. I am on the record. They have similar concerns and issues and it can get into the 'red thought' thing. It can focus on everything that is wrong. With different people coming from slightly different perspectives it makes you acknowledge that your world is not the only world. Like Fiona bringing in the visual component.

He was recognizing that when a group of people, who hold similar perspectives, get together thinking may become too narrowed and focused, important information can be overlooked, and alternative perspectives ignored. The group's diversity pushed all of us at one time or another outside of our comfort zone and made us think about things that we would not have imagined.

Shelley echoed this sentiment when she discussed disagreement between individuals:

> You don't need people to agree with you all the time. That is part of the thing. It is hard to find people to challenge you indirectly. Not someone directly challenging your beliefs or understanding, but perhaps your perspective and that makes you question yourself. I challenge myself all the time…What am I missing? Am I biased?

Susan felt that a diverse group also provided the best framework for learning and creativity:

> I actually feel that the most valuable framework is to have many different viewpoints to all come together rather than, let's say, a group of teachers all working on something that they may not have an opportunity to have another perspective on.

Carolyn was able to point out a downfall as well as some advantages to having a diverse group try to come to an agreement. Her example also had to do with the process of the diverse group trying to choose a topic to work on:

> The disadvantage was it was hard to nail down (a topic). Everyone was very respectful, but everyone had their opinion coming from different perspectives which made the job of figuring out what we were actually going to do harder. The advantage is that people take more ownership when they have a say in what it is and how it will be delivered and don't feel they are just doing what they are told. It is more inclusive.

She was reflecting upon how long it took and how confusing it was to come up with our inquiry topic. It took time to determine what the group truly wanted to study. People needed to express concerns and discuss needs before it was possible to come up with a topic. Confusion existed because not everyone had a similar perspective or even had a joint understanding of vocabulary. It took time to listen to each other, negotiate meaning, and drill down to an issue the group really

wanted to investigate. By the end of the process all team members recognized that confusion and recognizing confusion is probably the first step in learning something new.

As we learned more about the topic, we began to hone in on aspects we deemed most important. Graham described the organic nature of gaining consensus from a diverse group:

> It morphed from the idea we were going to focus on something concrete in terms of writing paragraphs and things like that. I am not sure exactly how it started to shift. We were given different options. We started to talk about if there was a way, we could work on how kids listen, how they acquire knowledge, and how they are able to see if they understand things. Just basically that they know what the task is and how to obtain information. How to help kids figure out how to learn to do something.

Originally, I suggested that we might want to work on a topic such as writing, but through the discussion of the group, the topic changed a number of times until we agreed on metacognitive strategies as our focus. It was messy and took time but I think the result was a good one as in the end the group agreed on a topic that has been discussed in education for many years, but that none of us had ever really focused on before as an area of instruction or deep understanding. The topic itself allowed for rich discussions about our own metacognition as well as how to help students think about their own thinking. It was quite fitting that as we tried to determine how to best help student think about their thinking, we learned a great deal about our own metacognitive processes.

Conversation. A specific type of communication that kept surfacing as being very important to the professional learning of the group and to the emotional well-being of the members was real-time, face-to-face conversation. This is consistent with social constructivist theory that posits language and social interaction is necessary for the co-construction of

knowledge. The current study facilitated professional learning by encouraging deep conversations between individuals who thought differently and had diverse experience and backgrounds. For example, requiring the initial group to come up with the project topic generated a great deal of conversations. And these conversations produced clarity of thought as individuals processed information and made connections between ideas that were different from their own. It was during the group conversations that many of the creative ideas and 'ah ha' moments occurred. Shelley, the special education teacher recalled:

> Even though people were talking about subjects, the common theme for the frustrations was around students not being independent in their learning and not being motivated. So even though we were naming writing, this and that. I heard all of the adults mention frustration of the students' inability to manage their learning. So, I think it was there all along and people were thinking of it as a behaviour to be managed and controlled vs. a thinking process that needed to be supported by lesson on how students learn.

Because of the diversity of thought and the availability of time and space to converse, the group was able to move away from focusing on a very concrete topic such as teaching writing and move toward examining a more complex idea, helping students think about their own thinking and learning so they could choose the strategies that worked the best for them. Shelley reported that because of the diverse group the team developed an, "inquiry that was real. I know we made a project, but there was also a lot of talk that was pedagogically deep. I think there was real depth to the conversations."

Susan, the OT, described the conversational process that happened in real time in which ideas come together from diverse backgrounds and connections are made.

> I like to be listening to what someone says and then I make a connection – Oh so what about this and that and make more connections so I love the inquiry-based model. By choosing this model you are not just doing the *whats* but also the *whys* and *how*.

An example of this could be seen during the focus group when Caroline said:

> I just made a connection while Fiona was speaking. We are actually experiencing here as adults what we are asking our students to do: cooperative learning. That is what we are taught to do in education, but we never really are given the opportunity to experience it.

Shelley and Graham agreed that the conversational aspect of the process, where the group took the time to sit and talk together, facilitated understanding and learning between the diverse team members. Shelley stated, "I think Graham made a good point, I think that a lot of 'ah ha' moments happen when people are having conversation as opposed to when they are on line. I think that the actual meetings were important."

The integration of diverse ideas that occurred through conversation happened a number of times during our team meetings. I can recall one particular meeting in which we were discussing learning and how in fact the first step of learning something new is often the feeling of confusion. A big discussion ensued about how we need to let our students know that confusion is a natural part of learning and it is uncomfortable. We went on to create a lesson on the topic. Without the real-time conversation of diverse individuals bouncing ideas off of each other, I don't know if we would have come up with such interesting and relevant lessons for the students, nor would we have considered the complex topics that we discussed. So, when Fiona noted, "This has been an awesome experience because we never get a chance to have good conversation and go deeper as to what we are doing with our kids!" I believe she was reflecting the enthusiasm that most of us felt with the depth and complexity of the conversations we had.

Graham reported, “I like the conversations and I like the thinking about things.” I think all of us enjoyed the conversations and felt that the time spent was both invigorating and exciting.

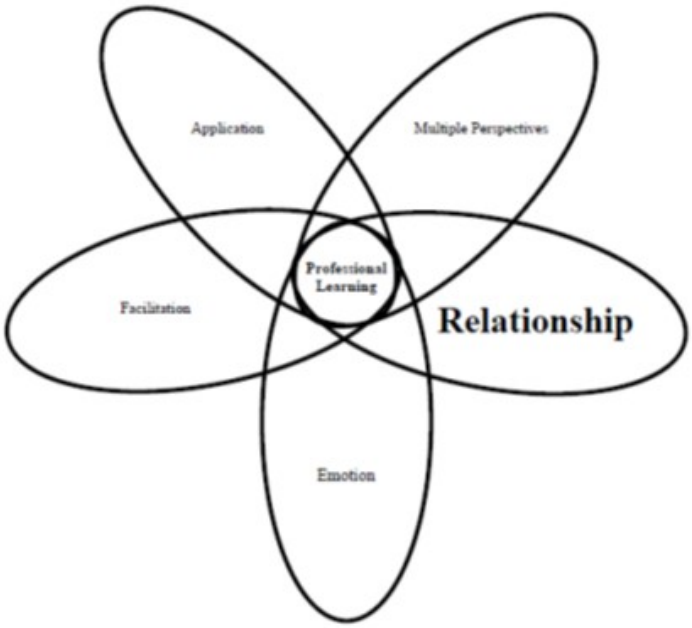
Face-to-face conversations also helped to provide a still space in which educators could gather and express their ideas. This time to be together helped to build the relationship between the various individuals and helped to inoculate against feelings of isolation. Shelley, the school special education teacher, noted:

> The face-to-face conversation was valuable. It was calming to be with people. Our building is intense right now. We have been hit by space crunch, personal challenges, high need behaviors and it is a bit of a rising concern… so to be able to be with likeminded people and have a great conversation is really calming. It helped give a bit of balance and allowed to know that that you are not alone, and you are not the only one.

Caroline, the school counsellor, reiterated that time to sit with other professionals and converse about an important topic was enjoyable, educational, and emotionally satisfying. It helped to reduce isolation and fostered connectedness. These neighbourly interactions allowed connections to be made and a complex learning system to be formed. She commented that she wished that there had been time for more group conversation when she stated:

> If we can have more conversations together it would be helpful. We often feel isolated going back to me as a teacher or even me as a counsellor we feel disconnected. You feel you need to do it all; it makes it more enriching personally and professionally if we work together and to be able to converse with others.

Through discussing the project, listening to others perspectives and in some cases debating these perspectives, and sitting together talking about a common goal, the conversations that the team engaged in helped to broaden thinking, disseminate information, and share knowledge. It also it allowed the group to experience "ah ha" moments when all members discovered something new about the topic and it helped to build a supportive relationship between the team members.



Relationship. The element of relationship and positive connections between the team members recurred as an important part of the project. Most members expressed the need for trust and respect in order to be able to participate fully in an exchange of ideas especially if those ideas were different from their own. Additionally, a number of the team members reported needing to feel safe if they were to put themselves in vulnerable positions, such as teaching in the classroom or suggesting unusual ideas. In addition to trust and respect, the idea of flexibility also surfaced a number of times. This idea of the importance of close relationships within a social environment is consistent with social constructivist theory which suggests that we learn through interaction and the co-creation of knowledge within a social environment.

Trust and support. In order to be able to try new things and express new ideas the team had to first trust each other. The initial group of teachers Shelley, Graham, and Carolyn had a

professional relationship prior to beginning the project and they already had a level of trust with each other. The associated professionals including Fiona, Susan, Caroline, and myself seemed to develop a feeling of trust for the group rather quickly. Perhaps this occurred because as associated professionals we are often quite isolated, not really belonging to a staff at a school and not really belonging to any one group at Student Support Services. Susan, Caroline, and Fiona all mentioned at one point or another that being itinerant could be isolating. Itinerant professionals have less opportunity to develop deep connections because they do not belong to one staff or space. Therefore, the itinerant educators seemed eager to connect and become part of a team. Every person in the team commented on trust in their interviews. Fiona, the resource teacher for students who are deaf and hard of hearing, stated:

> Trust to try something new. Trust to expose yourself in a vulnerable situation. If you are up there teaching or you might be coaching with somebody of far different experience or backgrounds so it could be intimidating for some. It was an amazing opportunity that this particular group got together and we got those times together.

Carolyn reported that trying something new in the classroom was not as difficult for her in this project compared to trying new things on her own. She stated that it is "more daunting when you don't have a team behind you." Shelley stated that "If you are going to work as a team there can be no hierarchy. To sit at the table equally you can't have your guard up either." She went on to say that "during the group discussion, it was not intimidating…I felt turn-taking was easy. The listening and the flow was steady. Everybody seemed comfortable." Both Graham and Shelley reported that they tried to be supports for Carolyn. Graham said "I have tried to express support (to Carolyn) but we will see how it goes. It is definitely a marathon, so you have to pace yourself and be ready for things not to work out the way you plan." These examples demonstrate

the decentralized network, the local interactions between individual agents, ground up decision-making, as well as unpredictability of the complex system.

During the focus group Susan, the OT, commented on the fact that trust developed between team members and that allowed the team members all to feel safe and take risks with ideas. “But trust is important because we all trusted each other that we were able to say something. Even throwing out random ideas. Often you think ‘I am not a classroom teacher, so just keep your mouth shut.’ (At this table we) didn’t feel like we just needed to sit quietly and nod.”

Fiona also reflected on the need to break down barriers and build trust between teachers and non-teaching professionals in the district. She indicated that understanding each other’s roles we were able to better understand differing perspectives:

> Well there is a real divide between specialists that come into work in our district who are not qualified teachers but are in our teaching union and in our classrooms and at the IEP meetings putting forth recommendations. I think somehow, we need to break down those barriers, build trust. We have to be able to accept the fact that they do have a lot of knowledge and expertise and we can’t be the specialist in everything as teachers we can’t.

So, trust allowed individuals to take action both by creating and using the mini-lessons but also just to provide their honest opinions and ideas to the group. By the end of the process, Susan was feeling so comfortable that she thought that she might be able to present a mini-lesson in front of an intermediate class. She stated:

> I’d absolutely do that but to be comfortable (teaching in front of a class), I would need a lot more time to prepare.

Respect. All team members demonstrated respect for the knowledge and abilities of all of the other members even though we didn't always agree with each other. Team members identified that respect is not always shown between members of different groups. Associated professionals reported that some teachers do not respect the opinions and knowledge of individuals who are themselves not teachers. Conversely, some teachers stated that some associated professionals believe they know more about teaching than teachers do. This dynamic has the potential to create silos and friction. In our team there was a great deal of shared respect for each others' knowledge, skills and abilities.

"Everybody had a lot of mutual respect for each others' perspectives and knowledge. Everybody had a chance to say something and be heard," Fiona explained. Fiona reflected on how important it is for various professionals to respect each other. She suggested that engaging in transdisciplinary inquiry may be a way to help ensure that in our district both teaching and non-teaching professionals are respected:

> Number one we all came to the table respecting one another and respecting our roles. Not everybody at the table was a teacher but we all had something to bring to the overall activity. And again, in our district, I think that the number of people that we have that aren't teachers but are specialists and they have a lot to bring and offer to our team. I think that if we had more opportunity to do this kind of thing that would really help to break down those barriers.

Graham noted that because there was respect and equality in the group no one person took over and no one agenda was paramount. He stated, "No one really steamrolled. There was no one person feeling they needed to take over." Carolyn, who was a relatively new teacher also felt valued. "Everyone was very respectful," Carolyn noted. As did Susan, who is an associated

professional in the education system, stated “I felt valued and I felt that I was part of a team and I learned while I went and I helped others learn as well.” Shelley posited that the reason that the team worked so well in a non-hierarchical way was because all of the team members had the good of children in mind rather than personal gain. She suggested that everyone was able to check their egos at the door and work for the purpose of helping others learn. She stated, “None of us want to be the poster child. We want to do work privately; we are all people who, the reward or the incentive is in the personal satisfaction of it,” Shelley asserted.

Flexibility. Flexibility refers to the ability to tolerate ambiguity and keep an open mind. It is my belief that the whole team demonstrated this characteristic as they all agreed to participate in a research study which could not be clearly delineated for them. Most of them agreed to participate only knowing that a topic would be chosen by the team and we would be working on it together for the purpose of professional learning. Carolyn reported:

> In June I had no idea. I didn’t know what it was going to look like. I knew we were doing something, but I was not sure what it was going to look like, and I couldn’t explain it. People would ask what we are doing, and I would say I am not sure.

Personally, I think it is amazing that the team agreed to take part in the research to begin with because I did not set any clear parameters on what topic we would be working on or how we would inquire into the topic. Even once we developed the topic, we were still unsure exactly how we were going to present it to students or how it would be used by the individuals in the team. On numerous occasions Susan, Shelley, and I all told Carolyn how brave and flexible she was for using the mini-lessons from the project in her practice. Teaching metacognitive skills to a class of intermediate students when you have never attempted it before could seem overwhelming, even to an experienced teacher. Carolyn was willing to trust the group and try the

ideas generated by the team even though at times she might have been concerned that they would not be well received by her class or even though she might not be completely familiar with the content. She was flexible because when things needed to be changed on the fly, she adjusted and supplemented activities easily. When Carolyn was describing qualities a team member needed to have, she expressed it well by saying: "Open-mindedness just because it is different. For example, the topic we chose was different, it is not like curriculum really." She went on to say that originally, she believed that the topic might be on writing, which is an area she was really interested in, but when the team eventually landed on the topic of metacognition, she was still quite willing to work on this topic with her class.

Flexibility was also demonstrated by the whole group in team meetings which were held in Shelley's tiny office, with people coming and going as needed. Yet in all of the chaos the team managed to get along well and accomplish a lot of work. Graham pondered:

> Part of me wonders if the little half day meetings in that small room where people were coming and going gave us respect for how hectic it was; maybe that made everyone understand that we have to get along?

Flexibility in process could also be seen in the way that the group communicated. Some individuals did not like to read emails, so some of the communication was done face-to-face and some via email, some of the group could not access the PowerPoint document, all of the group were very busy with their own work, yet they made time not only to meet but to think about and produce information for the lessons. There was also flexibility in the uses of the lessons because although we thought the mini-lessons would be about a half an hour long, many of them took longer and Carolyn, the grade 4/5 teacher, simply adapted. Graham used some aspects of the lessons with his class and Shelley and Caroline planned to use the activities and some mini-

lessons with small groups. Finally, all of the team members showed great flexibility and resilience when it was announced that the district was going to undergo an audit in all special education categories. The project did not stop, but people worked on it when they could. All of these examples demonstrate the flexibility of the group.

Connection. By putting diverse individuals together and allowing them to choose their purpose, the inquiry was able to foster new connections between individuals, whist allowed for the sharing of knowledge, skill, and expertise. The connected non-hierarchical feeling that developed as a result of being part of the transdisciplinary team helped to build a sense of unity between team members. Shelley, the school special education teacher, commented:

> We are sitting at this table as educators, not as classroom teachers or OT we sit here as educators vs. I am the Deaf and Hard of Hearing person, I am the OT, I am the counsellor, I am the grade 6/7 teacher. *That helps to build cohesion…* And breaks down professional isolation.

Shelley also noted, as did Susan and Fiona on other occasions, that the connections built during this process helped to reduce isolation and break down silos. It also helped to foster respect. Shelley stated:

> I like that there are no silos in this group. I don't think anyone is feeling like they know everything and that this is their owned area. Like, oh well I will have to come and teach you how to come and do that.

Shelley went on to state that in order for people to connect and build cohesion, there needs to be space and time for the group to come together, to put everything else aside and be together. In the hectic education system, this time is rare yet essential. Shelley stated, "I think it was very

important that we had time where we could stop thinking about everything else and just sit as a group and grow together."

Carolyn, as a newer classroom teacher, stated that this project did a number of things: "Meeting people I wouldn't have. Having an extra connection with Fiona was extremely helpful. I had no idea what OTs did in the school other than ergonomics so meeting Susan was great." The inquiry project allowed Carolyn and all of the team build connections and relationships that typically would not develop during our daily working lives.

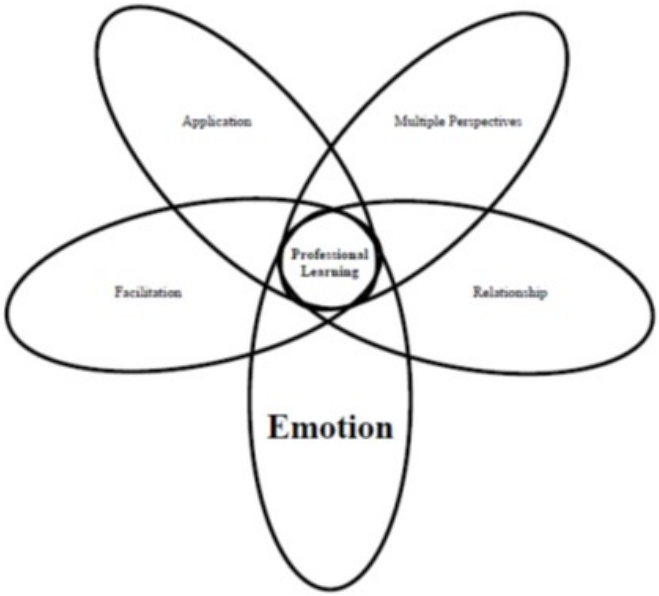
Fiona went on to reflect on how the inquiry process as well as investigating an important issue acted to connect the diverse group of educators and aided them in helping children learn:

> A group like this makes you feel quite connected. Everybody had a role, everybody had a purpose and if we are all openminded, we are able to see things from different perspectives. It is kind of like it takes a village to raise a child. Here, we are the village trying to bring up all of these children.

Susan too felt that the transdisciplinary inquiry process "builds connection and a team. It is not superficial." The idea that the project allowed for educators to connect with each other, build relationships, and develop a sense of belonging to a team, was discussed by all of the team members. The connections that were build between diverse team members allowed for feelings of support and friendship to develop as well as provided the members with feelings of safety so that they could express diverse perspectives without fear of reprisal. Finally, the feelings of connection and unity that the group shared with a joint purpose and the ability to meet and talk about concerns and ideas moved the group from a feeling of powerlessness to a feeling of comfort. Shelley stated,

> I think we were all feeling quite powerless before (we joined the group), but I think we all felt quite powerful (during the inquiry). I think when the sharing happened at the table it was powerful. Powerful or maybe reassuring that if other people feel this too, then it is not just me and the sky isn't falling in.

Positive emotion. In addition to the social and relationship aspects of the project, comments on the emotional nature of the process emerged. The team members noted that throughout the professional learning process they felt positive emotions such as excitement enjoyment, and care. Other emotions such as calmness and confusion were also discussed. For example, Shelley felt that being with likeminded people and having great conversations was really calming and helped to reassure us all that we are not alone. This element of emotion is consistent with enactivist theory which suggests that sense-making requires the convergence of experience, emotion and cognition.



Excitement. There were many instances throughout the process where team members identified that they felt excitement and enthusiasm. Shelley reported that right from the beginning of the study "people were all in." Susan reflected:

> How do people get energized? I don't think they get energized by being told what they are going to do. I think they get energized by getting excited about something and in order to get excited, they have to have chosen to be part of it.

Part of the reason that there was much excitement and energy about the project may have been because being involved in the project from the start was something that the team members chose to do. Graham stated, “Everyone had the feeling of if this really isn’t working for me, I don’t need to be here.” This statement was really powerful for me because it really was a conscious choice people were making to be involved.

It is surprising to me the amount of personal time that the team members chose to dedicate to the project. Typically, in the world everyone is very busy. Educators often express the fact that they are overloaded with work and are struggling to maintain a work-life balance. Yet the educators in this group dedicated quite a bit of extra time after school and on weekends to think about and work on the project. For example, at one point I asked Graham if I could chat with him after school about the activities we were planning. He agreed and I went to his class right after school ended at about 2:30, thinking that we would engage in a 15 to 20-minute chat. We got talking and at 4:30 we were still talking. This is a great deal of time to dedicate to a project. After I left him, he met Shelley in the parking lot as he was leaving and they talked about the activities as well. So, there was definitely an excitement about the project and people were certainly choosing to be involved. Again, this observation emphasizes the dispersed power in the group and how the individual team members demonstrated commitment but also the way the individuals were self-organizing and how the decision-making power was dispersed resulting in an energizing or catalyzing effect which propelled the team forward.

Carolyn observed that there was “enthusiasm to make it work (the project). Without that it would just stop.” So again, the idea that people were excited and enthused surfaced. Susan noted, “I felt excited every time we started working on a topic” and “I always feel passionate and excited when I get invited to be part of these bigger conversations” so this feeling of excitement

and passion was also associated with being invited and to being involved in important and deep conversations. Fiona felt excitement as she learned that the people in the group were very interested in including all students. “I have learned that people were very much interested in being as inclusive as can be and they are willing to learn different strategies which I find exciting.” For Caroline, excitement occurred at the prospect of learning with others. As for myself, I was excited to see the group develop and grow together. I was also energized by the diverse conversations and the sharing of ideas. There were many nights when I came home that I reflected on the conversations I had with the team.

Enjoyment. Many team members also commented on having fun. Graham reported that “it was an enjoyable process. Valuable. I think it is something that could be continued to be refined and worked on” and earlier he stated, “I found it quite enjoyable. I like collaborating on things of interest.” The enjoyment for Graham appeared to occur as a result of choice, interest, and working with others on a project that he viewed to have value. Possibly the aspects of community building and connecting with other professionals on a deeper level added to his feeling of enjoyment and positive emotions. He also used a very colorful simile to describe his experience and express his sadness that this type of learning for educators does not often occur:

> These moments I really like and enjoyed through my career (professional learning where people share ideas). The fact that these opportunities are like comets is a bad thing. The fact that they are bright spots and they disappear, and I don’t see them again for years.

Graham also associated feelings of happiness and encouragement that he experienced during his participation in the project to his own professional satisfaction and feelings of effectiveness:

> For me, just in terms of my overall feeling of effectiveness as a teacher, motivation or feeling happy or encouraged. I’d say it (the project) brings that up. If we value teachers

> being happy, motivated or inspired, if that is of value, it (the process) was positive for me.

Shelley too expressed feelings of happiness, but not for her own professional satisfaction but because she could share the experience of collaboration with her colleagues. She valued the fact that she was helping others to connect and develop professional friendships that would likely last well beyond the project:

> I am happy because I get access to all of you (Caroline, Susan, Fiona and I), I am happy that Carolyn and Graham had a chance to meet the wonderful people that keep me motivated and inspired all of the time. That was the real bonus, all those connections being made.

Fiona enjoyed the conversations and thinking deeply about learning and working collaboratively with the group. She also noted that the project gave her the opportunity to work in a classroom with a whole group of students. This is something that she doesn't have the opportunity to do as often due to her full caseload. She stated, "It was great fun to be back in the classroom with some of those students being on my caseload." Caroline also expressed enjoyment of the deep thinking that occurred during the conversations and the group meetings. She stated, "It made me wonder and it was inspiring."

Susan reported that she enjoys working with classroom teachers and this project gave her the opportunity to work with them. "Often I am working through others to others. It (this project) has given me more of a front-line contact which I really enjoyed. Susan also was happy with the project topic because it was an area of passion for her, "Thinking about thinking, there is so much to know there. And to get feedback about how much information was enough and how to apply it (in the classroom) and then having time to reflect was wonderful."

At one-point Susan stated that so much of our work can be exhausting, she identified that one thing she really liked about the project was that although it took time and energy, it was not. "For me I really enjoy that piece because it is energizing as opposed to energy draining." A number of the team members noted that the project was energizing and this speaks to the self-sustaining and autocatalytic nature of the team. The members were able to interact and engage without becoming drained or used up.

Feelings of care. The feelings of care for other team members, concern about making meaningful contributions to the project, and the desire to be a 'good team member' emerged many times. Team members also expressed desire to support and help each other through the process. Graham, Shelley, and I all regularly checked in with Carolyn to ensure she was comfortable with the implementation in her class. Susan, Graham, Shelley, and Fiona all checked in with me at various times to see how I was managing balancing the research and inquiry aspect of the project. Additionally, every person I interviewed, at one time or other, expressed feelings of concern for not doing as much work on the project as they felt they might have.

This feeling seemed to increase particularly for the Student Support Services staff during the special education audit completed by the Ministry. The audit was unexpected and significantly increased the work load of a majority of the team members. I continued to send information and emails even though I was quite aware that most of the itinerant team was very busy preparing for the audit process. I felt quite concerned about bothering people, but at the same time I didn't want to leave anyone out of the communication. Fiona reported that she also felt worried at this time because she knew that the PowerPoints and information were there for her to review but she didn't have time to get to them immediately, "The audit was thrown in and Rhonda would send the emails and I knew they were there, and we had to get through the

audit…" According to Fiona, feelings of accountability to the team did make her look at the emails even though she really didn't have time. Susan also expressed feelings of concern at letting the team down during her final interview, "I said at the very beginning I would love to be part of it and then the audit. I felt I wasn't contributing as much as I could." Everyone involved in the audit apologized to me at one point or other for not sending timely responses to my communications.

Even before the audit occurred, Caroline, the counsellor, expressed concern that she was not contributing as much as she could. "I didn't feel that I was making as much of a contribution as I would have liked to. I worried about it. Not all of the time but at moments" and "Then as it has been progressing, I had been feeling a little more apprehensive in that I was feeling that I am not doing enough in the process. I was worried about being a good team player." As the facilitator, these feelings of concern were something that I had to monitor and try to alleviate. I did not want people to feel overwhelmed. Additionally, by this time I had developed genuine feelings of care and concern for my teammates and did not want them to feel distressed about the project when in fact I felt that everyone was contributing quite nicely.

This feeling of not contributing as much as they should extended to Graham and Carolyn as well. Graham reported he read all of the emails because he felt accountable to the team:

> In a perfect world we would get a few more meeting times; more face-to-face time. When you wrote the email: "is this too many emails" – that really stuck out. I am an email glancer at best. Half of the time I would read them because I knew we would be talking – so shame basically – just so I wouldn't seem totally uninformed.

Even Carolyn, who carried a big part of the load because she actually used many of the lessons in her classroom and reported her experiences back to the group, expressed feelings of

concern that her role in implementing the lessons was too easy. She stated that having the team behind her made creating and using the lessons so much easier. Carolyn felt, "It was really easy. I was almost feeling guilty because you guys were like – here you go…all the materials and everything was prepared for me."

Both Shelley and Susan noted that people expressed feelings of care and concern for the project and the team members. Susan stated, "People don't want to disappoint other people so if you are invested in part of a team, and not just a think tank, if you actually have tangible commitments people often step up." And Shelley surmised, "Accountability to your peer group is a powerful motivator." In fact, many team members stated that they were motivated to work on the project even when they were busy both because they knew that it was being used with students and because they did not want to let down the other members of the team.

During the focus group I admitted,

> I think the pressure of not letting down others makes us make time. For me it is not like I would normally spend extra time creating lesson plans…but because I knew we had taken the time to talk about it and Carolyn was relying on us to have those PowerPoints completed so she could teach some of them in her class, that motivated me to make time.

Additionally, at the end of the focus group, because I didn't want people to be feeling guilty as all of them had really stepped up and helped even though they were all very busy, I stated:

> I feel that each one of us at one time said the same thing 'Oh I didn't contribute as much as I would have liked to'. But each person played an integral part that we couldn't have done without. That is transdisciplinary…everybody playing their part.

Fiona stated, "I think in the end we felt that we all contributed, and we all did play an important role, and we still can play an important role going forward." So, the feelings of care and concern

that were experienced by the team is a reflection of the strong bond and relationship that we built with each other during the process. In retrospect I believe that these feelings occurred because we actually developed into a cohesive team whose members cared about each other and about the project.

Facilitation. In order for this professional learning project to progress and not get stalled, it had to be actively facilitated. Most team members identified this and spoke about it at some time. For my part, I had to work very hard at not being directive and to set the stage for the process to occur rather than to drive the process. Through out the interviews and conversations the team identified three important areas of facilitation: provision of choice, use of variety of communication methods, active encouragement of reflection, and development of an organizational structure. Without these things, the project would likely not have progressed as smoothly as it did.

Choice. Almost all of the team identified that the project was effective because of the element of choice that existed. I have already addressed the idea of choice Chapter 4 when I provided information on autonomy. In addition to the comments made about autonomy, Graham noted that at any time individuals could choose to opt out, and this gave team members power and the continuing agency to choose.

> It was effective because it was a volunteer project from the get-go. People were happy to be invited and could have left at any point, so it removed the feeling of "need to". "Want to" is a very powerful thing.

Susan believed that in order to have investment in a project, people have to feel that they have some say in their own participation. "I think that my personal philosophy is that if you are going to get buy-in for anything the people have to be able to choose. You can't direct." Shelley also noted that the process was done with the group not to the group. Caroline also noted, "It was a choice for us to be in the group which makes a difference because then you tend to have people who are interested and want to contribute."

Choice was provided during the project in a number of important ways. People were not told that they had to participate in the project, they were invited and then chose to become involved. In fact, we did have at least one potential participant who chose not to become involved. Once individuals joined the team, their roles developed and they decided how much time they would invest. Finally, when people were given choice as to the topic of their learning rather than the topic being mandated by an expert who is providing the training, team members saw themselves as bringing expertise to the group. The role of 'expert' became redundant allowing all participants to consider themselves both leaders and learners.

Communication. One aspect that I should have considered more carefully prior to initiating the project was communication. With such a diverse group, located out of different places, and with different levels of preference for using electronic communication, it was difficult to determine the best way to communicate with everyone. The team ended up communicating in a number of ways including through emails, texts, phone messages, PowerPoint slides and comments, and face-to-face conversations.

Most of the team noted that the emails and the PowerPoint attachments were necessary in order for the group to collaborate even though it might not have been the most convenient method. Shelley stated, “Your emailing and putting things together was important.” Carolyn also thought that the PowerPoint information was useful for communication and it made it easy for her to use the materials in class. When asked about a chat platform she stated, “I think that an electronic platform where it is more of a forum or chat would have worked. But I liked the emails individually when it was the PowerPoint and information.” Susan also liked to look at the PowerPoint slides, but she preferred to provide feedback in person rather than by replying to the emails. She stated, “I have been peripherally involved in that I have reviewed many of the suggested strategies and provided ideas to augment or adjust them or suggest one to explore like the tool kit, the thumbs up/thumbs down.” She felt that she had been peripherally involved because although she was directly involved in all of the planning sessions and the development of the lessons, she did not implement any of the ideas with students in a class, rather she used the ideas to coach teachers. She added, “I have definitely thought about the project, especially when you send out the emails... There was always something that jumped off the page to me from the PowerPoint and I would comment.” Susan felt that the face-to-face communication was excellent, but she wasn’t as able to connect with individual group members regularly. She stated:

> I found that when we got together as a group the communication was excellent. I didn’t communicate that much with group members in between (meetings). I found I communicated through you to the other members of the group and sometimes Shelley and I would connect when I was at the school for a different purpose.

Graham noted that he was able to just chat with Shelley and Carolyn because they were in the same building as he was. He stated that he enjoyed face-to-face conversations such as the

short check-ins and the group meetings and felt they were the most effective mode of communication as there is less chance of miscommunication. When asked about the use of an electronic chat platform he stated:

> I don't like texting or emails. I like the interactions. I probably would have gone on (an online platform) I don't know how much I would have added. I take a lot of things out of context. I don't get the full story and I don't like misinterpreting.

Caroline also felt that the electronic communication was not as useful to her and she enjoyed the face-to-face conversations. She reported that she was not as comfortable with computer communications. Additionally, since she does not go regularly to Student Support Services and she is only at the school site two days a week, it was harder for her to communicate with everyone. She stated, "The slides and doing it over the internet was less effective for me. I am not savvy on the internet. It would have been easier to clarify if we would have been face-to-face." Overall the team managed to communicate enough to accomplish quite a bit of work, however, communication is certainly an area to consider prior to trying to implement a project like this one.

Reflection. Because of the nature of the research study and the fact that I was interviewing and speaking to team members on a regular basis about their experiences and their learning, reflection was somewhat required by the structure of the process. However, beyond the reflecting that I initiated through questioning and interviewing, the team members themselves reported that they engaged routinely in reflecting upon their learning and ideas of their own accord. It seemed that because the group was diverse and team members were engaged with ideas and events that were sometimes outside their typical experience, many commented on the importance of personal reflection to clarify ideas that they held and to explore new thoughts that

occurred to them because of the professional learning experience. Shelley talked often about thinking deeply after our meetings. Every team member at one time or another talked about thinking carefully and reflecting about some aspect of the project. In some respect the topic of the project likely also encouraged the team members to reflect more often on their own learning and thinking.

There was a very public and a social aspect to the professional learning the team experienced during conversations and activities, but there was also a very private aspect to this experience as well. Individuals reported reflecting on what they had heard, saw, did and believed. Shelley stated, “I think it is really helpful to sit back and be able to feel reflective because a lot of the time we are so busy doing that we don’t have a chance to sit back and do the thinking or reflecting part of it.” She expressed the need for quiet time to process all of the new experiences and information in her own consciousness. She believed that the process the team was engaged in required advanced thinking and time to process, “In terms of a higher-level thinking for educators, focusing on the process pieces of independent learners is definitely a higher level of professional learning.” She went on to say that the thinking and engagement required for this type of learning was unique, “So for me it was the kind of Pro-D you can’t pay money for. I couldn’t buy that somewhere. I couldn’t pay for a conference that could give me that.”

Graham stated that he found it refreshing and enjoyed both the conversation and the thinking he engaged in during the process. He reported, “Yes I feel I reflect on my learning quite a bit. I have two brains when I am teaching. I have this is were I want to go and this is where I am at.” Fiona spoke about reflections she had after she had worked in the classroom on a whole class activity. “Also, when we did the lesson, I had some after thoughts that I had wished I had

known more about the composition of the class and not been so concerned about my students…because there are a lot of other needs that we have to keep in the back of our minds." She went on to discuss how the process made her more aware of the possible needs of other students and how she could meet those needs.

Susan commented that she felt that she was a very reflective person and as she acquired information from the project, she needed time to get the information and mull it over in her head. She stated, "I have definitely thought about the project, especially when you send out the emails. I wish I had more time to delve into this." She also noted that listening to diverse perspectives helped her to broaden her thoughts about topics that she routinely talked to teachers about. For example, she often presents information to teachers about self-talk but she does this often from a motor planning or cognitive behaviour therapy perspective and she found it interesting to listen to other individuals speak about self-talk as a means to aid short-term memory, transfer to declarative memory or as a way for students to remember acronyms or steps in a process.

Carolyn reported that the project got her thinking a great deal about metacognitive strategies and their impact on student learning:

> I noticed that the (students) who are academically more successful seem to use more of these metacognitive tools. I don't know whether it is the chicken or the egg (they use the tools so they are successful, or they are successful so they use the tools).

The whole team seemed to be spending more time reflecting on thinking and learning, which mirrored what we hoped the intermediate students were going to be doing as well.

Caroline, the counsellor, stated that she is a very reflective person and she often thinks about her own practice:

> I am quite introspective and reflective. I feel that is a big part of how we learn. To be reflective about what worked and didn't work. I have been working on the compassionate piece and not getting down on yourself. It is learning and it is uncomfortable.

Shelley also talked about the reflections that the project helped her to focus on. Most of her thoughts were quite complex often she found herself asking some very important questions: "How do I contribute to my field, not through research but through my everyday work with my colleagues? How do I lead in place in the moment? How do I contribute to my colleagues?" When we start to take responsibility for our own professional learning and the learning of our colleagues, important reflections and questions emerge.

Organization. Another aspect of facilitation of the group was my ability to organize people and information without dictating what should be done. An extension to this is how the group began to organize itself. Many members of the team commented on some important aspects of organization such as developing a time-line, identifying roles, and organizing materials.

There was a fine balance between providing structure and organization and taking over control of the project. When asked about how the project was organized a number of the team members identified that initially I had a time-line that was laid out and later as we got into organizing mini-lessons and deciding when they would be available, the team organized the time-line. Shelley noted that I spend time "packaging" the information in an organized way and "taking our chatter and gleaning out important bits for the lessons." Shelley noted that she also found the timeline helpful but stated,

> That was one of the things that was good was the way you did allow for us to process at our own pace. So, the timeline was not so intense that it made you stop what you were doing, and it allowed people to process at a rate that was comfortable for them.

Graham stated that it was really helpful to have a timeline to begin with as an organizing factor even if the timeline changed as we started to determine what types of lessons would be created, he described the groups organizational process:

> Then we started with a list of 6 to 7 things that we ended up chopping down to listening, self-talk, recognizing confusion, which morphed from checking understanding, and getting help.

Carolyn was very pleased with the fact that the team helped to organize and structure for her and the messiness of lesson creation was completed before she started to present the information to the class. Therefore she, and the rest of the team, would receive the most updated version of the lessons prior to her scheduling them into her class calendar. All team members, including Carolyn were involved in the planning discussions for the lesson topics and all team members provided information, resources, ideas and feedback on the lessons as they were created. Once the team knew when she was planning to present a lesson to the class, one of the team members would copy the resources she needed and help her with any technological concerns she might have. She stated, “I like being organized and knowing what’s coming and the fact that everything was planned, and I just had to execute made it a lot easier.” She also said, “I could look at the slides ahead of time and read the information, but until I actually saw it in action and talked about it with them (the class), that is when I understood it.” However, because she was actually trying the lessons out systematically with her whole class, it was important that flexibility was built in. Carolyn reported, “I felt I could change the lessons if I needed to.” In

fact, she did when she found that her students needed more information about some of the videos that we were using she added materials to the lessons.

Susan also noted that the whole project needed to be facilitated to move forward, she told me, “You facilitated it and moved it forward. Here is an outline, if you have anything to contribute to it add and it will go forward. If it didn’t have a facilitator it wouldn’t move forward.” Susan also noted that was helpful that during the process of lesson planning:

> Someone else had done the task analysis and had broken it down into small chunks and made it (the lessons). Things were embedded into the lessons for the teachers to play with instead of saying, ‘Oh it would be great for you to make a lesson on metacognition and self talk’…that might have been overwhelming.

Susan identified that facilitating the group was akin to teaching; she said, “You kind of went, I am going to give you a little bit of information to keep you interested but I am not going to bombard you with too much.”

There was definitely a recognition by the group that the process had to be organized in some way. It was a delicate balance of providing structure without being demanding or controlling. Susan summed up the process in this way, “(This approach) takes more time, it is messier, it can feel overwhelming, but I think that is one of the roles (you) have been able to play well is to weed through the underbrush and find the flowers.”

Challenges to professional learning. The team members didn’t talk as much about the challenges they experienced through the process as they did the other elements professional learning. In fact, many of the challenges to the development and maintenance of the transdisciplinary inquiry that I was expecting such as dissent within the group, inability to reach consensus and failure to create a joint conceptual framework did not occur to any great extent

and were not discussed by the participants when they talked about the challenges they faced. However, the team members did identify a few events and situations that they felt hindered their professional learning both during this project and in general included: lack of time due to overwhelming workload, unexpected occurrences, as well as difficulties with communication. However, because of the complex nature of the system, the enthusiasm of the educators to experience deep learning, and the feelings of care between the members such that everyone wanted to do their part, none of the challenges prevented the team from engaging successfully in the inquiry. Perhaps this was one of the true strengths of our transdisciplinary inquiry. It acted as a complex system; therefore, the team was energized by the inquiry process, adapted to overcome difficulties, and transformed their learning in spite of barriers that existed.

A Complex System Perspective: Forces Occasioning Learning

Learning occurs within complex systems through the process of emergence as an adaptive response to change in the environment. Learning occurs if a system becomes complex and 'couples', or develops and interdependent relationship, with the environment. Information flow from interactions between the agents in the system and with the environment catalyzes an openness and need to change. As the environment provides opportunities for action, structural changes in the system itself, changes in schema (associative information networks) of the agents and the system, and adaptive changes in behavior can result. Learning, therefore, can occur at both at the system and agent level (Byrne & Callaghan, 2014; Doolittle, 2014; Ovens & Godber, 2013; Ramiah, 2014; Stacey, 1996). Because the transdisciplinary team exhibited the qualities of a complex learning system, it is useful to examine the forces that interact with the system as learning occured so that we can better understand the learning process within our system.

From a complexity lens, three important forces catalyze complex learning systems toward emergence: “information flow through the system, richness of connectivity between agents in the system, and level of diversity within and between the schemas of the agents” (Stacey, 1996, p. 35). Both similarity and difference between the agents within the system are necessary: similarity holds the system together whilst at the same time difference expands its boundaries and available opportunities (Davis et al., 2008). In our case, the cohesive forces developed through relationship and familiarity, the diversive forces developed through difference in perspective and function, and the interactive forces developed through flow of information as the agents interacted with the internal and external environment within the context of their work with students. These forces could be seen acting upon our transdisciplinary team as the team members engaged in inquiry. Cohesive and diversive forces, combined with the interaction and flow of information from the external and internal environments, created the disequilibrium needed for development of new perceptions, knowledge, and action from the existing system, agents within that system, and the environment. I have simplified and attempted to diagram the process in Figure 2.

Referring to Figure 2, in our transdisciplinary learning system the information flowed between the environment and the agents in a recursive manner. Knowledge and expertise from the team members was combined with information from the environment through conversation in whole group meetings, informal discussions, and electronic communication. This combining of information from all sources occurred in the presence of forces that simultaneously drew the team together and pushed its boundaries, providing the energy and the space to allow the system to adapt and change facilitating new ideas and behaviours to emerge.

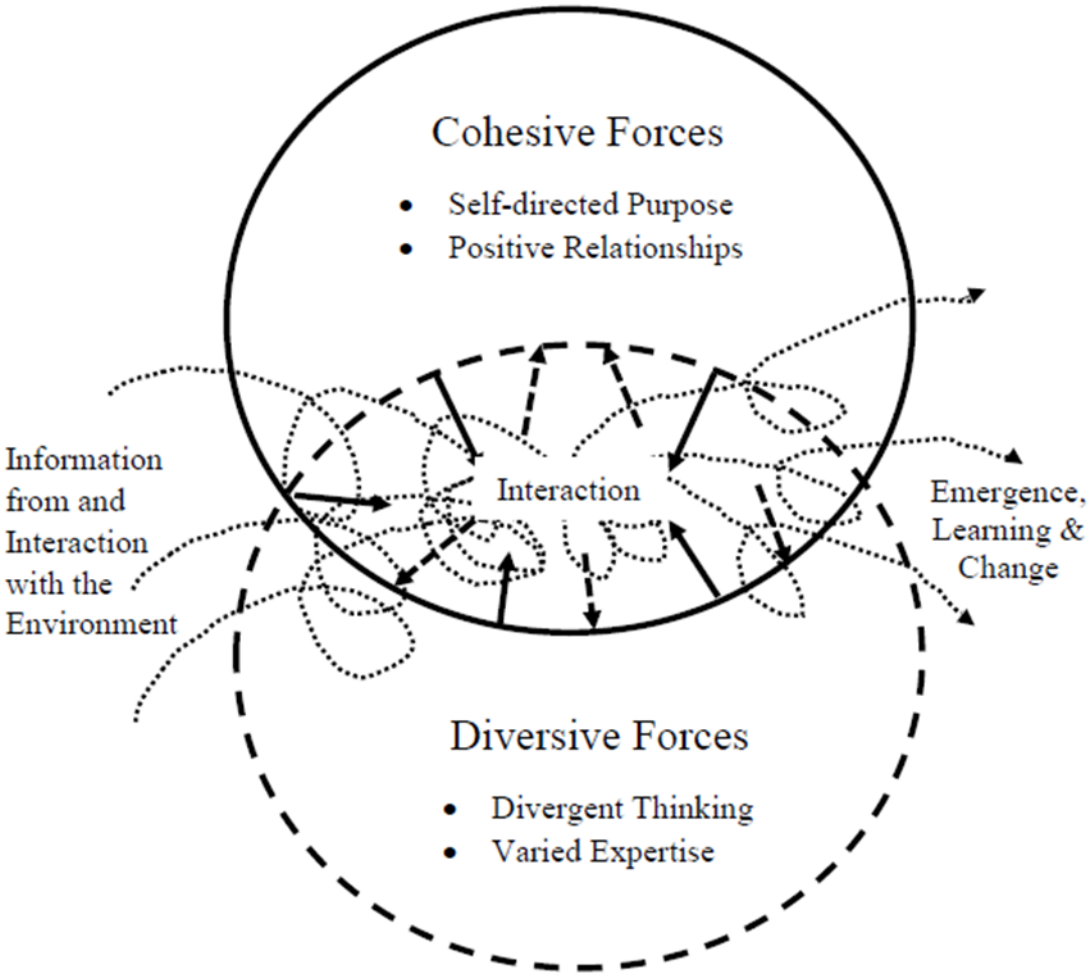


Figure 2. Forces occasion learning in our system

Cohesive and diversive forces within the transdisciplinary system were needed for the mingling and dispersion required to provide both synthesis and space so an autocatalytic condition could develop. This generative process, captured by the arrows in Figure 2, provided momentum for the team to move together in a particular direction and develop a joint conceptual framework in the form of mini-lesson plans. Cohesive forces were supported and maintained by two of the key elements identified by the team members: positive relationship and self-directed purpose. Diversive forces were supported and maintained by two other key elements identified

by the team members: divergent thinking and varied expertise. The primary means of interaction between these forces, the environment, and the agents were also represented by four of the key elements identified by the team members: communication, conversation, application, and context. In this way cohesion and diversity in the presence of a flow of information from the environment occasioned learning within our particular system.

Combining Team Member Perspectives with a Systems Perspective

Cohesive forces. These forces work to hold a group together and in our case were identified by team members as the elements of shared self-directed purpose and positive relationships. Cohesion developed through the autonomous unification of the group for a shared purpose. As the members worked together, they experienced pleasant feelings and developed positive relationships. The importance of these cohesive forces is consistent with academic literature on professional learning.

Academic research into professional learning has identified that choice and shared purpose are important for educator learning as they can increase levels of educator of involvement, commitment, and motivation in the professional learning process (Broad & Evans, 2006; Caena, 2011; Cox, 2012; Diaz-Maggioli, 2004; Iucu & Marin, 2014; Moor et al., 2005; Walter & Briggs, 2012). Additionally, current understandings of learning communities suggest that they are developed and maintained through a collective purpose and joint action (Hoban & Erickson, 2004; Vaughan, Cleveland-Innes, & Garrison, 2013). Additionally, through the creation of a self-determined, shared purpose, team members developed positive relationships.

The importance of trusting relationships in the development of individual and group learning has been identified over and over again in the literature on professional learning and learning in general. Educators have repeatedly reported they learn best when they feel supported

to discuss their experiences within a safe, positive, and constructive environment (Cox, 2012; Zwart et al., 2009). Research suggests that high-quality, trusting relationships provide the connectivity and flexibility needed to facilitate collaboration, reflectivity, and dialogue. These features tend to increase support between individuals and facilitate learning by encouraging social connections, open communication, and allowing individuals to safely exchange ideas, take risks, and co-create knowledge (Brueller & Carmeli, 2011; Parker et al., 2015; Stoll et al., 2006).

Trusting relationships also provide positive experiences and can encourage the development of strength, support, acceptance, and positive regard (Colledge, 2002; Dutton & Ragins, 2007; Shefer, Carmeli, & Cohen-Meitar, 2018). Positive regard can catalyse warm feelings, instill a sense of value, and encourage feelings of acceptance. When individuals exhibit and experience positive regard, they are more likely to develop caring relationships, reduced prejudices, and increased compassion (Rogers, 1983; Shefer et al., 2018). Both the building of positive relationships and taking action for a self-directed, joint purpose helped to hold the transdisciplinary group together in the face of diversive forces.

Diversive forces. By diversive forces I am referring to differences in philosophy, experience, and knowledge that can both isolate and specialize individuals. Diversive forces worked collectively to push the boundaries of the team's understanding, stretch the thinking of the individual members, and can be seen in the elements of divergent thinking and varied expertise that were identified by team members as important for their learning. In our case, differences surface in discussion and process causing unexamined biases and assumptions to be recognized, new avenues of thought to be explored, and new viewpoints and ideas to be reflected upon. The conversing and reflecting on differing ideas likely contributed to divergent thinking. The importance of these diversive forces is consistent with academic literature on learning.

The idea that learning can be facilitated by encountering diversity in ideology, philosophy, and knowledge is supported in formal learning theory (Mezirow, 1997, 2003; Taylor & Hamdy, 2013). By gathering diverse people together, divergent views are expressed which can generate discomfort (cognitive disequilibrium) within individuals. This discrepancy between what is understood and what is presented can cause confusion, but also provide an opportunity to grow as individuals work to reconcile new information with existing knowledge (Bormanaki & Khoshhal, 2017; Chinn & Brewer, 1993; D'Mello, Lehman, Pekrun, & Graesser, 2014; Maiese, 2017; Mezirow, 2000; Plensdorf, 2011; Shayer, 1997).

A simple example of this shift can be seen as all of the team members adjusted their behavior to ensure that they all utilize the closed captioning option on videos whenever they present video information to adults or to students. This occurred after the discussions about hearing and reading and after being presented with information from Fiona about the importance of closed captioning for deaf and hard of hearing students. A more transformative example can be seen as educators began to realize that metacognitive strategies should and could be taught to intermediate students and educators commented on their desire to be more mindful and explicit in their instruction of these strategies.

Interactive forces. By interactive forces, I refer to the reciprocal process by which information flows through the system as individuals influence and gain knowledge through exchanges with each other and the physical environment. A web of interactions occurred between the team members and the internal and external environment of the system. Within the learning system, team members engaged in real-time conversations, observations, creation and use of materials, but also remotely through electronic communications. The team members also

selectively interacted with and received feedback from sources external to the team such as students, teachers, parents, professionals, and academic research.

The importance of information flow through a complex learning system in the form of interactions between the learner, the physical, and social environment is compatible with social development theory, experiential learning theory, and andragogy (Beard, 2018; Dewey, 1916; Knowles, Elwood, & Swanson, 2005; Kolb & Kolb, 2009; Shayer, 1997). The literature suggests that collaborative learning experiences within a real-world context are more effective and appreciated by educators than conceptual learning occurring out of context (Boston & Smith, 2009; Caena, 2011; Garet et al., 2001; Walter & Briggs, 2012; Wei et al., 2009). The importance of conversation and social interaction identified by the members of our team are reflective of ideas of social development and social constructivist theory which suggests learning is a social activity occurring within a cultural context where understandings are co-created (Amineh & Asl, 2015; Doolittle, 2014; Shayer, 1997; Vygotsky, 1978).

In our case, individual educators were learning through their interaction with each other and the environment as they developed ideas and created materials they could use in their practice. All team members commented on the importance of the creation and implementation of mini-lessons to their learning. Additionally, all members spoke about the importance of the communications and conversations they experienced with other team members, their students, and other professionals as well as their reflections on these interactions.

Although all of the interactions appeared to impact the professional learning process, the face-to-face conversation experienced in real time with the other team members and the interactions team members had with students during the classroom lessons were commented on the most as being important to learning. Learning appeared to be facilitated by team members:

interacting in the context of the working environment, experiencing face-to-face conversations which facilitated ‘aha’ moments, having choice in the type of interactions engaged in, and facilitation of the interactions in a structured yet flexible manner.

Essential Ingredients for Learning in Our Transdisciplinary System

Upon examining the transdisciplinary team as an example of a complex learning system, two important observations can be made. First, the transdisciplinary team exhibited the characteristics of a complex adaptive system which was acted upon by cohesive, diversive, and interactive forces. Second, some elements of the transdisciplinary process, as identified by the team members, appeared to support these generative forces. When these elements were combined with the forces that occasion learning with a complex system, three ingredients vital for professional learning can be identified: **diverse expertise**, **positive relationship**, and **purposeful action**.

The transdisciplinary inquiry process provided the ingredient of **diverse expertise** by bringing together teachers and associated professionals from within our district, with diverse knowledge, skill and perspectives, to work on a jointly defined issue. Diverse expertise occasioned professional learning because it allowed for the sharing of knowledge and skill, the building of understanding and relationships across disciplines, the reduction of feelings of isolation, the examination of issues from multiple perspectives, and the imagining of a multitude of solutions and creative ideas. Additionally, by uniting a multiplicity of perspectives, biases and assumptions held by team members were uncovered that may not have been recognized if a homogeneous group had been convened.

The transdisciplinary process also provided the ingredient of **purposeful action**. Learning was catalyzed because the team had an immediate and authentic purpose for building

and applying knowledge. Team members engaged with academic research, consulted with other professionals, created mini-lessons, presented the mini-lessons to an authentic audience, and observed student reaction to mini-lessons. These actions helped to motivate, unite, and give meaning to the team's learning endeavours. Unlike some methods of collaborative learning such as study groups or professional learning communities that simply discuss topics of concern, our team extended action beyond discussion and into the realm of creation, application, reflection, and reapplication.

The transdisciplinary process also fostered **positive relationships**. By taking purposeful action toward a joint goal in respectful, caring, and purposeful ways, the team was able to build positive relationships whilst also creating an effective professional learning environment for themselves as well as their students. Connections between members were initially established by simply allowing time for the group to gather for uninterrupted discussion. These regular face-to-face discussions fostered mutual respect and established an environment of care which was further nurtured by encouraging team members to check in on each other and worked together toward their goal.

The current study has provided information to help build a better understanding of three key ingredients needed to catalyse professional learning in our case: diverse expertise, purposeful action, and positive relationship. By identifying these ingredients, we can seek to examine their existence in other professional learning situations in an attempt to gain a better understandeng effective professional learning experiences for educators.

Chapter 7: Summary and Implications

Summary of the Study

As I embarked on this research, I questioned whether it would be possible to provide an effective professional learning experience for educators through the use of transdisciplinary inquiry. The data and analysis suggest that transdisciplinary inquiry does provide powerful professional learning. First a diverse group of educators did unite and identify the topic of 'metacognitive strategies' as an area of inquiry and collaborated over an extended period of time to generate knowledge about, create, and implement a series of mini-lessons on the chosen topic. Secondly, the mini-lessons acted as a shared conceptual framework for the process and ensured that the group remained a transdisciplinary one. Additionally, the mini-lessons not only addressed the topic of metacognitive strategies but did so in a way that was accessible to diverse learners. Thirdly, interview and focus group data demonstrate that educators had positive emotions about and identified that they experienced professional learning through this process. All of these details provide evidence that it is possible to use transdisciplinary inquiry as a vehicle for educator professional learning in the public-school system.

The stated purpose of this case study was to examine two questions: How a transdisciplinary approach to collaborative inquiry might facilitate embedded professional learning for educators and how I, as a school psychologist, could both initiate and participate in this type of professional learning. Using data obtained from iterative interviews, focus group discussion, observational field notes, research diary entries, and artifact collection, the current case study provided a complete description and analysis of the process of the development and utilization of transdisciplinary inquiry for the purpose of professional learning. The study also demonstrated that the transdisciplinary team and inquiry acted as a complex adaptive system

demonstrating the characteristics of self-organization and self-determination, selective yet flexible boundaries, and existence far from equilibrium. The learning occurred in the system due to the action of forces on the system as learning emerged. Team members identified and described experiencing professional learning throughout the process.

Categorical analysis of the data from the team member's perspective indicated five important elements supporting their learning: application, multiple perspectives, relationships, emotion, and facilitation. Most individuals felt that applying the knowledge that was developed provided context and motivation to the group. Presentation of multiple perspectives was valued and identified as a basis for conversation and contributed to the collective cache of knowledge. Diverse ideas fueled reflection as members were forced to consider their own assumptions and to look at content through different lenses. The importance of building safe and supportive relationships was also a factor. Trust and support between members developed and this was particularly important when dissenting views were presented. Positive emotions of enjoyment, excitement, and care were experienced by team members. Active facilitation was necessary for the process to move forward and included supporting team member choice, organization, flexibility, and communication. Finally, some challenges to the process were identified including: lack of time and overwhelming workload, communication difficulties, and unanticipated events.

Analysis of the data from a complex adaptive systems perspective, identified three forces acting on the process: cohesive (drawing the system together), divisive (pushing the boundaries of the system) and interactive (information moving through the system). By viewing the transdisciplinary team and inquiry as a complex system, I was able to identify key ingredients that supported the forces that facilitated emergence or learning: purposeful action, diverse

expertise, and positive relationship. I suggest that our transdisciplinary inquiry successfully occasioned professional learning because these ingredients were present and suggest that when considering utilizing a transdisciplinary inquiry as a method of professional learning in the future, these ingredients be added to the process. Finally, I also discovered that as a school psychologist I was able to participate and facilitate the process whilst conducting research.

Implications for Professional Learning

It is sometimes necessary to provide professional development opportunities for educators utilizing experts and transmission models in the form of lecture or workshop. For example, if there has been a change in procedure or if the intent of the professional development activity aims to provide educators with broad new concepts, transmission models may be useful. However, when educators are asked to tackle complex issues or develop new skills within the context of their own workplace, it is my opinion that the transmission style of professional development is less effective. First, by its nature, it is impossible for transmission styles of professional development to provide the choice participants need to feel empowered and motivated to learn. Transmission styles of professional development most often present only one perspective on an issue, that of the expert doing the transmitting. This does not nurture a culture of critical inquiry and agency within the individuals who are being transmitted to, instead the process fosters the fear that only experts can solve the issues faced by educators. It is difficult for external experts, even if they transmit information during numerous iterative workshops or coaching sessions, to truly understand their audience's current knowledge and skill level, the diversity of their learners, and the context of their audience's working life. It is also difficult, using these methods, to develop a joint purpose, build positive lasting relationships, obtain and

react to contextual feedback, engage in deep meaningful conversations, or provide the ongoing support needed to help educators implement new ideas in their own context.

Therefore, I suggest that when professional learning is desired in areas that are complex and require ongoing support, we should consider the use of transdisciplinary inquiry as a method of professional learning. Transdisciplinary inquiry can develop into an autocatalytic learning system which can be sustained over a long period of time. It can create positive relationships between team members and break down silos. It can tap into local expertise within a local context. Transdisciplinary inquiry can allow for educator choice and agency, can encourage deep conversations, and purposeful action within the context of educators' daily work lives. Finally, it can allow for and catalyse diverse thinking so that creative solutions to complex issues can be considered. Transdisciplinary inquiry as a means of professional learning can be an effective addition to the professional learning models already in use as educators try to address the complex social and educational issues they face today and into the future.

Moving from professional development toward professional learning. The current case study stands in contrast to the typical types of professional development opportunities educators are most commonly offered within the public-school system. The process used in this case, honored and tapped into the knowledge that educators in the district already had available to them and did not rely on external experts. It allowed for educator autonomy and agency and was focused on both student and educator learning. Finally, it encouraged diversity and creative thinking whilst also allowing for application of knowledge and relationship development.

I created Table 3 to summarize differences between typical transmission style professional development and professional learning experienced by our team when engaged in transdisciplinary inquiry. My observations lead me to assert that when utilizing a

transdisciplinary approach diversity is desired and respected, new ideas and power are distributed, choice is required, relationships emphasized, and change actively supported.

Table 3. Traditional Professional Development vs. Transdisciplinary Professional Learning

Typical Transmission-Style Professional Development	Transdisciplinary Inquiry as Professional Learning
• Expert transmits information	• Learners discuss, create, implement ideas
• Teaching is situated out of context and learning is considered context independent	• Learning occurs within context and is considered context dependent
• Educator is expected to implement ideas independently with little ongoing support	• Educator is supported by a team and implements the ideas in their classroom or work context
• Educator engages in linear learning on one or two occasions	• Educator engages in an iterative process of researching, planning, discussion, implementation and feedback
• One perspective and one set of knowledge are accepted and used	• Diverse perspectives, expertise, and knowledge bases are acknowledged, used, and respected
• Administration or presenter chooses what will be taught	• Learners determine the topic of inquiry and how the inquiry will progress
• Focus on a single discipline	• Transdisciplinary investigation
• Disparate philosophies and theories are considered incompatible & discouraged	• Disparate philosophies and theories are seen as adding to a holistic phenomenon & encouraged
• Learning is pre-determined	• Learning emerges
• Relationship is not a considered in the learning process	• Building positive relationships is a valued and necessary aspect of learning
• Independent and individualistic in nature	• Collaborative and cooperative in nature

The current study suggests that it is the integration of the differences in the perspectives of the individual members of the learning team that likely created and allowed new ideas and learning to emerge. It also suggested that educator choice in topic, role, participation, and process enabled distribution of power and the development of a self-organizing, self-sustaining

system. Findings indicate that through relational cohesion, feelings of care, excitement, and belonging developed so as to provide safe environments for educators to risk, experience dissonance, and ultimately make shifts in practice, belief, and understanding. Findings also suggest that it was not through use of complex electronic devices that learning occurred but rather through the face-to-face interactions between caring but diverse human beings and through the application of knowledge within a real-world context. The use of transdisciplinary inquiry as a means of professional learning may be an effective, efficient, and exciting way to empower educators to obtain the transformative learning experiences they both desire and need to adapt to the rapidly changing times and to effectively support the learning of students.

Contributions and Future Implications

After sharing the results of the current research with the administration in my school district, interest was expressed in incorporating this type of professional learning into the menu of support that school psychologists, and perhaps other district staff, can provide to educators. One contribution this study has made to the field is that it has demonstrated using transdisciplinary inquiry as a mode of professional learning is possible in the public education system. Some of the results suggest that this type of professional learning may: be more effective in supporting teachers in the implementation of new ideas in the classroom; enhance feelings of educator connectedness; and be more effective in creating more inclusive learning environments. This study has also been able to characterize and identify how a transdisciplinary inquiry can be used to view educator professional learning teams as complex systems. In doing this, the current study honors both the complexity and diversity required to tackle complex social issues and it identifies that simply transmitting information will likely not effectively aid educators in addressing the concerns and difficulties they face today and into the future.

However, more research is needed across a wider variety of contexts. Specific research on time commitment and cost of implementation in comparison to other methods of professional learning would be helpful to better understand if the time commitment required would be acceptable to educators, practicable for administrators, and economical enough to be adopted by school districts. Research on what elements, techniques, and characteristics support facilitation in this context would be useful. Examining how to reduce barriers (such as lack of time and difficulties in communication) to the use of transdisciplinary inquiry as a method of professional learning may be helpful. Finally, research into the effect that transdisciplinary inquiry has on educator instructional change and student learning would also be important as educators of today strive to provide the support, leadership, and guidance to develop the educated citizens of the future.

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Appendix A

Semi-structured Interview Questions (Sessions will be Recorded)

Session 1 (30 – 45 Minutes) Prior to the Inquiry

1. Tell me about yourself and your teaching background.
2. Describe your typical type of professional development experiences.
3. Tell me about one of the best professional development experiences you have had.
4. Tell me about one of the worst professional development experiences you have had.
5. How would you define professional learning; what should it be like?

Session 2 (30 – 45 Minutes) Middle of the Inquiry

1. Tell me about the inquiry project you are involved in.
2. Describe your feelings about the process so far.
3. What expertise did you bring to the group?
4. What have you learned during this process so far?
5. Describe the challenges you have had in your own learning?
6. How would you change the process in regards to professional learning?

Session 3 (30 – 45 Minutes) After the Inquiry

1. Tell me about the inquiry project you were involved in.
2. Describe your feelings about the process now that it is over.
3. Regarding your own professional learning,
    a. What did you learn?
    b. What aspects of this process were beneficial?
    c. What aspects were challenging? Detrimental?
4. How did this experience compare to other professional learning experiences?

Appendix B

Focus Group Discussion Topics (Semi-structured Discussion: Video Recorded)

1. Inquiry project as a means of professional learning
2. Effectiveness of the transdisciplinary team
3. Beneficial aspects of the process
4. Challenging aspects of the process
5. Improvements that could be made to the process
6. Overall Impressions

Appendix C

Team Member Description

During the first interview that I had with each of the team members, I asked them about themselves and their experiences. The following paragraphs were distilled from approximately an hour of conversation with each participant. This information was not obtained as the monologues presented here, but rather in response to back and forth conversation. I have tried to preserve, as much as possible, the team member's own voices as they briefly describe their history, their work, and what they hoped to get out of the PL experience. This information was important to me as I tried to learn more about the team members and began to build a closer relationship to them, as I tried to think about organizing a learning experience that would be useful to all participants, and as I tried to determine what aspects of their work would be helpful to bring into the project. I am including this information for the reader to provide a deeper understanding of the diversity of the team members as well as their perspectives on learning in general and professional learning specifically. Consistent with a social constructivist perspective, I believe that each team member was a co-creator of the knowledge presented here; therefore, it is important to me that they too have the opportunity to position themselves in this research and describe their history, context, motivations and hopes for the project.

Shelley's introduction (special education teacher). Well I am not your 'typical' teacher. I have a fine arts degree in visual arts and completed my education degree in secondary art, yet I have never taught art in high school! My first teaching position was as a music and band teacher in the primary grades. I taught in a rural school K to 7 and it was an amazing place to start. You just become a jack of all trades because when you teach little ones, you teach everything. Throughout my 19-year career, I have worked as a primary teacher across most of the grades and have held the learning assistance teacher position for grades K to 7.

At present, I am in the special education teacher role helping students with various exceptionalities to learn, supporting the educational assistants that help these students, and helping classroom teachers to make learning accessible for all students. Three of my colleagues have multiple roles in addition to their LA/Resource role; I am often finding myself trying to support them in their roles but also trying to help them grow as educators. It is so often on the fly, because I usually can only have a few words in passing. Therefore, I think I try to be conscientious of using my influence in a measured, careful, and thoughtful way.

My current school is a very busy place. It is great because it is not too big. People know each other; it is easier to get to know all of the students and their families. Teachers can find their niche and usually if someone has a particular interest, there is someone and some way to support it. Many of our students come from a lower socioeconomic background and there are high needs. So, we are always caught between what we are told kids should be able to do and what we know our students can do – we have to find a good fit for them. It is a struggle for us to meet their needs but also meet the expected pieces from the Ministry of Education.

My hope for this project is that I will be able to watch connections being made between people. I love those "ah ha" moments for my friends and colleagues. So, I will enjoy watching these lovely human beings, who are newer in their career, have those "ah ha" moments. Also just having time to work with my peers, in the building, with our feet on the ground so that we can better help our students and ourselves. Being with like-minded people is the key for me. It can be stagnating if you are not connected with someone to bounce ideas off.

Graham's introduction (grade 6/7 classroom room teacher). I have been teaching now for about 15 years. My teaching areas are Physical Education and Language Arts for high school. My first job was as a grade 7 teacher in a middle school. I worked there for ten years during which time I moved up to teaching grade 9. I think I became a teacher because I like working with kids and because of the coaching option. I find kids are easy to deal with and to talk to. While teaching, I was also able to coach basketball for many years and it was year-round. I coached basketball at the high school the first three years that I came to this school and then it just became a little too much. I have a young one at home and at daycare and a wife going back to work full time. Plus, I want to have energy to help my son out with whatever he decides to do when he is older.

I have been in this school now for five years. When the middle schools closed, I transferred to this school to a full-time position and set up a team-teaching program with a coworker. We basically run what we think is a middle school model. We use a team-teaching concept and split the academics between us. There is a good feel here at this school. I like our kids. They don't come in with a lot of pretense; they don't come in entitled. There are struggles. With some of the kids I am amazed at how well they do despite some of the challenges in their lives. I think overall our students need extra help to build up some of the basic skills.

My hope for this project is just that there will be collaborating and communication. I am not really worried about creating a product. I think sometimes you don't even know what will come out of a process like this one. If everyone leaves the process feeling like they understand something a bit better, then I think it is worthwhile. If we can come up with some ideas or ways to improve things, great. I keep thinking that when we are teaching, we are working in a cafeteria buffet style environment, but we are really trying to give each student an individual, home-cooked meal. The needs are there for the individualized meal, but the delivery system can't support it. It is important that we work together to try to figure out how to best meet the needs of all of our students.

Carolyn's introduction (grade 4/5 classroom teacher). I am a late bloomer in the teaching industry. I obtained my degree majoring in psychology, minoring in English at St. Frances Xavier University in Nova Scotia. I also completed a two-year certificate in clinical massage therapy. I practiced as a certified massage therapist for a bit and then I got the travel bug and I went overseas to teach English as a Second Language at a university in South Korea. When I wasn't teaching at university, I was tutoring children privately. I tutored a two-and-a-half-year-old and a thirteen-year-old and every age in between. The experience definitely gave me an inside look to see if teaching was something I would want to do.

When I returned to Canada, I settled on Vancouver Island and I started to play rugby and at Nationals, I got scouted for Canada and went off and represented the country. It was all encompassing. After the three years on the National team I decided I would just play recreationally. I got married and I had two kids. I had been sort of plugging away at the courses for teaching because it was always in the back of my mind. In 2013, I finally decided to bite the bullet and become a teacher. I graduated in 2015 and did a year of subbing then I got a contract at this school in September. I have mostly taught the intermediate grades. Both last year and this year I had a grade 4/5 class.

I enjoy teaching because there is something new all of the time and because of the relationships with the students. You are always learning, and I like learning; I don't like feeling stagnant. There is always something that I can do to learn more. This school is like home to me; I love it. The staff is super supportive. I would never have survived my first year without collaboration. There are things that they just don't teach you at university. You learn it on the job. That is why I love this school. I could ask anybody anything and not feel intimidated or uncomfortable.

My hope for this project is that it will help me to feel that I am better able to meet the needs of my students. I think listening to different perspectives will help. As a new teacher, one of the most difficult things I have found is the week to week organization. I hope that sitting down with the group and saying this is what we are going to do will help me plan and organize. I also hope that the focus will be on writing because my students struggle with that. I am a sponge, everything I can take away I will.

Susan's introduction (occupational therapist). I am an occupational therapist (OT). I graduated from the University of British Columbia in 1980 with a combined degree in physiotherapy and occupational therapy. I worked for about nine years in a rehabilitation center and became passionate about neurology. Eventually, I became very involved in a working group that was examining cognitive assessments in adults. I ended up with a National Research Grant for three years looking at the effectiveness of treatment. I also spoke at our national OT conference on two occasions. My husband had the opportunity to improve his career so we ended up moving here. After I had my third child, I was looking for part-time work and ended up taking on a number of OT jobs before settling on working in the district in September of 1992.

Currently I am the only occupational therapist in the district. My job is itinerant and involves problem solving, collaborating with others, and navigating through difficult situations. I spend a lot of time trying to simplify things and impart information to nonhealthcare professionals about medical or developmental needs that may or may not have relevance to them. I work with teachers to help students in a variety of ways such as helping with equipment for students with mobility issues, providing strategies for students with autism, making suggestions to help students with motor, fine motor, and motor planning problems, and providing recommendations for student self-regulation to name a few. I help people understand why I recommend what I recommend. I find if you haven't built it (a program or plan) together or if someone doesn't understand the why, things won't get implemented.

My hope for this project is to be able to make connections with others and to transfer knowledge. I think that as a school-based OT the only way I can be effective is to intersect my knowledge with the teachers'. I hope that this project will help me to figure out how to impart some of my knowledge in a practical and useful way. I think that what happens when I am involved in a project with different professionals is that we all get a broader view of things. If you can get an adult to change the way they view something, you can make one of the biggest differences in a child's trajectory in life. If you can show that they are unable instead of unwilling, the effort that someone will put into that child or to shift things is amazing.

Fiona's introduction (special education teacher for the deaf and hard of hearing). My family owned a greenhouse business and agriculture was my first love so initially I obtained a B.Sc. with a major in agriculture at the University of British Columbia (UBC). I worked for the agricultural employment services where as part of my work I helped young people fill out application forms; through this work, I realized I had a passion for helping young adults learn so I began thinking about teaching. I returned to university and completed the B.Ed. Program at UBC with a specialty in teaching deaf and hard of hearing; it was really a good fit.

I have had a hearing loss for as long as I can remember. I was the first-born child in my family and when I was young my parents and I were living in Hong Kong. My parents, without prior experience raising children, thought I was just naughty and not obeying what they were asking me to do. My kindergarten teacher noticed that I didn't seem to be reacting to auditory information the same way the other students did, so she suggested I get tested. Sure enough, I was diagnosed with a bilateral hearing loss. I wear hearing aids in both ears and am well aware of the struggles that my students face.

My job here in the district is multifaceted. I go from school to school to teach the children who meet the ministry of education guidelines for hearing loss, typically that means moderate to profound. I work with students, who communicate orally and with sign language, the classroom teachers of these students, with visual language interpreters, and the school-based teams. I work with students on my caseload until they graduate. It is all about building relationships and trust. Also, a big part is modelling the fact that I wear two hearing aids and I'm able to have a full life while managing my work. I understand what it is like for them to learn in a noisy classroom and I try to advocate for them while teaching them to be their own best advocate. It is a constant learning process for everyone, because hearing loss is invisible.

My hope for this project is that I can start to learn more about what other people are doing in their areas of specialty and classrooms. I think that this will increase the number of educators that I will have contact with and will help us to build relationships. I hope to be able to educate others about the needs deaf and hard of hearing learners so that together we can create classrooms and environments that are accessible for all.

Caroline's introduction (school counsellor). I wanted to be a teacher since I was a child; however, my own elementary 'schooling' as I would prefer to call it, wasn't a very positive experience for me. So later in life, I decided to be a primary or early childhood teacher because I wanted kids to know from day one that learning could be a fun and enjoyable experience.

I didn't go to university until about ten years after I graduated from high school. I became a single parent and decided that going back to school would provide me with an opportunity to support my kids. So, I went back as a mature student and completed a BA in psychology, specializing in Early Childhood, then completed the Professional Development Program to become a teacher. I was hoping to eventually become school counsellor. I started teaching grade 2 on the Mainland and loved it. Seventeen years ago, I was hired by this district to implement the ESL/ESD program. I have worked here as the early childhood literacy liaison, kindergarten teacher, special education teacher, and a grade 1, 2 and 3 teacher.

Quite a few years after I came to this district, I came in contact with an organization that introduced me to the idea of secondary or vicarious trauma. I ended up getting very ill and had to take a leave from work. I was trying to understand why this was happening to me and finally I went ha-ha – secondary trauma. A majority of my teaching career had been in inner city-type schools filled with trauma. I returned to university and completed my Master's in school counselling. My research examined childhood trauma and its effect on the classroom teacher. Now, I work as the school counsellor in two of the schools in the district.

For me I am excited about the project and I hope that we all learn more about collaboration and the educational process. I also hope that we find that we have enough time to do it. Also, one thing I really enjoyed doing, and I have only had an opportunity a few times, is team teaching. Working with another educator in the same class makes it more fun and it is a big part of building relationships. I hope I have a chance to team teach during this project. I am very excited about learning. My grandfather on my mom's side died when he was 97 years old. One thing that he left with me; he said, "To stop learning is to stop living." That is one of the tenets I have carried with me through my life.

Appendix D

Mini-Lesson Plans

Selected PowerPoint Slides

ACTIVITY

- STUDENTS ARE DIVIDED INTO GROUPS AND A RECORDER AND A REPORTER ARE CHOSEN
- EACH GROUP OBSERVE A DIFFERENT PICTURE AND TALK ABOUT WHAT THE CHILD IS FEELING.
  - WHAT FACIAL AND BODY CLUES ARE SHOWN
  - WHAT SITUATIONAL CLUES
- THE RECORDER WRITES DOWN THE OBSERVATIONS
- THE REPORTER SHARES THE OBSERVATIONS OF THE GROUP WITH THE REST OF THE CLASS.

CONFUSED?

Group Discussion

1. Were you confused when the water did not pour out of the glass after it was tipped?
2. What does it feel like when you are confused?
3. Why did the water stay in the glass when it was tipped over:
   a. And the plastic lid was on the glass
   b. And the mosquito netting was on the glass

Confusion is not necessarily a bad thing. Often it can be the first step to learning.

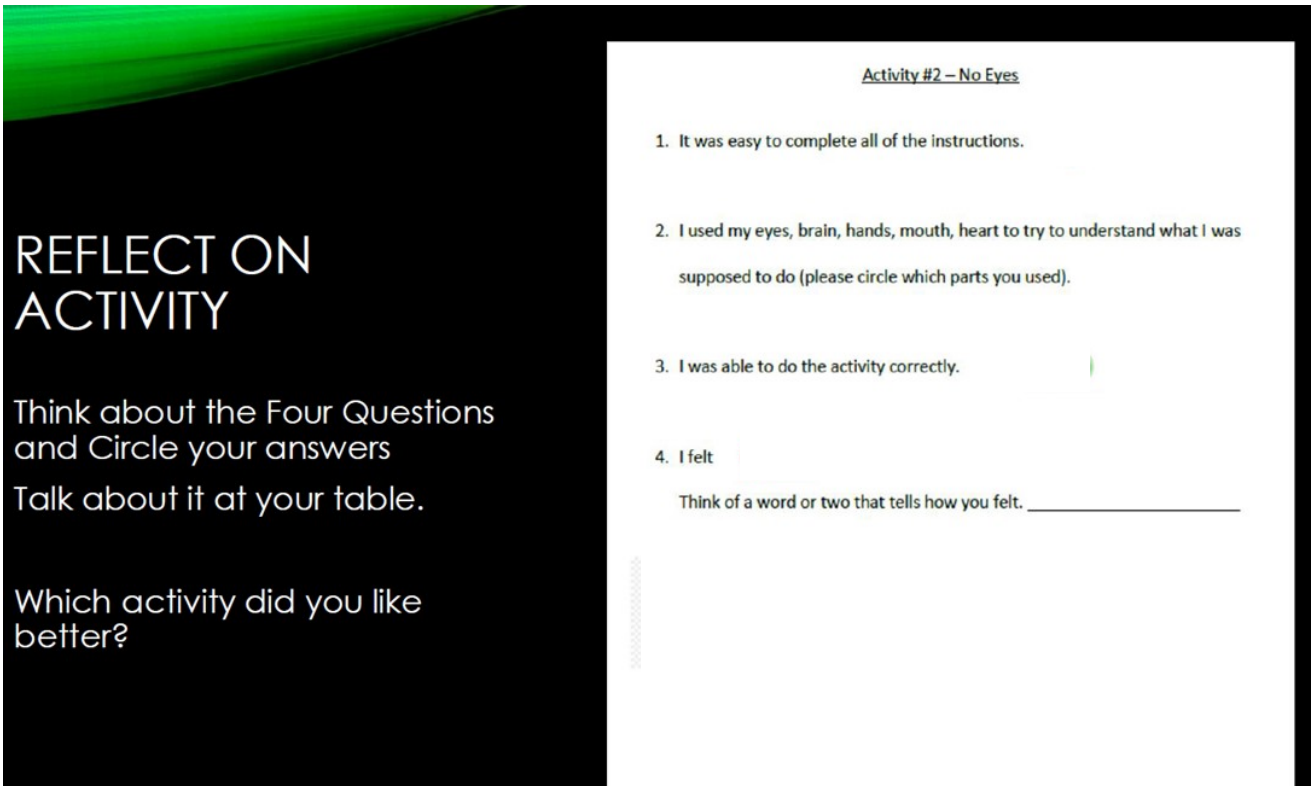
Appendix E

For this activity the teacher chose to use blindfolds for the students. She stood at the front of the class and demonstrated the actions on the board, but since students could not use their eyes, many were confused as to some of the vocabulary and the instructions. The end result was that students should have drawn a happy face on their paper (a very simple task), but most of them couldn't complete it because they couldn't see.

Instructions:

- This time again I want you to put a piece of paper on your desk and place a red blue and black crayon on your desk.
- Next, I want you to follow the instructions very carefully. Close your eyes and don't open them or peek (or you can give them blindfolds to cover their eyes)
- Make sure you don't open your eyes.
- Feel the paper on your desk and place it so the short side is along the bottom of your desk.
- Pick up this color of a crayon.
- Now make an ellipse like this horizontally on your page
- (do the best you can)
- Next put two dots in the middle of the ellipse and a curvy line below the dots
- Put lines like this at the top.

Put your crayon/marker down and look at the board. This is what you should have made show your table your drawing.


REFLECT ON ACTIVITY
Think about the Four Questions and Circle your answers
Talk about it at your table.
Which activity did you like better?
Activity #2 – No Eyes
1. It was easy to complete all of the instructions.
2. I used my eyes, brain, hands, mouth, heart to try to understand what I was supposed to do (please circle which parts you used).
3. I was able to do the activity correctly.
4. I felt
Think of a word or two that tells how you felt. _____

Appendix F

Thinking About My Learning

Name: Date:

Never Sometimes Always

1. I use my eyes to watch for information while I am listening.
2. I think about the type of listening I will be doing before I begin.
3. I listen to others without interrupting.
4. I ask myself questions in my head while I am learning.
5. I tell myself I did good work when I follow instructions correctly.
6. I talk to myself to remind myself of the steps to follow in a task.
7. I ask for help if I don't know how to do something.
8. I check with myself during a lesson to see if I understand.
9. I find out what the completed task should look like before I begin working.

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Certificate of Approval

PRINCIPAL INVESTIGATOR:	**Rhonda Geres-Smith**	**ETHICS PROTOCOL NUMBER:** Minimal Risk Review - Delegated	**18-165**
UVic STATUS:	**Ph.D. Student**	ORIGINAL APPROVAL DATE:	08-Jun-18
UVic DEPARTMENT:	**EDCI**	APPROVED ON:	08-Jun-18
SUPERVISOR:	**Dr. Kathy Sanford**	APPROVAL EXPIRY DATE:	07-Jun-19

PROJECT TITLE **Transdisciplinary Inquiry: Exploring a New Approach to Professional Learning in Education**

RESEARCH TEAM MEMBER None

DECLARED PROJECT FUNDING: **None**

CONDITIONS OF APPROVAL

This Certificate of Approval is valid for the above term provided there is no change in the protocol.

Modifications
To make any changes to the approved research procedures in your study, please submit a "Request for Modification" form. You must receive ethics approval before proceeding with your modified protocol.

Renewals
Your ethics approval must be current for the period during which you are recruiting participants or collecting data. To renew your protocol, please submit a "Request for Renewal" form before the expiry date on your certificate. You will be sent an emailed reminder prompting you to renew your protocol about six weeks before your expiry date.

Project Closures
When you have completed all data collection activities and will have no further contact with participants, please notify the Human Research Ethics Board by submitting a "Notice of Project Completion" form.

Certification

This certifies that the UVic Human Research Ethics Board has examined this research protocol and concluded that, in all respects, the proposed research meets the appropriate standards of ethics as outlined by the University of Victoria Research Regulations Involving Human Participants.

Dr. Rachael Scarth
Associate Vice-President Research Operations

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Certificate of Renewed Approval

PRINCIPAL INVESTIGATOR:	Rhonda Geres-Smith	ETHICS PROTOCOL NUMBER: Minimal Risk Review - Delegated	18-165
UVic STATUS:	Ph.D. Student	ORIGINAL APPROVAL DATE:	08-Jun-18
UVic DEPARTMENT:	EDCI	RENEWED ON:	14-May-19
SUPERVISOR:	Dr. Kathy Sanford	APPROVAL EXPIRY DATE:	07-Jun-20

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