A Framework for Implementing Inquiry-Based Learning in the Elementary Classroom

by

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Bachelor of Education, Simon Fraser University, 2006

Bachelor of Engineering, University of Salford, 1998

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Abstract

This project focuses on using inquiry-based learning (IBL), supported by the development of specific self-regulated learning (SRL) skills, as a student-centred approach to teaching and learning in grades 4-6. With many jurisdictions around the world changing their school programs from teacher-centered learning environments to student-centered learning environments, teachers are looking for ways to immerse their learners in more personalized learning environments. This resource was co-created with my colleague Suzanne Bartel and provides a resource for teachers introducing IBL to students that is supported by the development of SRL skills in the learner. The IBL cycle details six critical steps including generating an inquiry question, researching, analyzing and evaluating the research, creating, sharing, and reflecting. Support for the development of SRL skills in the unit is based on Winne and Hadwin's (1998) four phases of SRL. The project concludes with a reflection on the development of the resource and some further recommendations for educators.

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Acknowledgments

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Chapter One: Introduction

Context

As a classroom teacher, I constantly face the challenge of capturing and maintaining student attention, developing highly engaging lesson plans, and stimulating curiosity. Many of my learners struggle to make school personally relevant, and struggle with the mass volumes of content in current curricula. I have discovered that allowing learners periods of time in their weekly schedule to direct their own learning and pursue topics of interest increases engagement and fosters a love of learning. Therefore, a balance needs to be struck between covering important content in school curricula and creating authentic learning experiences of students. Inquiry-based learning practices may offer a solution to the problem.

I have attempted various forms of inquiry-based learning in my grade 5-6 classroom in the last five years with mixed success. The biggest challenge when engaging in this type of learning is in ensuring that all students have the necessary skills to be independent, self-directed, learners. Many of the students I have engaged in inquiry-based learning have not developed the necessary self-regulated learning (SRL) skills required to be successful with this style of learning.

After reading a literature review on SRL written by my colleague, Suzanne Bartel, it became clear that engaging in inquiry-based learning combined while specifically guiding the development of learners SRL skills may enhance the experience for more learners. Together, we have developed a teacher resource targeted for grades 4-5 on the subject of inquiry-based learning supported by SRL skills development. The resource breaks a cycle of inquiry down into eight specific phases. Each phase of the inquiry cycle is supported by specific SRL strategies to help students learn how to learn, as they direct their own learning.

Literature Review

Definition of terms

1. Discovery-based learning. Discovery-based learning (DBL) is an inquiry-based constructivist approach to learning. Pioneered by Jerome Bruner (1961), DBL is a problem-solving method where learners use their prior and existing knowledge to discover new learning. An example of DBL may occur when a student is given the materials or resources to develop or discover an appropriate response to a problem rather than being given a problem with 'one right answer.' DBL is designed to promote deep understanding of subject matter, develop metacognitive skills, and enhance student engagement. Following the scientific method, DBL enables students to develop hypotheses to answer questions, and often leads to the development of a lifelong love of learning. DBL acts as the overarching framework within which other forms of student-centred learning occur. One of the characteristics that distinguishes DBL and other forms of inquiry learning is that "...the learner is not provided with the target information or conceptual understanding and must find it independently and with only the provided materials" (Aldrich, Alfieri, Brooks, & Tenenbaum, 2011, p. 2).
2. Problem-based learning. Problem-based learning (PBL) was first formally used as a method of instruction in the field of medicine in the 1960s (Strobel & van Barneveld, 2009). PBL is a student-centred approach where learners are given an ill-defined problem, identify the knowledge gaps, and work towards finding the missing information and making plausible assumptions, they plan out their approach and iteratively refine their plans as new information comes to light, they work towards a solution that they can justify and support and then look back to confirm that they have answered the original

problem and forward to see what other questions they might now explore (Barrows, 2002). PBL "empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem" (Savery, 2006, p. 9). PBL is a constructivist approach to learning that promotes knowledge development and leads to self-directed and lifelong learning (Hmelo-Silver, Duncan, & Chinn, 2007).

3. Challenge-based learning. Developed by Apple Inc. (2009), challenge-based learning (CBL) is an established instructional practice firmly rooted in inquiry (Johnson & Adams, 2011). It offers the chance for learners to use technology to solve real world problems. CBL builds on the philosophy of project-based learning, but its distinct difference is that it uses a collaborative team approach to problem solving. It was developed in response to business and educational concerns that students lack the necessary abstract thinking, problem solving, self-directed learning, and the ability to work in groups when entering the workforce (Johnson & Adams, 2011). CBL promotes creativity and risk-taking, and according to Marin, Hargis, and Cavanaugh (2013). CBL is effective in educational institutions in the midst of pedagogical change.
4. Inquiry-based learning. Inquiry-based learning (IBL) can be considered a student-centered way of learning and teaching where students develop a sense of curiosity about the world around them and are introduced to mathematical and scientific ways of thinking. Although IBL is used extensively in the areas of mathematics and science its framework can be used in all subject areas. In IBL environments, students' work independently or in collaborative groups to develop knowledge by exploring, and

problem solving to find their own understandings and solutions (Maaß & Doorman, 2013).

The purpose of the literature review is to collate and synthesize the latest research on IBL in k-12 settings to support the development and presentation of a guided inquiry-learning resource for educators. Integrated with this resource is a framework of scaffolding to support the development learner's SRL skills.

The terms DBL, CBL, and PBL are often used synonymously with the term IBL. The literature review is supported by the theoretical framework of constructivism where learners construct their understanding and knowledge of the world, through experiencing activities and events and reflecting on those experiences. In addition, examination of the effectiveness of inquiry-based learning with respect to the relative skills of both teacher and student, the benefits and the challenges of practicing inquiry learning are also considered. Finally, the role of digital technologies, the need for self-regulated learning skills development, and effects of inquiry-based learning environments on student motivation and engagement in are discussed.

Rationale. Jurisdictions around the world are changing their school curricula - moving from teacher-centered learning environments to student-centered learning environments (British Columbia Ministry of Education, 2015; Dumont, Istance, & Benavides, 2010; Parson & Beauchamp, 2012). The current model of school is firmly rooted in our industrial past and represents an impractical way to meet the needs of learners living in a highly-connected knowledge-based society. The British Columbia Education Plan (B.C. Ed Plan) calls for a substantial shift in educational practice by putting students at the center of their own learning and making school more personally relevant. The goal of the B.C. Ed Plan and the larger educational community is to develop innovative learning environments where students can discover,

embrace, and fulfill their passions (British Columbia Ministry of Education, 2015). In British Columbia and Alberta, student-centered school curricula have been in development since 2011. In research to support curriculum development change in Alberta, Parson and Beauchamp (2012) found, "The current paradigm of the education system dates from the Industrial Revolution where learning has traditionally been associated with requiring students to gain information, rather than encouraging students to learn" (p. 294). The current educational model struggles to meet the needs of the 21st century learner, and as such a model of education based on personalization that puts the student at the centre of the learning may create more meaningful and authentic learning opportunities, and increases student agency (Parson & Beauchamp, 2012).

Creating opportunities to engage students in IBL represent one example of a shift in education towards a more personalized learning environment. In a report on innovative learning environments titled *The Nature of Learning: Using Research to Inspire Practice*, Dumont et al. (2010) describe rapid advances in digital and communication technologies, a shift to economies built on knowledge, and new brain research on how people learn as driving forces behind the need to change what learning, teaching, and school should look like. The National Research Council (2012) also makes the link between student-centered and inquiry approaches to learning,

> As in all inquiry-based approaches to science teaching, our expectation is that students will themselves engage in the practices and not merely learn about them secondhand. Students cannot comprehend scientific practices, nor fully appreciate the nature of scientific knowledge itself, without directly experiencing those practices for themselves. (p. 30)

In British Columbia, Timperley, Kaser, and Halbert (2014) raise serious concerns about the current state of learning. They note that significant numbers of middle and high school students

are actively disengaged from school, and there exists a disproportionately low-level achievement in specific disadvantaged groups of students. Their stance is clear: schools must be transformed to engage today's youth because our 20th century education system struggles to meet the needs of all learners, and society at large, in the 21st century.

The personal relevance of school is also important to today's learners. Creghan and Adair-Creghan (2015) found a disconnect between the curriculum that students were asked to engage with in school and the application of the learning within their daily lives. They suggest the demands of standardized testing, schoolwork, homework, combined with a lack of personal relevance is causing significant numbers of students to reconsider the value and importance of school.

Many researchers advocate for a move away from curricula focused on the transmission of information from teacher to student, to curricula that centers on learning by exploring. For example, Ergul et al. (2011) compare children to scientists. They claim that curiosity is an innate trait in children and leads them to develop questioning skills and inquiry from an early age. Furthermore, they suggest that when students learn by exploring they use almost all of their senses. In this way, hands-on activities help learners acquire experience in authentic ways and learning becomes more permanent. Harris and Rooks (2010) agree but take a more scientific perspective on the matter. They suggest that when students observe, investigate, and explain real-world problems, it helps them relate scientific concepts to the world around them and allows them to test the validity of scientific ideas. Furthermore, they state that inquiry-based learning environments engage students in scientific processes that create opportunities for students to think about and develop both scientific knowledge and scientific habits of mind (processes).

IBL offers more opportunities for learners to developing questioning and problems solving skills when compared to more traditional, teacher-centered, instructional practices. Several researchers (Marshall & Horton, 2011; Sadeh & Zion, 2009; Wirkala & Kuhn, 2011) highlight the cognitive benefits of a hands-on approach to science, and a growing body of research supports IBL as a method of challenging students to think critically and deeply about concepts, processes and strategies in science and mathematics. In contrast, traditional classrooms, which place a higher degree of importance on memorization of facts and retention of knowledge may not develop higher-level thinking skills in the same genuine way IBL can. When compared to teacher-centered instructional practices, student-centered IBL methods are more likely to develop stronger higher-level cognitive skills in the area of questioning, researching, synthesizing, and problem solving.

Problem Statement

In order to meet the needs of the learner in the 21st century, school curricula are in a process of transition from traditional teacher-centred environments to environments that are more student-centred. What learners know is less important than what they can do with their newly created knowledge. The 'knowledge society' we now live in requires educators to rethink effective and engaging teaching and learning practices. This document seeks to support grade 4-6 teachers in implementing inquiry-based learning (IBL) in elementary classroom settings and guide students in gaining the necessary skills that they will need to be self-regulated learners.

Project Overview

There is mounting evidence to support the need for curriculum change in schools around the world. As learners navigate their way through school in preparation for the workforce, employers are looking for people who can solve non-routine problems, analyze data, work in

collaborative teams, question findings, effectively communicate results, and work autonomously (Abril et al., 2013). Student-centered learning, specifically, IBL supports the development of these skills more effectively than teacher-centered learning.

With a shift to more student-centred learning, there is a need to design a framework within which students can pursue their own interests and topics, and for educators to equip their students with the strategies to be independent, self-directed, learners. The project documents the development of an IBL guide for educators that is enhanced by integrating scaffolding to help students become self-regulated learners (Winnie & Hadwin, 1998). The resource, targeted for grades 4-6, is intended to guide teachers through a full cycle of inquiry-based learning with eight distinct phases - as adapted from Kuhltau, Maniotes, and Caspari's (2012) Guided Inquiry Design. The eight phases include Engage, Generate, Explore, Question, Collect, Create, Share, and Reflect. Each phase of the inquiry cycle is supported by specific SRL skills such as task understanding, goal setting, and study strategies. The resource is designed to provide an opportunity for all students to be successful in this type of learning by specifically targeting important 'learn to learn' skills.

Review Methods

To support the research question, does IBL lead to increased engagement, motivation, and student achievement? This literature review offers an analysis of the theory and research documenting ways in which authentic IBL can make education more meaningful to learners.

Selection criteria. I studied a range of sources, including research articles, reports and books. This was my selection criteria:

1. Research that included both qualitative and qualitative methods.

2. Reports, articles, and books written by academics and/or professional organizations known nationally and/or internationally.
3. Literature published internationally, nationally, and provincially.
4. Literature published within the past five years was prioritized.

Search procedure. From September 2014 to April 2015, I searched published academic work using search words that included, IBL, challenge-based learning, problem-based learning, student engagement and achievement, student motivation, inquiry+learning+(motivation OR achievement), inquiry+learning+k-12+(motivation OR achievement), and student-centred learning. I used the following search strategies:

1. Electronic searches on the following databases: University of Victoria Summon, ERIC, Google Scholar, PsycINFO, Academic Search Complete, UVicSpace, ProQuest Dissertations and Theses, and WorldCat
2. Manual searches of relevant journals, published research reports, and books.
3. Internet searches using Google search engine.

In addition to the above resources, I also accessed the reference lists of useful articles and books for research that corresponded with my search criteria.

Chapter Two: Review of Research Literature

The purpose of this literature review is to organize published research evidence in the area of IBL in K-12 schools, and help to address the research question of whether inquiry learning leads to improved motivation, engagement, and achievement outcomes for students. Starting with a theoretical framework centered on constructivism to support the use of IBL, the review continues to discuss different models and levels of IBL in current practice. The main body of the literature review then considers the effectiveness, benefits, and challenges of incorporating practices of IBL in schools, as well as discussing the perception of IBL from the perspective of teacher and student. Finally, scaffolding of IBL instruction is explored including the need for self-regulated learning skills, effect on student's levels of motivation, and the use of technology.

Theoretical Framework

Humans are inquisitive beings. Our relatively large brains contain a well-developed prefrontal cortex and temporal lobes that set us apart of from other species. We are, therefore, capable of high levels of abstract reasoning, language and problem solving, through inquiry and social learning. Instructional practices involving IBL compliment the high-level cognitive abilities of our brains. Intelligence, which was once thought of as being fixed is now understood to be capable of being continually developed: "People may start with different temperaments and different aptitudes, but it is clear that experience, training, and personal effort take them the rest of the way" (Dweck, 2012, p. 5). Based on Dweck's (2012) research, it stands to reason that as new brain research emerges, pedagogies need to shift. A pedagogical shift is in motion to move learning from curricula that is more focused on content, knowledge and procedures to curricula

and instructional practice that honours the intellectual part of the brain and is based on understanding, discovery, and inquiry. IBL is a student-centered approach to learning and teaching, which places understanding at the core of its design.

Constructivism. Constructivism is a philosophical view of how humans acquire knowledge. It is also an established learning theory, which argues that humans develop knowledge and meaning by combining their experiences with the world around them with their existing ideas (Ergrin, 2012; Minner, Levy & Century, 2010; Tamin & Grant, 2013). Constructivism was developed with contributions from the scientific disciplines of education, psychology, and philosophy. Born out of the frustrations with the didactic teaching methods associated with behaviourism, learners in constructivist settings are not considered passive recipients of knowledge. Instead, they construct and co-construct their knowledge.

John Dewey (1982), an educational theorist, pioneered the constructivist theory. He rejected the idea that schools should focus on rote memorization and instead suggested that students should engage in real-world, practical tasks. By doing so, they would be capable of demonstrating their knowledge through creativity and collaboration. Dewey (1998) as cited in Mapes (2009), was also an advocate of inquiry learning and called for education to be grounded in authentic experiences. He wrote, "If you have doubts about how learning happens, engage in sustained inquiry: study, ponder, consider alternative possibilities and arrive at your belief grounded in evidence" (Dewey, 1998, as cited in Mapes, 2009, p. 11).

Jean Piaget (1973), another pioneer of constructivism, developed the theory of cognitive development. The theory of cognitive development suggested that children deepen their understanding of the world by acting on and reflecting on the effects of their prior knowledge. He also stated that children are capable of organizing their knowledge in increasingly complex

networks. Piaget wrote, “To understand is to discover, or reconstruct by rediscovery, and such conditions must be compiled with if in future individuals are to be formed who are capable of production and creativity and not simply repetition” (Piaget, 1973, p. 20).

Bruner contributed to constructivism with his theories on discovery learning. Discovery learning, a form of IBL, assumes learners generate knowledge by forming and testing assumptions. Bruner argues "Practice in discovering for oneself teaches one to acquire information in a way that makes that information more readily viable in problem solving" (Bruner, 1961, p. 26).

Lev Vygotsky developed social constructivism based on assumptions that social interaction and critical thinking were essential to learning (Liu & Chen, 2010). He also established the concept of a zone of proximal development (ZPD), which he described as “the intellectual potential of an individual when provided with assistance from a knowledgeable adult or more advanced child” (Jones & Brader-Araje, 2002, p. 6). In his theory, learners made sense of new information based on pre-existing understandings. Making sense of this new information was an active process (Jones & Brader-Araje, 2002, p. 3). Vygotsky described IBL, or cooperative learning as he characterized it, as “an integral part of creating … a social constructivist classroom” (Powell & Kalina, 2009, p. 244).

Models of inquiry. Several different models of inquiry have been proposed to support our understanding of the key steps or phases. To strike a balance between 'open' inquiry and 'guided' inquiry, Song and Kong (2014) developed a pedagogical model based on six elements: engage, explore, observe, explain, reflect, and share. Their model, cylindrical in nature rather than linear, does not require all steps to be completed during each inquiry cycle. Marshall and Horton (2011) used a similar model but stressed the importance that students must be actively

involved during both the explore and the explain components, and actively participate during the explain component. In his work for the Biological Sciences Curriculum Study (BSCS), Bybee (2015) uses a model of inquiry known as the 5E Instructional Model. Developed in the 1980's the model has five distinct phases titled engage, explain, explore, elaborate, and evaluate. The 5E instructional model is researched-based, is grounded in practices of constructivism, and is best suited to a unit of study rather than an individual lesson. In contrast, Kaser and Halbert (2014) offer a more holistic model of inquiry to creative quality learning experiences and provide equity for all students. This flexible model is suitable for both individual student inquiry projects as well as teacher professional development. The model has six components; scanning, developing a hunch, engaging in new professional learning, taking new professional action, assessing change, and then taking time to consider what comes next. In a visual framework for guided-inquiry learning, Anastopoulou et al. (2012) developed a cross-curricular model based on questioning, investigation, evidence collection, analysis, sharing, and reflection. Alternatively, Harris and Rooks (2010) discussed a pyramid model consisting of a task, students, science ideas, materials, and classroom community. Each component represented an area of instruction requiring teacher attention in order for effective learning to take place.

Levels of inquiry-based learning. Research shows there are three common levels of IBL instruction; structured, guided, and open inquiry. The level of inquiry directly relates to the amount of structure provided by the teacher. Therefore, it is beneficial for the teacher to match the level of of inquiry to the needs of the students. Sadeh and Zion (2009) found that educators engage students in a broad spectrum of approaches that range from structured inquiry to open inquiry. Blanchard et al. (2010) designates the three levels of inquiry. Level one indicates a method of structured inquiry where students are given a research question and a method and are

only independently responsible for interpreting the findings. In level two or guided inquiry, students are responsible for determining the method of investigation and interpreting the findings. In level three or open inquiry, students have more freedom to generate the question, determine the method and interpret the findings. This is similar to Engeln, Euler, and Maass' (2013) description who state that in structured inquiry activities students are given a problem to solve and the necessary materials and resources to build the method for solving the problem. In guided inquiry, students choose the method for solving the given problem, and in open inquiry, students are required to form the problem they are investigating. Sadeh and Zion (2009) also incorporate the terms structured, guided, and 'open' to describe the level of student engagement. However, they add a level in between guided and open inquiry called coupled inquiry. Coupled inquiry acts as an intermediate stage before complete student autonomy. The teacher allows the student to choose an inquiry question from a list of predetermined questions. Song and Kong (2014) define 'structured' inquiry as the approach where the teacher sets up a hands-on problem for students to investigate, and then provides the necessary procedures, materials, and resources, but does not divulge expected outcomes. They describe guided inquiry as the process in which the teacher assigns the inquiry question/problem but allows students to design their own procedures for completing the inquiry, whereas open inquiry students design their own problem, methods, and solutions. Song and Kong (2014) caution that although open inquiry is the purest form of inquiry and leads to the highest level of cognitive development, a more teacher-centred 'guided' inquiry method may provide stronger opportunities for students to develop specific science concepts. Approaches to IBL vary from one learning environment to the next, and lie on a continuum of extremes starting with traditional teacher-centred inquiry on one end to student-centred and open inquiry at the other end.

Inquiry-Based Learning

Research surrounding the effectiveness of IBL and instruction is broad but inconclusive. There is mounting evidence-based research that supports the use of IBL in schools (Bruder and Prescott, 2013) and significant research that speaks to the positive effects IBL has on student motivation, engagement, and achievement (Sever and Güven, 2014). Other research, particularly studies focusing on methods of open inquiry, question its effectiveness when compared to more traditional teacher-centred methods (Furtak, Seidel, Iverson, & Briggs, 2012; Kock, Taconis, Bolhuis, & Gravemeijer, 2014). These opposing views seem to originate from a lack of clear understand of how to define and practice the act of inquiry (Blanchard et al., 2010; Haug, 2014; Maaß & Doorman, 2013).

Effectiveness. Research showed several important factors that related to the effectiveness of an inquiry-based approach to learning - they include; student prior knowledge, level of teacher guidance, teacher skill set, and school support. According to Wirkala and Kuhn (2011) and Marshall and Horton (2011), activating students' prior knowledge before engaging in IBL contributes to its effectiveness. Harris and Rooks (2010, p. 232) state, "There is broad agreement that student success in… inquiry learning environments is dependent upon skilled and thoughtful guidance from teachers." Song and Kong (2014) raise concerns about whether all levels of students have the ability to engage in inquiry learning and develop conceptual understanding without scaffolding and without accessing student's prior knowledge. This coincides with Levy, Aiyegbayo, and Little (2009) and Wang, Kinzie, McGuire, & Pan's (2010) work on the same topic. They suggest the amount of teacher support directly relates to the success students experience when engaging in IBL. As inquiry relates to science, Schmid and Bogner (2015)

suggest that the higher degree to which teachers scaffold, the higher probability exists that students will see increased benefits in science classes.

Teacher skill set is also a contributing factor to the effectiveness of inquiry learning. Schmid and Bogner (2015) found teachers who practice inquiry need to be provided with professional development to determine what constitutes as too much or too little guidance for their students. Wirkala and Kuhn (2011) also found that the success of student outcomes in inquiry learning environments depended on the skill of the facilitating teacher.

There exist challenges for teachers wishing to move their practice along the continuum from teacher-centred learning to student-centred learning including time constraints, teacher experience, and administrative support. Sandholtz and Ringstaff (2014) suggest one reason teachers may have difficulty making the shift is related to teacher confidence. If teachers lack the appropriate preparedness in adopting approaches of inquiry, they may be unlikely to change their practice. Van Deur (2010) found school support for inquiry influences students' ability to complete inquiry projects and mature as self-directed learners. Time is also a contributing factor to the effectiveness of inquiry learning. Marshall and Horton's (2011) research showed that when teachers had more time to engage students in inquiry learning, lower cognitive level thinking associated with non-inquiry practices was often replaced with higher cognitive level thinking and learning. In a comparison study of teacher's beliefs and practices in IBL techniques, Engeln, Euler, and Maas (2013) found the failure to establish a concrete definition of IBL caused misunderstandings between teachers and contributed to the ineffectiveness of this approach.

Benefits. The benefits of engaging k-12 students in practices of IBL are numerous and are linked to long-term knowledge retention, curiosity, problem solving, and collaboration. IBL has been found to support higher-level cognitive interaction (Marshall and Horton, 2011; Bruder

and Prescott, 2013; Yager & Akcay, 2010; Abril et al., 2013), longer-term knowledge retention (Minner, Levy, & Century, 2010; Song & Kong, 2014), and more efficient collaboration (Timperley, Kaser & Halbert, 2014). In a framework designed to transform learning in schools by addressing the question of what is going on for learners, Timperley et al. (2014) explain the importance of evidence-informed collaborative inquiry to help all students experience success. Field-tested in many school districts in British Columbia, the framework known as Spirals of Inquiry focuses on developing curiosity and a social collaborative approach to learning. Research shows that IBL is equal to traditional, teacher-centred, methods, but also more beneficial to learning at other times. In a study on the effectiveness of problem-based learning (PBL) in K-12 schools, Wirkala and Kuhn (2011) compared student learning across three instructional conditions; lecture/discussion, small group PBL, and solo PBL. They discovered that PBL was more effective in cultivating both comprehension and the application of concepts when compared to traditional lecture and discussion modes of instruction. Similarly, in a meta-analysis of research on the impact of IBL in science, Minner et al. (2010) discovered inquiry-based science instruction to be more effective in terms of student learning when compared to instruction focusing on the transmission of knowledge from teacher to student.

Research also suggests that IBL leads to higher-level cognitive interaction and increased understanding from students. In a study on the relationship between guided-inquiry instruction and high-order thinking skill development, Marshall and Horton (2011) found that accessing prior knowledge and increasing the time for exploring and explaining topics led to a deeper understanding of the topic and a more thoughtful interaction with the fundamental concepts. In their research working with science and mathematics middle school teachers in over 100 classrooms, Marshall and Smart (2013) gathered data using EQUIP (Electronic Quality of

Inquiry Protocol) to measure the quality and quantity of inquiry instruction. Their findings showed that when non-inquiry instruction was replaced with inquiry instruction, lower cognitive level thinking was replaced with higher cognitive level thinking and learning. Similarly, Abril et al. (2013) found in their study promoting inquiry in mathematics and science education across 12 European countries that student's developed competencies that supported and deepened their understanding of the content when engaging inquiry learning. Bruder and Prescott (2013) conducted research describing the current state of knowledge of empirical studies concerning IBL in mathematics and science. They found through analyzing various short-term, long-term, and longitudinal studies that IBL results in better understanding of the real life relevance of mathematics.

Long-term retention of knowledge is a benefit of inquiry-based instruction. In a study on seamless science inquiry in upper primary classes, Song and Kong (2014) addressed two important questions, how students advanced their domain knowledge? And how students developed their inquiry skills? Their study of 27 students in Hong Kong used the 5E inquiry model to guide students' science inquiry in a seamless learning environment between home and school. Their findings showed that using an inquiry approach during a 'rustproofing' unit had a positive effect on students' domain knowledge and inquiry skills. Minner et al. (2010) also found that IBL led to better student retention of knowledge. On the subject of creativity and concept mastery, Yager and Akcay (2010) examined the effect teachers' professional development programs had on a variety of student indicators. They measured student's concept mastery, use of process skills, application of science concept and skills, attitudes toward science, creativity, and perceptions about science. Researchers conducted pre- and post-assessments of 734 students covering six assessment domains. They concluded that students' engaged in inquiry instruction

were more creative, better able to apply scientific concepts, and had a more positive outlook on science when compared to those who engaged in teacher-centred methods of instruction.

Challenges. In contrast to the numerous benefits of including IBL practices in schools, there also exists significant research that cautions the use of inquiry-based instruction in K-12 schools. The research shows that a lack of adequate training and professional development for teachers, a lack of understanding between educators of a common practice for inquiry learning, and lack of district and school support, as major challenges when implementing IBL in schools.

Harris and Rooks' (2010) research describes five interconnected areas that need to be addressed in K-8 inquiry science classrooms; students, task, materials, science ideas, and classroom community. The five areas were considered issues that elementary and middle school teachers face when engaging learners in inquiry-based science instruction. Through their own review of literature on inquiry learning, they found teachers may adopt superficial features of an inquiry-based approach, experience difficulty in maintaining student engagement when inquiry lessons cover multiple days, have difficulty with classroom management, have weak content knowledge of their own, and lack the technological expertise to help students harness technology for the purpose of learning.

Similarly, a Norwegian study by Haug (2014) highlighted the need for effective teacher training for implementing IBL. A professional development program for teachers, Budding Science and Literacy Project, was used to engage teachers' approaches to inquiry learning. Teachers and researchers collaborated to test and design a teaching model that integrated inquiry-based science and literacy. Cameras in the classroom were used to identify teachable moments. Results showed that one of the major challenges in science education stems from the school's ability to help teachers fully understanding and effectively engaging students in inquiry-

based instruction. Levy, Thomas, Drago, and Rex (2013) also found a lack of teacher professional development in inquiry-based teaching in their study across three fields of education.

In a study investigating perceptions of teaching inquiry science including the benefits and challenges of this student-centred approach to teaching, Gillies and Nichols (2014) found that classroom management skills were considered a challenge in inquiry classrooms; specifically, dealing with students going off topic and losing focus. In a study based on interview data from 20 elementary teachers, an analysis of data found that inquiry learning as an instructional method for teaching struggles to find a place in the average teachers' classroom (Ireland et al., 2012). Yager and Akcay (2010) suggest one reason for this might be that teachers are not comfortable using inquiry-based approaches to learning simply because they did not learn this practice when they first entered the teaching profession.

Another challenge of inquiry learning that emerged from the research centres on lack of understanding of what constitutes as inquiry learning. Haug (2014), Levy et al. (2013), and Yager and Akcay (2010) all agree that there is no single definition that describes the process inquiry learning. The resulting contrasting conceptualizations and practices across educational fields leads to difficulties associated with proving the effectiveness of the approach, and providing the necessary quantifiable data required by schools around the world to support its use.

A lack of support from schools and school districts for implementing inquiry is a challenge encountered by educators who embrace student-centred learning. In a comparative baseline study of teacher's beliefs and practices across 12 European countries, Engeln, Euler, and Maass (2013) found the effort required to change teaching practice to support IBL is dependent on the involvement and cooperation of school authorities and policy makers. In research carried

out to assess elementary support for inquiry learning, Van Deur (2010) found that a greater amount of school support for IBL led to better SRL skills in students. Schmid and Bogner (2015) found time restrictions in schools to be a negative factor in implementing inquiry. Bruder and Prescott (2013) suggest that schools driven by standardized test scores, may not embrace practices of IBL.

Some research exists that suggests there are no benefits to inquiry instruction when compared to traditional methods of instruction. For example, in a study by Kock et al. (2014) that involved investigating how physics inquiry instruction can contribute to Grade 9 students' understanding of theoretical concepts in electric circuits, the authors found little evidence that inquiry instruction leads to deeper understanding of the subject matter and go so far as to say that not all variations of inquiry instruction are equally effective in promoting student learning. Similarly, in a study on the impact of inquiry on students' understanding of science concepts, Minner et al. (2010) found no advantage in using inquiry instruction for developing and understand scientific concepts.

Scaffolding the inquiry process to meet the needs of all students represents a challenge for teachers who engage in student-centred practices. Furtak et al. (2012) meta-analysis on inquiry-based science teaching distinguishes between cognitive features of an activity and the degree of guidance given to students. They found that the less-structured approach of IBL when compared to more traditional methods do not provide a sufficient framework to help all students learn the important theory and procedures of science. Students who participate in inquiry lessons may not do so successfully without appropriate scaffolding from their teacher (Levy et al., 2013).

Some of the evidence on IBL implementation in schools suggests that success may be limited (Wirkala & Kuhn, 2011; Bruder & Prescott, 2013). Wirkala and Kuhn's (2011) middle

school study analyzing PBL under three different conditions; lecture/discussion, small-group PBL, and solo PBL, found little experimental evidence of its effectiveness in K-12 environment. While Bruder and Prescott (2013) found many IBL studies were isolated experiments and not field studies, which makes it difficult to assess the effectiveness of inquiry.

Perceptions

Although research shows IBL helps to challenge and encourage critical thinking skills, the roles of teacher and student in student-centered learning environments like IBL can be complex and sometimes difficult to adapt to. For example, in successful IBL environments the role of learner is embraced by both teacher and student. Similarly, teacher and student perceptions around the implementation of IBL are varied and unique. In spite of the challenges of IBL implementation and practice the outcomes for both student and teacher are favourable.

Teacher and student as learners. In order for inquiry learning to be successful in the classroom, both teacher and student need to be active participants in the inquiry cycle. The role of the teacher in an inquiry classroom differs considerably when compared to more traditional teacher-centred approaches, and the role of the student moves from passive to active participation. According to Harris and Rooks (2010) students accept more responsibility in IBL environments as they collaborate and communicate around authentic tasks and scientific investigations. In many successful IBL environments, teachers take on the roles of facilitators and learners interchangeably. For example, Yager and Akcay (2010) found that teachers who are new to IBL must invest the time necessary to become comfortable with the key understandings and abilities involved in scientific inquiry, and they must learn to ask new and more focused questions that require thought and analysis.

Teachers on teaching inquiry. Teachers who make the shift from teacher-centered instruction to student-centered instruction with IBL experience several challenges including adequate training, administrative support, and classroom management issues. “Teachers are the key players in implementing IBL pedagogies in mathematics and science classrooms and in transforming the potential benefits of IBL into real effects” (Abril et al., 2013, p. 1).

According to Marshall and Horton (2011) teachers’ move from a position of delivering education to the role of facilitator and, are required to probe, question, and assist students in their problem solving. In order to practice inquiry successfully, teachers require sufficient training (Yager & Akcay, 2010) and adequate resources (Bruder & Prescott, 2013). Gillies and Nichols (2014) found in their study using the 5E model of inquiry learning that teachers face significant challenges when teaching inquiry science because they lack content knowledge or pedagogical skills to do so. Professional development in itself may not be sufficient. Blanchard et al. (2010), found that even with intensive professional development, the instructional methods of teachers varied widely. To combat this effect, Ireland, Watters, Brownlee, and Lupton (2012) suggest providing teachers with a range of experiences during their professional development activities allows them to see examples of inquiry in practice for themselves, which may have positive benefits in their own instruction. Understanding how students learn best is also an important skill to have when teachers engage students in inquiry activities. According to Tseng, Tuan, and Chin (2013), teachers must understand how students construct new knowledge, differentiate instruction, scaffold effectively, and develop strategies and skills in order to effectively implement inquiry teaching. In their middle school analysis of teachers implementing inquiry in science, Harris and Rooks (2010) discovered teachers had difficulty deciding how much guidance or independence to give students. To address this, Yager and Akcay (2010) suggest

teachers who lack self-efficacy with the inquiry process can start with a more structured, guided-inquiry, method before extending toward more open methods of inquiry.

Regardless of how challenging facilitating inquiry learning in the classroom may be, Engeln, Euler and Maass (2013) report that teachers, in general, have a positive attitude toward inquiry instruction. Ultimately, researchers found the effort required to change teaching practices from teacher-centred to student-centred requires the full support and cooperation of all stakeholders including students, teachers, school administrators, and policy makers (Engeln, Euler & Maass, 2013).

Scaffolding

Self-regulated learning skills. "We are convinced that we need to move rapidly to a place where all learners feel connected and all learners are able to self-regulate their own learning" (Halbert & Kaser, 2013, p. 37).

In order for students to get the most benefit from an inquiry approach to learning, they need to develop important SRL skills. There is a direct link between the effectiveness of inquiry learning as a student-centred approach to learning, and the extent to which learners have developed the SRL skills required to be successful lifelong learners (Blanchard et al., 2010; British Columbia Ministry of Education, 2015; Bruder & Prescott, 2013; Sever & Güven, 2014; Timperley et al., 2014). The B.C. Ed Plan - a British Columbia Ministry of Education document outlining how the province plans to shift K-12 education from its current teacher-centred model to a model that puts students at the centre of their learning - states teachers will be empowered to move from a position of deliverer of content to a position from where they can focus on helping students learn how to learn (British Columbia Ministry of Education, 2015). In their paper detailing a framework for transforming learning in schools through innovation and inquiry,

Timperley et al. (2014) support the need to engage students in developing the necessary SRL skills to tackle high-level cognitive tasks. They justify the need for SRL in schools by documenting increased levels of anxiety in students, and acknowledging a disconnect students are experiencing from community and the natural environment surrounding them. Bruder and Prescott (2013) raise several concerns about the SRL in schools. In their large-scale meta-analysis on the research evidence to support IBL in schools, they found that having the appropriate skills to work effectively in groups as well as independently were a prerequisite for successful IBL. They also found that in all levels of IBL (structured, guided, and open) students need a variety of SRL skills to maximize the full potential of IBL. Blanchard et al. (2010) connected SRL and inquiry to the importance of accessing prior knowledge. In their study comparing guided inquiry to verification lab instruction in 1700 students from middle and high school, they measured knowledge of content, procedure, and nature of science. They found that the skill of accessing prior knowledge and their own prior knowledge were important components of effective inquiry. Consequently, they found that the greater the skill level and knowledge of students, the higher level of inquiry they could be exposed to. In a qualitative investigation of IBL in upper primary classes, Song and Kong (2014) looked at how students improved their domain knowledge and inquiry skills. The findings of the study raise concerns about whether IBL is an instructional approach suitable for all learners and stress the importance of metacognition. Metacognition, or reflecting on your learning, is an important IBL and SRL skill. Wang et al. (2010) also discovered the importance of developing SRL in conjunction with inquiry approaches to learning in their study on applying technology to inquiry learning in early childhood education. They suggest that young children can face challenges finding and using resources during their inquiry learning. In addition, they found that if the resources used by

children in inquiry scenarios are not used effectively, they could impede learning, as they are likely to decrease a child's motivation to learn, and expend valuable cognitive resources that could otherwise be put towards productive learning objectives.

Motivation and engagement. ''Overall, inquiry-based instruction was shown to produce transferable critical thinking skills as well as significant domain benefits, improved achievement, and improved attitude towards the subject'' (Hattie, 2009, p. 209-210).

Levels of student motivation, engagement, and achievement can increase under certain conditions of IBL (Cafagna, 2012; Gillies & Nichols, 2014; Hattie, 2009; Kock et al., 2014; Schmid & Bogner, 2015; Wirkala & Kuhn, 2011). On the topic of student engagement, Wirkala and Kuhn (2011) found in their study on the effectiveness of problem-based learning in K-12 schools that student-centred instructional approaches engaged students more than traditional methods and led to better long-term retention of information and the transfer new knowledge to new situations. In their observational study on middle school science and math teachers questioning the benefits of accessing student's prior knowledge, Marshall and Horton (2011) found that greater the time spent exploring the topic led to increased levels of student engagement. In a longitudinal study of learners in k-6 science classes, Amaral, Garrison, and Klentschy (2002) discovered several benefits for students practicing inquiry learning, including developing positive attitudes toward learning, and increased engaging in conversation with peers. Similarly, Bruder and Prescott (2013) found in their study of the advantages and disadvantage of inquiry learning in schools and colleges found an increase in engagement levels whereby the positive attitudes of students in one subject transferred to other subjects. In fact, in one large cohort longitudinal study covered in their research reported that IBL students noted their enjoyment of mathematics. They also reported several positive effects of IBL that included

increased motivation, deeper understanding of the subject content, and the relevance of mathematics instruction to their daily lives. Engaging in hands-on activities like those encompassed in inquiry classrooms has positive effects on student's attitudes towards science.

Using a hands-on approach when engaging in practices of IBL may improve student's attitudes towards school. In a Turkish study by Ergul et al. (2011) to investigate the effects of hands-on activities in inquiry-based science teaching, 241 fourth, fifth, sixth, seventh, and eighth grades students' science process skills and attitudes toward science were evaluated. Findings showed that hands-on activities incorporating inquiry-based teaching improves students' attitudes towards science and enhances their concept knowledge and process skills. In a study to investigate how physics inquiry instruction contributed to Grade nine students' understanding of theoretical concepts in direct current electric circuits, Kock et al. (2014) discovered that the majority of students enjoyed working in the experimental, hands-on inquiry classes.

Student achievement may also improve through the use of IBL. Cafagna (2012) states, in his study of the impact of inquiry-based instruction in New Jersey public schools, that inquiry leads to higher achieving students. Marshall and Alston (2014) agree with this in their five-year study on the effectiveness of inquiry learning in science in the USA. They discovered that effective guided-inquiry might benefit all students regardless of demographic. Similarly, Blanchard et al. (2010) noted in their quantitative comparison of guided-inquiry versus verification laboratory instruction that inquiry-based instructional methods increase the achievement of middle and high school students in lower income schools when compared to student engagement in more traditional approaches.

In some cases, the positive effects of IBL on a learner's interest level may not transition to a attitude toward teaching, learning, and school in general. Sever and Güven's (2014) study

which identify the effects of the IBL approach on the resistance behaviours of seventh grade students' in science and technology, found that although IBL changed students' participation and interest levels, it had little effect on their views of teaching and learning.

Technology. Digital technologies can enhance the experience of students working in IBL environments. It can lead to increased student engagement, promotes higher-level thinking skills, and facilitates easy collaboration. Halbert and Kaser (2013) describe the role of digital technologies in inquiry learning as exploring new possibilities. They encourage educators to develop innovative learning environments that put students at the centre of the learning, work towards developing connections and strengthening community, use technology to help personalize learning for students, and develop a global perspective on education. In the study by Harris and Rooks (2013) on the challenges of enacting complex science instruction in elementary and middle school classrooms, they found that in many inquiry-based classrooms, students are using digital technologies such as the Internet, search engines, model building software, handheld technologies, and a variety of communication tools to participate in authentic investigations.

Technology also promotes higher-order thinking, cognitive, and metacognitive skills, which are essential components to successful inquiry. When technology is used to enrich problem contexts, facilitate resource utilization, and support metacognition in early childhood education, Wang et al. (2010) found that technology leads to clearer thinking around inquiry problems.

Research also shows that in some cases technology usage can lead to greater student satisfaction when engaging in IBL. In a study on web-based inquiry, Ikpeze and Boyd (2007) found that technology use within IBL environments promotes students' engagement in

meaningful activities and develops their critical thinking skills. A Taiwanese study by Hwang, Chiu, and Chen (2015) used the development of an educational computer game to support IBL in social studies. An experiment conducted on elementary school students was designed to evaluate the effects of IBL on students with different learning styles. The purpose of the study was to compare the learning achievement, motivation, and satisfaction of students who learned with an educational computer game versus those who learned with a web-based inquiry learning approach. Findings show that game-based learning can improve student's IBL performance. The study also showed that educational computer games used in the context of the subject being taught could increase student satisfaction. This suggests that a contextual educational computer game, or game-based learning, improves the motivation for students to learn more than a web-based inquiry learning approach. In addition, they found that in order for students to get the most from the digital technologies available, teachers need to have the appropriate, knowledge expertise, and diagnostics capabilities to maximize the use of the tool, support students, and maximize learning opportunities.

Improved collaboration may be more easily achieved through the use of technology. Song and Kong (2013) who used Edmodo, a social networking site used primarily by schools, to study the effects of managing inquiry science between home and school found social networks played an important role in student's project work by developing rapport between collaborative partners and helped to foster working relationships between peers.

In contrast, some software currently used in schools may not be beneficial for the purposes of IBL instruction. According to Wang et al. (2010), there exists a wide variety of educational software in schools that cover a variety of subjects including mathematics, science, literacy, and socials studies but they fail to incorporate components of inquiry instruction.

Sarama (2004), found that existing products included drill-and-practice, edutainment, or frivolous exploration activities, which fails to scaffold the development of concepts and skills. Overall, research suggests that technology usage in IBL environments has positive effects on students' attitudes towards learning, and promotes collaboration.

Conclusion

A wide body of research suggests that inquiry-based teaching and learning practices impact students' levels of engagement, motivation, and achievement. In particular, the student-centered approach of inquiry learning, which is focused on tackling real-world, authentic problems, develops students' ability to better understand fundamental concepts and processes. IBL appears to be most successful when the facilitator has adequate training in inquiry instruction and adopts a guided-inquiry method of instruction. It is also beneficial when students have developed the necessary SRL skills to work and think critically, take learning risks, work collaboratively, and when all participants are supported by their schools and school districts. The success of inquiry-based teaching and learning in schools tends to be least successful when facilitators engage in open inquiry before their learners are ready for such limited guidance, when there is confusion around what constitutes as inquiry learning, when there is limited scaffolding for students, and when schools are driven by the results of standardized testing.

Chapter Three: Learning to Learn: A Teacher's Guide on Implementing IBL/SRL in the Intermediate Classroom

Co-created by Christopher Lister and Suzanne Bartel

"At birth we are endowed with the dispositions and mechanisms to discover the world and make it a meaningful place in which to live. Without a desire to look, to explore by hand, by mouth, eye and ear we would not grow up to be the human beings we are." (John Barrell, 2003)

The purpose of the following resource is to support teachers in implementing inquiry-based learning (IBL) in elementary classroom settings and guide students in gaining the necessary skills that they will need to be self-regulated learners. It gives strategies, practical ideas, and resources to engage learners in student-centered environments. The resource combines current research in IBL and self-regulated learning (SRL) to help more students develop into effective independent learners.

What is IBL?

IBL is not a new approach to learning. It dates back to philosopher John Dewey. Like John Dewey's (1982) pedagogy, IBL is established on the basis that new knowledge and understanding is constructed while learners are working and collaborating together. In Dewey's student-centered learning environments, learners present and solve problems, make discoveries, and test those discoveries during the time they are working together. Although there is no single definition used to describe the process of IBL, it is safe to say that the inquiry process is an approach to learning that places students' questions, ideas, and observations at the center of the

learning experience. For students, the inquiry process is driven by students' own curiosity, wonder, and passion to better understand an observation, issue, idea, or problem. For educators, the process is about honouring and paying attention to students' learning needs, knowing when and how to introduce students to ideas that will move them forward in their inquiry, and supporting students with SRL to engage in independent learning.

The act of implementing IBL in a classroom is very flexible, and can suit a variety of comfort levels. There are several levels of inquiry that can be implemented by educators. The range of IBL options in classrooms around the world range from 'structured,' through 'guided,' to 'open' methods. In structured IBL, the teacher directs most of the learning, provides the inquiry question, shows learners where to find research information, and gives step-by-step instructions of how to proceed through the inquiry process. In guided inquiry, teacher and students collectively generate the inquiry question, and the teacher acts as a facilitator through the phases of inquiry. The teacher may use a closed platform or 'walled-garden' to search for information related to the topic, and they may also choose what the final product should look like. In open inquiry, students generate the inquiry question, independently choose where to look for information, synthesize and evaluate, and choose their own methods of presenting and sharing their findings. Using the gradual release of responsibility model as a guide, educators should choose the right level of support for IBL.

The inquiry process can be broken down into six manageable stages:

1. In the **'Question'** stage, student and/or teacher generate an interesting question to research, which will form the backbone of the inquiry cycle.

2. In the **'Research'** stage, student and/or teacher start to research the inquiry question using a variety of means including, but not limited to, books, magazine, videos, audio, Internet searches, web pages, etc.
3. In the **'Analyze'** stage, student and/or teacher must use the research information they have documented to analyze, synthesize, and evaluate the information. During this stage research information will be sorted, compared, and discarded using a variety of methods.
4. In the **'Create'** stage, once the remaining information has been collated and a new understanding of the topic has been constructed, student and/or teacher must then choose a final product to highlight their work.
5. In the **'Share'** stage, student and/or teacher share their findings with a larger audience that may start at the school level but expand to a larger global audience with the adoption of social media platforms.
6. In the **'Reflect'** stage, students use their thinking skills to reflect on their learning, and highlight new knowledge.

What is SRL?

SRL is the idea that students take control of and evaluate their own learning. A self-regulated learner is a student who is able to control, evaluate, and adapt his or her own learning process. These learners persevere when the going gets tough and are capable of making adaptations to their learning strategies to help them succeed. SRL occurs when a student realizes that there is a better way or strategy to achieve a goal than the current method they are employing, and then they act upon this realization by making changes to their goals and plans. SRL is essential to meaningful learning in the classroom and the development of lifelong learning skills (Zimmerman, 2002).

According to Winne and Hadwin (1998), there are four phases of SRL: task understanding, goals and plans, applying strategies, and adapting and regulating. As students are guided through each of these phases, they constantly monitor and evaluate their progress, making adaptations to previous phases as necessary. Research shows that children do not just inherit these skills but rather must learn them through explicit instruction embedded into naturally occurring learning experiences. Many students who arrive in classrooms find basic SRL skills to be challenging. They need instruction and support in learning to set appropriate goals, create plans, monitor their time, ignore distractions, adapt goals, and choose appropriate learning strategies.

While teachers generally agree that these basic learning skills are necessary, there are few resources specific to the elementary classroom to help them instruct students in gaining SRL skills. In an era where 'how to learn' is becoming more important than 'what to learn,' it is imperative that students are supported in gaining basic learning skills that will help them navigate themselves through the various learning environments that they will face both in and out of school.

Combining IBL and SRL

The new B.C. curriculum repeatedly encourages educators to support and encourage student-centered inquiry-based approaches to learning (B.C. Ministry of Education, 2014). Students in inquiry-based learning environments, who are expected to take control of their own learning experiences, need educators to support them in gaining the basic SRL skills that will help them be successful. When students are unable to set goals, make plans, manage their time, evaluate their progress, and apply appropriate learning strategies, their IBL learning experiences are likely to be frustrating and unsuccessful. The model below shows how the six steps in IBL

can be supported by the four phases of SRL. The following IBL unit is designed to support educators in introducing their learners to IBL with step by step support in developing SRL skills.

There are many models of IBL available to educators. The model below was influenced by several experts in the field of IBL including Bybee's 5E instructional model (2015). Bybee's 5E model was designed specifically for science instruction, and represent five stages of a sequence for teaching and learning: Engage, Explore, Explain, Extend, and Evaluate. The model for IBL in IQ: A Practical Guide to Inquiry-Based Learning (2014) was also useful in designing our own cycle of inquiry; Particularly, the interactive questions they posed for educators at each stage of their inquiry. Guided Inquiry by Design: A Framework for Inquiry in Your School (2012) was helpful when considering methods to use when searching for information with students. Lastly, the Genius Hour movement was a source of inspiration when selecting methods for creating and sharing students' final products.

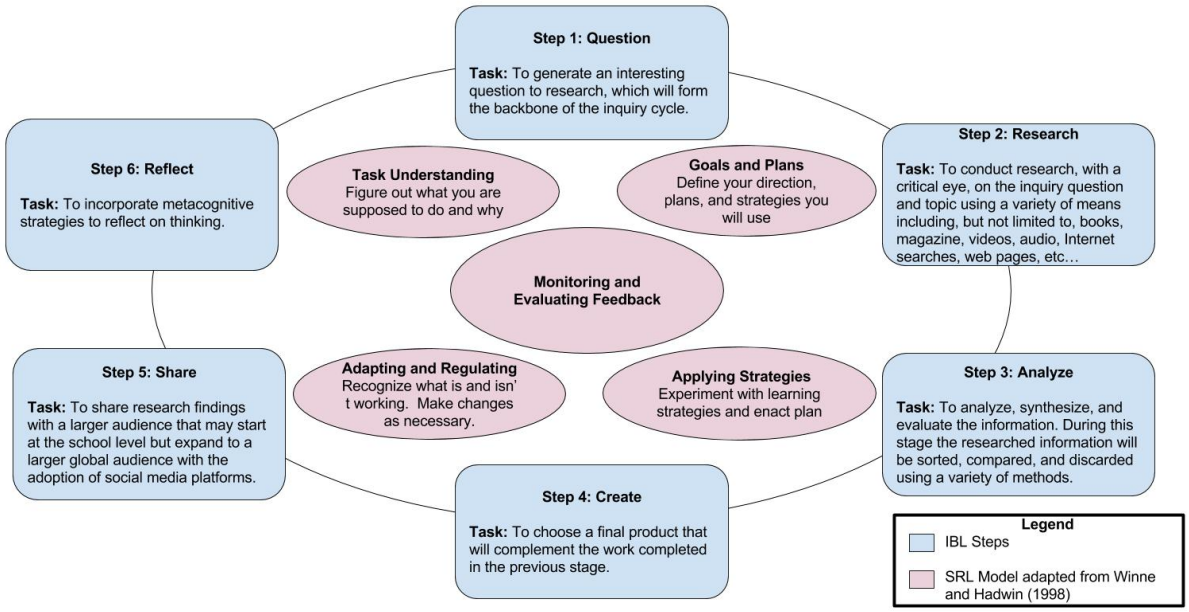


Figure 1: Model of IBL combined with SRL

B.C. Core Competencies and Learning Outcomes Addressed

Core Competencies		
Communication	Allowing students the opportunity to share information, experiences, and ideas with others in unique and creative ways.	
Thinking	Allowing students to take concepts learned and transforming it into a new understanding. Helping students to build metacognitive awareness, creative thinking, and critical thinking.	
Personal and Social	Helping students develop the skills to thrive as learners: understanding and caring for themselves and helping them to achieve their personal goals.	
Big Ideas and Learning Standards		
English Language Arts: Grades 4 & 5	Big Ideas	• Exploring text and story helps us understand ourselves and make connections to others and to the world. • Listening carefully helps us learn. • Texts can be understood from different perspectives • Combining different texts and ideas allows us to create new understandings.
	Learning Standards	• Access and integrate information and ideas from a variety of sources and from prior knowledge to build understanding • Use a variety of comprehension strategies before, during, and after reading, listening, or viewing to construct meaning from text • Apply a variety of age-appropriate thinking skills to gain meaning from texts • Show an increasing understanding of the role of organization in meaning • Use writing and design processes to plan, develop, and create texts for a variety of purposes and audiences

English Language Arts: Grade 6	Big Ideas	● Exploring text and story helps us understand ourselves and make connections to others and to the world. ● Exploring and sharing multiple perspectives extends our thinking ● Synthesizing the meaning from different texts and ideas helps us create new understandings
English Language Arts: Grade 6	Learning Standards	● Access and integrate information and ideas from a variety of sources and from prior knowledge to build understanding ● Use a variety of comprehension strategies before, during, and after reading, listening, or viewing to construct meaning from text ● Apply a variety of age-appropriate thinking skills to gain meaning from texts ● Show an increasing understanding of the role of organization in meaning ● Use writing and design processes to plan, develop, and create texts for a variety of purposes and audiences
Social Studies: Grades 4-6	Learning Standards	● Use inquiry processes (ask questions, gather, interpret and analyze ideas, and communicate findings and decisions) ● Ask questions, corroborate inferences, and draw conclusions about the content and origins of different sources
Science: Grade 4	Learning Standards	● Demonstrate curiosity about the natural world ● Make predictions based on prior knowledge ● Suggest ways to plan and conduct an inquiry to find answers to their questions ● Represent and communicate ideas and findings in a variety of ways such as diagrams and simple reports, using digital technologies as appropriate

Science: Grades 5 and 6	Learning Standards	● Demonstrate a sustained curiosity about a scientific topic or problem of personal interest ● Identify questions to answer or problems to solve through scientific inquiry ● Make predictions about what the findings of their inquiry will be ● With support, plan appropriate investigations to answer their questions or solve problems they have identified ● Choose appropriate data to collect to answer their question ● Communicate ideas, explanations, and processes in a variety of ways

Figure 2: B.C. curriculum and learning outcomes addressed in this project

The Process of IBL Supported by SRL

Step 1: Question.

"Classrooms that resonate with questions are cultivating thinking." (Gear, 2008, p. #)

Questions have driven people's desire to learn since time immemorial. The role of the teacher in guided IBL is to model good questioning skills and create learning opportunities for students to ask and answer interesting and powerful questions derived from curricula learning outcomes. Creating environments that encourage learners to engage in the practice of wondering about the world around them is sometimes no easy task. Before engaging in IBL, it may be necessary for students and teachers to unlearn practices that stifle curiosity and adopt practices that nurture our natural curiosity. Therefore, the first step in creating an environment where IBL can thrive is creating a safe place for students to express their opinions and thoughts without prejudice. Next, teachers should develop classroom experiences where students are encouraged and expected to question together and be exposed to a variety of different ways of thinking,

beliefs and experiences. A powerful inquiry question extends beyond simply recalling, summarizing, or detailing events: it becomes an opportunity to think and take action.

Note: Before jumping into the topic of what makes a great inquiry question, it may be beneficial to complete a couple of foundation lessons on what constitute powerful questions. Adrienne Gear has developed some excellent resources on generating powerful and deep-thinking questions.

Simple Questions	Powerful Questions
• quick to answer • can be answer with a yes/no response • usually one single correct answer • thinking stops when the answer is found • help to understand only the topic of concern • need little or no justification	• take mental effort and time to answer a powerful question • answer not found in a single text, rather across multiple sources • no one single correct answer • answer to the questions leads to more questions • help to deepen understanding • require support and justification

Figure 3: Criteria for differentiating between 'powerful' and 'simple' questions
Adapted from Gear, A. (2008) "Nonfiction Reading Power."

Helping Students Develop Their Own Powerful Inquiry Questions. Developing an inquiry question to drive thinking and learning in your classroom is one thing, but helping students derive their own questions is an altogether more challenging task. We have collated some resources and ideas that should help. It is important to remember that students who are have become conditioned to work in teacher-centered classroom may have initial difficulty moving into a student-centered environment that is rich in questioning, curiosity, and wonder. Not to worry, time and the development of SRL skills will enable these learners to ignite their passion for inquiry. Here are some strategies to consider:

- Make questioning a central theme in your classroom
- Create opportunities for students to wonder and be creative doing projects such as Wonderopolis, Genius Hour, Passion Time, Maker Education, and 20% Time

- Create a ‘Powerful Question’ wall in your school
- Avoid asking questions that return a factual answer, or have a fact as their answer. For example, how many people in prison are teenagers - we know this - it’s quantifiable
- Create an ‘I Wonder Board’ in the classroom
- Model ways to ask questions about media, ideas, behaviours and topics in class
- Model questioning in teacher read-alouds

Examples of Powerful Inquiry Questions:

- When and why should we estimate?
- Is Canada a great country?
- What makes objects move the way they do?
- How do effective writers hook and hold their readers?
- Is illegal action ever justified when trying to cause political change?
- How do we know what really happened in the past?
- What will Canadian communities look like in the future?
- Further examples can be found in Appendix 1

Adapted from McTighe, J., & Wiggins, G. (2013) “Essential Questions: Opening Doors To Student Understanding.”

Finding Inquiry Questions - Where to Look. The new B.C. curriculum (2015) has many more opportunities for inquiry learning than previous iterations. Try to create your powerful inquiry questions that connect to big ideas in your learning outcomes. See example:

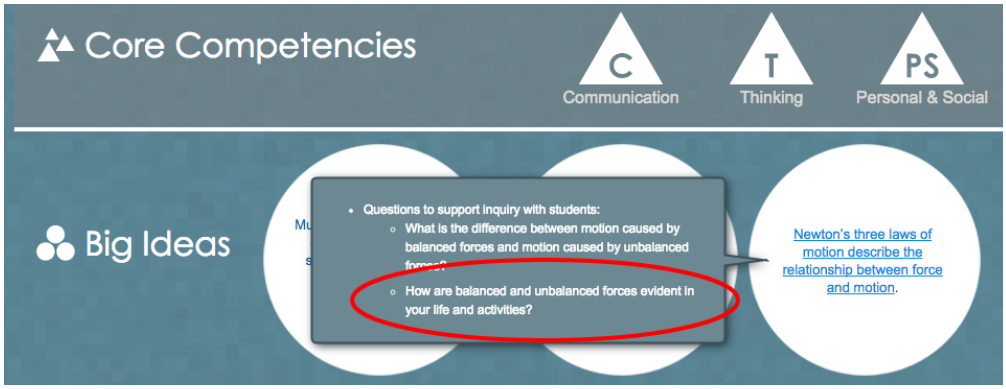


Figure 4: Inquiry questions embedded in B.C. curriculum. Adapted from British Columbia, Ministry of Education (2015) "Social Studies Grade 6 Curriculum."

Refining your inquiry question. Below is a checklist to help you refine your inquiry question. Make sure:

- The question is appealing to students
- The question taps into students' interests and passions
- Students can relate to the question in their daily lives
- The question is concise
- Students will have a variety of choices for end products
- There is an authentic audience for the project
- The question requires serious investigation
- Students will learn important skills and content

Adapted from Vincent, T. (2014) "Crafting Questions That Drive Projects."
Strategies for Developing Powerful Inquiry Questions

A powerful inquiry question will likely lead to more wondering and stimulate your learner's natural curiosity. These additional questions expose students to thinking about what they need to know to answer the inquiry question. Mind mapping tools like the Popplet app

Lucidchart, and Mindmeister allow students to group their additional questions based on similarities.

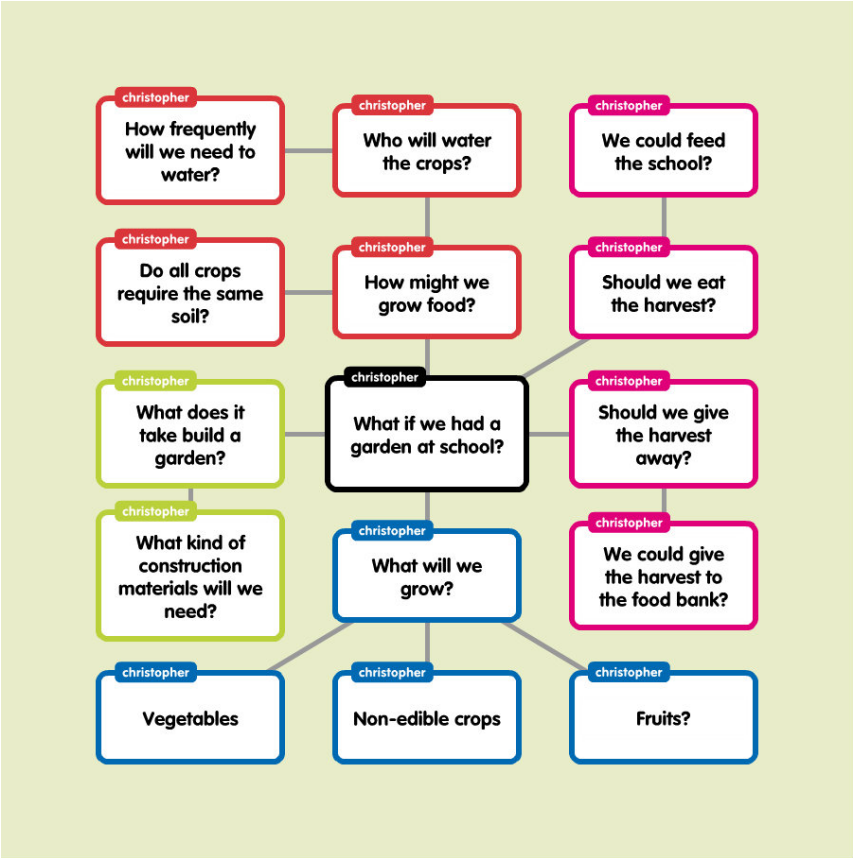


Figure 5: Example of mind-mapping using Popplet.

SRL Support to Questioning.

Step 1: Generating an Inquiry Question	
Recommended activities to support SRL development	
SRL focus: goal setting and task understanding	Goal setting naturally compliments this initial stage of inquiry learning. As students begin to generate their inquiry question, they will inherently begin to set goals towards the final outcome of their project. At this stage, it is important that a teacher comes alongside the students and helps them verbalize and adapt their goals to be appropriate for the timeline of this unit.
Develop an inquiry	At the end of step one (generating an inquiry question), students

goal	should use the My Inquiry Goal form (Reproducible 8) to set their initial goal and create a simple plan to achieve that goal.
Class discussion about goal setting	Discuss the importance of monitoring and adapting goals on a daily basis and let students know that they will be doing so often throughout this unit. Students must understand that their goals are flexible and adaptable.
Demonstrate how to make adaptations to original goals	If students are making insufficient progress, they can use post-it notes to make adaptations to their goals. For example, if a student's inquiry question is too general or broad, they could grab a post-it note to narrow it down to a more focused question. Or if a student has a family tragedy occur in their lives and realizes that they will not be able to meet their initial goal, they could make it smaller and more feasible for their current situation.
Task understanding	Use the IBL planning form and/or the My Inquiry Goal form (Reproducible 8) to help students understand the task that they to accomplish and how to get there. This form can be revisited often to help students plan out their daily tasks, as well as to assess if they are making significant enough progress to meet their goals.
Introduce "My Inquiry Log"	Guide students through the steps of filling out their daily My Inquiry Log (Reproducible 7). Show students that each day they will have a chance to assess their own confidence in meeting their goals.
Support student organization	Take time to aid students in setting up their Inquiry Binders. A Binder Organization Suggestion is provided (Reproducible 13).

Figure 6: SRL strategies to support generating an inquiry question.

Step 2: Research. Once an inquiry question has been formulated, the next phase of the inquiry cycle is to conduct critical research on the topic. In order for learners to be successful in this stage, and not become overwhelmed or distracted by mass amounts of information, it is important that the teacher offer a variety of strategies. These strategies should encourage learners to gather a variety of robust sources from a variety of different perspectives.

In a time when students in schools are interacting with information from a variety of online sources (e.g., images, videos, websites, etc.), it is critical to support students in learning the necessary digital literacy skills to become critical readers and interpreters of a range of

different types of media. There are many different strategies available to educators to use with learners when searching for information. Assuming most of the research will be conducted online, then narrowing down search efforts for students will help them avoid getting lost down the metaphorical 'rabbit hole' associated with Internet searching.

Strategies.

- Limit the boundaries of the search process
- Direct them to predetermined websites
- Evaluate resources for usefulness, trustworthiness, and readability
- Develop appropriate, efficient, and effective search strategies
- Choose the best resources for the task
- Understand what primary and secondary sources are and when to use each one
- Take notes using keywords and phrases
- Keep a detailed record of resources used

Types of Sources. A variety of sources should be considered when gathering information such as print, websites, video, images, and opinion pieces. Keeping a detailed list of sources will help students organizing their research.

Topic:		
Date	Website	Type of Media

Figure 7: Reproducible 1 - Organizing sources. Full page available here.

Research options. Depending on your comfort level, there are a variety of options open to your students when searching for information. Your first stop should be your librarian if you have one, as they are the experts on searching information. If you have access to a district library service like Follett Destiny, you can create your own walled-garden approach to research by presenting and limiting where students get their information from. You can also achieve the same results using a social bookmarking applications such as Diigo or Symbaloo.

If your students are using a search engine such as Google, then they will benefit from a little practice developing powerful search techniques. A simple Google search will return a number of resources to help with this, but we have included a Google search techniques resource (Appendix 2) you might find useful. Common Sense Media (2015) also has some excellent resources on strategic searching.

Reading research. Research is a complex cognitive process. Students will need extensive guidance and practice to read research effectively. The independent reading level of students will likely impact their ability to read websites that do not have the built-in capacity to adjust the reading level. There are several website and browser extensions including Newsela, The Readability Test Tool, and Wonderopolis that can help with making sure your students are reading research at their individual reading levels. A more extensive list can be found in Appendix 3.

Usefulness. Evaluating research information and sources to determine whether or not they come from reliable and trusted sources is an integral part of the search process. This step is often overlooked by intermediate-aged students. The danger of blindly accepting whatever is put in front of them as the truth is that it tends to negatively impact the quality of their inquiry. Internet research without critical evaluation is a flawed process. The following list highlights some of the problems associated with Internet searching:

- Internet search results, like those you would find after a Google search, are ranked by importance by computer algorithms. The highest-ranked websites may not therefore be the most relevant
- The content found on websites searched from the Internet have little or no review process to determine whether the content is accurate or not
- Advertisements and links can be distracting
- The information varies greatly in accuracy, purpose, and reliability
- Information from the Internet needs critical evaluation before using

Using a simple checklist like the one below can ensure that your learners develop important critical thinking skills.

Question	Answer	
	Yes	No
Does it help me answer my inquiry question?		

Figure 8: Reproducible 2 - Research checklist. Full page available here. Adapted from UC Berkeley Library. (2012) "Evaluating Web Pages: Techniques to Apply & Questions to Ask." and from Tech-Ease. (2011) "How can my students know if a web source is reliable?"

Biases. It is inevitable that students will allow their own biases to impact the decisions they make about gathering certain pieces of information to support or disprove their inquiry question. To engage in authentic IBL, it may be beneficial to make students aware of the implications of allowing biases to infiltrate their inquiry. MediaSmarts (2013) has some excellent resources to help to combat biases when researching.

SRL Support to Researching.

Step 2: Research Inquiry Question	
Recommended activities to support SRL development	
SRL focus: applying strategies	At this point, teachers should focus on helping students to attain a variety of learning strategies that support the process of learning. For this step (research inquiry question), it is important that teachers provide many options for appropriate research.
Revisit inquiry goal often	Students should revisit their Inquiry Goal (Reproducible 8) each day to determine whether or not they are making sufficient progress towards achieving the overall goal. If they are not, they can make adaptations or find support through their Inquiry Log (Reproducible 7).
Fill out 'My Inquiry Log' each day (Reproducible 7)	Students will need support learning how to fill this out initially. Eventually they should be able to fill it out in 5 minutes or less.
Introduce SRL forms	This will most likely take an extra lesson or two apart from the IBL unit. Students should receive explicit instruction on how to use their Inquiry Log (Reproducible 7) to determine where they need support and what forms or strategies would be appropriate to use. See 'SRL Support Handbook' provided for more information.
Begin to use SRL support forms	Students will begin to use their Inquiry Log (Reproducible 7) to determine which SRL support form will help them gain the skills needed to help them achieve their goal.
Class discussion about goal setting	Continue the class discussion about the importance of monitoring daily goal setting and adapting goals.

Continue to support student organization of work and supplies	Make certain that students place their notes and work into the appropriate location in their binder prior to the end of each work session. Some students may need one-on-one support in this area initially. See Reproducible 13 for binder organization support.

Figure 9: SRL strategies to support researching an inquiry question

Step 3: Analyze. In the analyze step, determining the importance of one's research information, synthesizing, and drawing conclusions are important skills which need to be developed. The teacher will need to help students develop the strategies needed to be selective about which research to keep and which to discard. It may also be necessary for the teacher to help the student decide if there is enough information collected, if the information represents diverse perspectives, if it helps to answer the inquiry question, and if further research is required. Without the ability to determine what is important in student's research they have little chance of drawing conclusions, making personal connections, and developing high levels of comprehension.

Determining Importance. Determining the importance of the research as it relates to the inquiry question is a complex process. Helping students determine the main idea of each piece of research is a critical skill required in this step. The graphic organizer below may help students organize their research and determine the main idea.

Organizer To Help Identify The Main Idea

Title, Subtitle, and Headings	First Sentence of Each Paragraph	Last Sentence of Each Paragraph

Introduction	Ending

Conclusion: What are the most important ideas in the article?	Important Pictures
1.	

Figure 10. Reproducible 3 - Identifying the main idea. Full page available here.

Synthesizing.

"Synthesizing combines awareness and understanding on all levels-it is the summary of text, combined with the readers' connections, questions, and inferences, to formulate a new perspective." (Gear, 2008)

Learners will need to be able to connect what they read, view, and process during their research to their own existing knowledge. The connections learners make can be personal connections, connections to other text or media, or connections to the larger world around them.

Strategies for Synthesizing.

1. Understanding the difference between a summary and a synthesis will help students transform their learning into new areas.

Summary	**Synthesis**
• "two-dimensional" reading: text + reader • facts from the text made simpler • no additional input • a retelling of the text	• "three-dimensional" reading: text + reader's thinking = new thought • facts from the text expanded upon • opinions, thoughts, ideas included • a rethinking of the text

Figure 11: Difference between summary and synthesis

2. One of the simplest ways we can help students to synthesize is allowing them to notice their thinking before and after reading. The following graphic organizer will help students extend their thinking beyond information found in the research.

Inquiry Question:	
Summary from the text	My thinking
•	•
Transformed thoughts:	

Figure 12. Reproducible 4 - Synthesis. Full page available here.

3. Identifying trends or patterns in evidence and information can also help to improve the act of synthesizing. Trends may include ideas, themes, or arguments that repeat throughout the research evidence. Contrasting and comparing the research information can also help.
4. There are several important questions educators can encourage their students to ask in the synthesizing phase such as.
    a. What is similar about the evidence?
    b. Are there two or three points or arguments that are consistent across a number of pieces of research evidence?
    c. What has been the thing that has most changed my thinking? Why?

Struggling Synthesizers. Synthesizing is a high-level cognitive thinking and processing skill. Not all learners will be able to achieve this without guidance and significant practice. Educators may find it useful to use the following prompts with students:

- What will you need to think about before we get started on this?
- How are your ideas about his changing?
- What has been the thing that has most changed your thinking? Why?
- What are you noticing about your thinking?
- How are you feeling about what your have learned/done so far?

The graphic organizer below will help learners make connections between their own beliefs on the research topic and their findings in the research information.

Inquiry Question:	
Personal point of view and beliefs	Ideas to support this found in research

	evidence
1. 2. 3.	1. 2. 3.
My initial position was 'yes'	The research evidence is pretty evenly split.

Figure 13. Reproducible 5 - Synthesizing. Full page available here.

Drawing Conclusions.. Some students may be experienced at drawing their own conclusions whilst others will need a support. The following questions may help learners to draw several conclusions from their research:

- How do my findings affect me or others interested in this inquiry question?
- What did the research evidence tell me about my inquiry question?
- What are big ideas that have been learned?
- How and when did my thinking change?

At the lowest level, drawing conclusions is about weighing the pros and cons of an issue.

A simple pros and cons chart might help struggling learners draw conclusions.

Inquiry Question:		
Pros (Positives)	Cons (Negatives)	Interesting

Figure 14: Pros and cons chart

A strong conclusion to an inquiry question should be based on a combination of the research evidence students have found, student's prior knowledge and assumptions, and the connections they were able to make between the various pieces of information they studied.

Inquiry Question:	
What I knew	What I learned
What I now know - Conclusions	

Figure 15. Reproducible 6 - Drawing conclusions. Full page available here.

SRL Support to Analyzing.

Step 3: Analyze	
Recommended activities to support SRL development	
SRL focus: applying strategies	At this point, teachers should focus on helping students to attain a variety of learning strategies that support the process of learning. For this step (*Analyze, Synthesize, Evaluate, and Draw Conclusions*), it is important that teachers provide many options to help students analyze and evaluate their research.
Revisit inquiry goal often	Students should revisit their Inquiry Goal (Reproducible 8) each day to determine whether or not they are making sufficient progress towards achieving the overall goal. If they are not, they can make adaptations or find support through their Inquiry Log (Reproducible 7).
Fill out 'My Inquiry Log' each day (Reproducible 7)	This is designed to help students assess themselves and their progress in this inquiry project.
Use SRL support forms	Students should use their Inquiry Log (Reproducible 7) to determine which SRL support form will help them gain the skills needed to achieve their goal.
Class discussion about goal setting	Continue the class discussion about the importance of monitoring daily goal setting and adapting goals.
Continue to support student organization of work and supplies	Make certain that students place their notes and work into the appropriate location in their binder prior to the end of each work session. Some students may need one-on-one support in this area initially. See Reproducible 13 for binder organization support.

Figure 16: SRL strategies to support analyzing

Step 4: Create. After students have gathered enough information to formulate their own understanding on the topic, they are ready to shape their research into a presentation in the create phase. One of the most important factors students need to consider is to the align their research into a suitable end-product in preparation for dissemination and sharing. Choosing a suitable end-product, which can be shared can be a difficult task for students. There are several considerations students need to attend to before making a final decision about their end product.

1. End products should be chosen based on individual's strengths. For example, if the learner is a visual learner, then they may consider making a movie as an end product.
2. Consideration should be placed on how far the end product will be shared. For example, if sharing is being restricted to the classroom, a wide variety of end products can be considered, but if the objective is to share with a global community, the end product needs to be in a format that can be shared easily on social media.
3. Another important consideration before choosing an end product is the audience that will receive the product. A younger audience may need the end product to be produced in a way that is simple to comprehend. In this instance, a poster may suffice. However, an older audience may demand a more sophisticated way to receive the end product and may also want the option to interact, reuse, reshare, and remix it. A video hosting site with options for commenting may be more appropriate.
4. Lastly, it is important for students to choose a method of presenting their end-product with a tool they already know how to use. At this stage, it may not be effective or efficient for learners to learn how to use a new tool as some tools require extensive knowledge in order to use effectively.

Both low-tech and high-tech methods of creating an end product should be considered. Examples of low-tech methods are a dance, diorama, or poster. High-tech methods involving digital technologies offer a variety of ways to showcase a learner's research. One of the most powerful attributes of digital technologies are how they intuitively allow students to represent their understanding in a number of different ways. Student have free access to incredibly powerful multimedia authoring tools for text, audio, image, and video production. Tools suitable for synthesizing work in preparation for sharing include: text (Word, Pages, Google Docs, InDesign, and Open Office); image manipulation and remixing (Photoshop, Gimp, Aviary); audio production (Garageband, Audacity, Aviary); graphic design (Illustrator, Fireworks); screen capture (Gawker, Quicktime, Awesome Screenshot, SmartRecorder); video production (iMovie, Movie Maker, Animoto); Animations (Flash, cameras); and presentation tools (Powerpoint, Keynote, Prezi, Pecha Kucha). Many of these features can also be added to your Firefox or Chrome web browsers.

SRL Support to Creating.

Step 4: Create	
Recommended activities to support SRL development	
SRL focus: adapting and regulating	As students near the finish line of their IBL project, it provides a great opportunity for teachers to help students learn to adapt and regulate their learning to ensure that they meet their final goal.
Revisit inquiry goal often	Students should revisit their Inquiry Goal (Reproducible 8) each day to determine whether or not they are making sufficient progress towards achieving the goal. If they are not, they can make adaptations or find support through their Inquiry Log (Reproducible 7).
Fill out 'My Inquiry Log' each day (Reproducible 7)	This is designed to help students assess themselves and their progress in this inquiry project.

If needed: use SRL support forms	Students will use their Inquiry Log (Reproducible 7) to determine which SRL support form will help them focus on achieving their goal.
Revisit task understanding	Have students review their initial goal for how they would share their new knowledge to others. At this point they can reevaluate their initial goal and adapt it if necessary. Help students revise what their end task might look like and how they will create this in the next couple work periods.
Continue to support student organization of work and supplies	This becomes even more important as students may be working on creations that are outside of their binders (multimedia, poster, etc.). Make certain that students place their notes and work into the appropriate location in their binder or other place prior to the end of each work session. Some students may need one-on-one support in this area. See Reproducible 13 for binder organization support.

Figure 17: SRL strategies to support creating

Step 5: Share.

"Share what you love, and the people who love the same things will find you."

(Kleon, 2014)

Students' need to share their stories. Sharing is a key component of learning in the digital information age. Making student's learning visible is an important step of the inquiry process. Students become experts in the area of their inquiry question and over time move from the position of learner to teacher. It might be said that they have an opportunity and a responsibility to the learning environment to share their findings. It also presents an opportunity to share with a wider audience and connect with like-minded people. When learners connect with others for the purpose enhancing learning, a shift occurs from learning for someone else to learning for oneself. Students need to self-select their method of sharing and their comfort level. Sharing may occur at the classroom, school, community, or world level. There are numerous free applications, which allow students to share their work.

Projects can be shared at school assemblies by connecting the media to a projector. Depending on the size of the project, it may be possible to email projects to parents containing an embedded file. Alternatively, an email containing a link to secure file-sharing site such as Dropbox, Box, Google Drive, or One Drive may be used. Recipients of the link could log in with a password and view the content. Projects may also be hosted on a school website, class website, or uploaded to a blog or wiki service such as Edublogs, Wordpress, Blogger, or Wikispaces. To harness the true power of social media and reach a wider audience, projects may also be uploaded and shared on a video sharing sites such as Vimeo or YouTube. Once uploaded, video projects can be shared on a variety of social media networks. A link to the project can be disseminated on services such as Twitter using an appropriate hashtag. It is also possible to post the project to a Facebook page or Google+ page. Using social media as a method of disseminating projects allows like-minded people to interact with the project. These interactions often lead to invaluable feedback, a deeper understanding of the topic, and may lead to improved iterations of the project. An extensive list of presentation tools can be found can be found at: http://cooltoolsforschools.wikispaces.com/

Note: It should be noted that it is the responsibility of the educator using the above tools to make sure that they are in full compliance with British Columbia's Freedom of Information and Protection of Privacy Act (Office of the Information & Privacy Commissioner for British Columbia, 2015)

SRL Support to Sharing.

Step 5: Share	
Recommended activities to support SRL development	
SRL focus: monitoring and	Although students have been doing this all along, this is a great

evaluating feedback	point for students to receive feedback from their peers and teacher to help support their learning journey.
Revisit inquiry goal often	Students should revisit their Inquiry Goal (Reproducible 8) each day to determine whether or not they are making sufficient progress towards achieving the goal. If they are not, they can make adaptations or find support through their Inquiry Log (Reproducible 7).
Fill out 'My Inquiry Log' each day (Reproducible 7)	This is designed to help students assess themselves and their progress in this inquiry project.
If needed: use SRL support forms	Students will use their Inquiry Log (Reproducible 7) to determine which SRL support form will help them focus on achieving their goal.

Figure 18: SRL strategies to support sharing

Step 6: Reflect. Metacognition can be described as 'thinking' about one's 'thinking.' In education, it involves knowing when and how to use a specific series of strategies to improve learning. When students have and use these strategies to analyze how they learn, they become more powerful learners.

Strategies That Improve Metacognition.

1. ***Teach students about how their brains grow and brain science*** - Research shows that when students understand the difference between a growth mindset vs. a fixed mindset, there is an increased likelihood that they will participate in reflective thinking, and be more aware about how they learn and grow. Teaching students about the science of metacognition is an important strategy in helping learners understand how they can help their brains to develop.

2. ***Think-Pair-Share*** - Allow time for students to update each other on their inquiry projects. Assigning students an inquiry partner will encourage discussions, facilitate elaborations on project development, and promote self-reflection.

3. ***Give students practice recognizing what they do not understand*** - Creating opportunities for learners to develop self-awareness skills is critically important. Posing

questions such as "What was most confusing about the material we explored today?" will help to create an environment that embraces struggle in a positive way. Pausing to acknowledge the challenges that arise during inquiry learning can jumpstart metacognitive processing, and help to create a classroom culture that understands confusion is part of the learning process.

4. ***Have students keep inquiry journals*** - One way to help learners monitor and track their own thinking is through the use of personal inquiry journals. Assigning weekly questions to help students reflect on how they learn rather than what they learn is an important metacognitive skill. Example questions may include:

- What was easiest for me to learn this week? Why?
- What was most challenging for me to learn? Why?
- What helped my learning this week? How?
- What got in the way of my learning this week? How?
- Allow learners the freedom to choose and use a variety of journal formats. Examples may include mind-maps, blogs, wikis, diaries, lists, e-tools, etc.

SRL Support to Reflecting.

Step 6: Reflect	
Recommended activities to support SRL development	
SRL focus: monitoring and evaluating feedback	Now students will spend time reflecting on their learning journey and assessing themselves on the process. Encourage students to be honest about areas they need to continue working on to improve themselves as learners, as well as areas that went really well for them. It is important that learners identify the SRL strategies that they found most useful on their journey.
Revisit inquiry goal	Ask students to evaluate whether or not they achieved their Inquiry Goal.

Self-Assessment on SRL skills	Students assess their SRL skill development over the past weeks using the following SRL Self-Assessment (Reproducible 14)
Now What? learning reflection	Students reflect on their learning and develop an understanding that learning does not end here using the 'Now What?' form (Reproducible 14)

Figure 19: SRL strategies to support reflecting

SRL Support Handbook

Purpose. The purpose of the following handbook is to help students develop independent SRL skills. Explicit instruction of SRL skills is more effective when accompanying other classroom learning goals rather than as a stand-alone unit. Therefore, the following forms are designed to compliment an inquiry based learning environment where it is necessary for students to have basic SRL skills such as time management, ability to focus on a task, goal setting, and self-monitoring. The aim of this handbook is to help students quickly pinpoint areas of SRL that they find difficult and develop strategies to work on in these areas.

In a gradual release of responsibility model, students will initially learn how to use each of these forms with direct instruction from a teacher. However, ideally, as a student becomes more independent, they will use their daily 'Inquiry Log' (Reproducible 7) to determine areas of SRL that need extra support and then choose the appropriate form to help them with that skill. For example, if a student is not meeting their learning goal because they are too distracted, they will use the form titled 'I'm Distracted!' (Reproducible 11) to help develop strategies to focus on their work. If a student has a learning goal that is too big, they can use the 'My Goal is Too Big' form (Reproducible 10) to help them narrow their focus. If students feel that they are strong in all areas of SRL, they may be encouraged by their teacher to pick an area of SRL to strengthen.

It is recommended that these forms are kept in a separate duo tang, folder, or binder section so that students can look at them to monitor progress in their learning and development

of SRL skills. Students will also go back to these forms at the end of the IBL unit to help them reflect on and assess their learning.

Description of SRL forms.

- Daily Inquiry Log (Reproducible 7) - This form is designed to be completed at the beginning of each work period or day. Students take a couple minutes to choose a goal for the session, and make a simple plan to achieve it. They will be asked to consider any distractions or challenges that they might face in meeting their goal.
- My Inquiry Goal (Reproducible 8) - This form helps students with a 'big picture' goal for the entire inquiry based learning unit. At the beginning of the unit, students should fill this out to help focus their inquiry. If students wish to adapt their goal or plan at any point, they can do this with post-it notes in the bottom right-hand side of the page. If drastic adaptations are necessary, then students may consider refilling in the form.
- My Daily Goal (Reproducible 9) - This optional form is for teachers who wish to delve deeper into daily goal setting with their students. For most teachers and classrooms, the 'Daily Inquiry Log' will be a quicker method of setting daily goals. However, this form allows students to spend extra time on making a well thought out plan and obtaining support for achieving their goals. If students wish to adapt their goal or plan at any point during the day, they can do this with post-it notes in the bottom right-hand side of the page.
- My Goal is Too Big! (Reproducible 10) - Many students struggle with making attainable goals. This form helps students take a large goal and narrow it down into more specific and manageable steps. Students will restate their large goal and then break it down into smaller steps that need to happen to reach that goal. Once this has been completed,

students will pick on of those smaller steps to become their new (smaller) goal for the day.

- I'm Distracted (Reproducible 11) - Distractions are one of the number one reasons students do not accomplish their goals. This form helps students to identify internal and external distractions. The student will brainstorm strategies they can use to help them deal with these distractions. In order to better support the students in the process, the back of this form has examples of distractions and strategies they can use.
- Time Management (Reproducible 12) - Students are juggling numerous activities and events each day. Learning to prioritize what is most important and what can wait till tomorrow is a crucial SRL skill. This form helps students to identify the many things they need to accomplish in a day including mandatory and leisure activities. Using a colour scheme, students will determine what must be done, versus what can wait until tomorrow. Students are encouraged to use this form in replacement of their planner for three or more days.
- Binder Organization Suggestion (Reproducible 13) - Many students struggle to meet their goals because they cannot find their work supplies or notes. This makes it difficult to get started during a work period. These students need to take extra time at the end of each class to make sure they know that everything is in the right place so they can get started on their work quicker in the next work session. This may take one-on-one support at the beginning.

Recommended lesson plan: IBL supported by SRL.

1. **My Inquiry Log (5-10 minutes)**

The My Inquiry Log (Reproducible 7) form is the cornerstone of monitoring and adapting SRL skills throughout this unit. When this form is filled out honestly each day, teachers and students will be able to use it as quick assessment of progress and areas of need. Using their Inquiry Log, students should take 5-10 minutes before each work session to set goals, develop a plan, and evaluate themselves and the progress they are making.

Students should start by determining if they met the previous day's goal. If they did not achieve it, they should read the options provided to determine what might be the reason that they did not. After this, students will set their new goal and make a simple three-step plan to help achieve their goal. A quick self-assessment of their confidence level follows this. If they are not feeling confident, students should pick one or more things that might help them build their confidence. Finally, students will make a short list of the distractions that might affect their ability to work during this work period.

2. SRL Support Forms (10 minutes)

Once the Inquiry Log is filled out, teachers will help students find the appropriate SRL form to support them in the development of their SRL skills. It is recommended that the teacher hold a separate instructional time to review these forms and their purpose before starting the IBL unit. If students are meeting their goals and feeling confident, teachers can choose to either let them start their work period immediately or ask them to choose a SRL form to help support their further development of SRL skills. However, if a student either did not meet their goal the previous day or is not feeling confident about meeting their new goal, they should be directed to the appropriate support (see Figure 14 below). The reason a student does not meet their goal should be clearly stated on their Inquiry Log.

If student...	Options/strategies they can try (pick one or more)
does not have enough time to get work done	• Managing my Time form to help student learn to prioritize activities (Reproducible 12) • I'm Distracted form to help student use time more efficiently (Reproducible 11) • My Goal is Too Big!! form to help student adapt their goal and inquiry question to be more manageable (Reproducible 10)
is overwhelmed and does not know where to start	• Allow students to look for sample inquiry questions online or in Appendix 1 • My Goal is Too Big!! form to help student narrow down their focus (Reproducible 10) • Partner student with a more focused student to help them understand the task better
has too many distractions (either inside or outside of their heads)	• I'm Distracted form - to help student determine what is distracting them and some strategies to help them deal with these distractions (Reproducible 11)
has a goal that is too big	• My Goal is Too Big!! form to help students develop a smaller goal (Reproducible 10)
does not understand their goal	• My Daily Goal form to help student understand what they are trying to achieve (Reproducible 9)
cannot work in their current location	• I'm Distracted form to determine what is distracting them about the current location and what their options are to deal with this (Reproducible 11)
struggles with finding appropriate online research	• Look at list of appropriate online search sites provided (Appendix 3) • I'm Distracted form if student is easily distracted on the computer to other websites such as Facebook or YouTube (Reproducible 11) • Teach students how to use search techniques (Appendix 2)
does not understand their inquiry question	• First, revisit My Inquiry Goal form from beginning of unit and make adaptations or clarifications to develop focus (Reproducible 8) • Next, use My Goal is Too Big!! form to help students determine the next steps that will help them work towards their end product (Reproducible 10)
needs to adapt their goal	• Revisit My Inquiry Goal form from beginning of unit

	and make adaptations or clarifications to develop focus (Reproducible 8) ● My Goal is Too Big!! form to help student adapt their goal and/or inquiry question to be more manageable (Reproducible 10) ● My Daily Goal form to help student understand what they are trying to achieve (Reproducible 9)
needs more time to work on project	● Managing my Time form (Reproducible 12) ● I'm Distracted form to help student use time more efficiently (Reproducible 11) ● My Goal is Too Big!! form to help student adapt their goal and inquiry question to be more manageable (Reproducible 10)
needs support in organizing and keeping track of their work and papers	● Teacher or EA to help student one-on-one to organize a separate binder in the suggested way (Reproducible 13)
has little to no confidence in the ability to achieve goals	● Meet with teacher to receive individual support ● My Goal is Too Big!! form to help students develop a simpler goal (Reproducible 10)

Figure 20: Strategies to use to develop SRL skills

3. IBL Work Session (45 minutes)

- see instructional IBL methods and suggestion in the IBL process

4. Reflect and Organize (5 minutes)

Students will do one or more of the following activities (in order of priority):

1. Organize notes, work, and SRL forms into binder so they are ready for next work period
2. Assess their progress on today's goal by using the Inquiry Log for next work session
3. Write down their goal for next work session on the Inquiry Log for next work session
4. Write down steps to help them achieve their new goal

Assessment Strategies

Assessment strategies are the tools teachers use to collect evidence of student learning. Formative and self-assessment practices are the most powerful forms of assessment when the end goal is to improve student's SRL skills and motivation to learn. We have created a self-

assessment for students to use to evaluate their learning at the end of their inquiry cycle. This assessment will give the teacher feedback on student confidence in SRL and IBL. It also allows the student to look to the future and how they will continue their learning journey. This self-assessment tool can be found in our reproducible section (Reproducible 14). Following, you will find a list of other formative assessment strategies that you could use in monitoring student progress throughout the unit.

Other assessment tools.

- Student Portfolios
- Reflection Journals (Appendix 4)
- Rubric for Discipline-Based and Interdisciplinary Inquiry Studies
    - http://www.galileo.org/research/publications/rubric.pdf
- Effort/Achievement Rubric
    - https://balancedtech.wikispaces.com/Effort+and+Achievement+Rubric
- Freedom to Fail Rubric
    - https://www.isteconference.org/uploads/ISTE2015/HANDOUTS/KEY_94213546/FailureRubric.pdf
- Oral Presentation Rubric

    https://docs.google.com/document/d/1NUmCtENNQCUZFcsUocPhouPOSs7bUKFubZKz3mDQzN8

Reproducibles and Appendices

Reproducibles.

Reproducible 1 - Documenting Sources
Reproducible 2 - Research Checklist
Reproducible 3 - Identifying Main Ideas
Reproducible 4 - Synthesis
Reproducible 5 - Synthesizing
Reproducible 6 - Drawing Conclusions
Reproducible 7 - Daily Inquiry Log
Reproducible 8 - My Inquiry Goal
Reproducible 9 - My Daily Goal
Reproducible 10 - My Goal is Too Big!
Reproducible 11 - I'm Distracted!
Reproducible 12 - Time Management
Reproducible 13 - Binder Organization Support
Reproducible 14 - Assessment

Appendices.

Appendix 1 - Sample Inquiry Questions
Appendix 2 - Google Search Techniques
Appendix 3 - Leveled Reading Websites
Appendix 4 - Reflection Questions

Name: _____
Date: _____

Documenting Sources

Topic:		Name:	
Date	Website	Type of Media	

Name: _____
Date: _____

Research Checklist - Usefulness

	Answer	
Questions To Ask	Yes	No
Does it help me answer my inquiry question?		
Is this a personal website?		
Does this resource list the name of its author or publisher?		
Are there lots of advertisements?		
Is it biased?		
Is the content support by addition sources?		
Can I find other sources with the same information?		
Overall - is this a reliable source?	YES	NO

Adapted from http://www.lib.berkeley.edu/TeachingLib/Guides/Internet/Evaluate.html and http://etc.usf.edu/techease/win/internet/how-can-my-students-know-if-a-web-source-is-reliable/

Name: _____
Date: _____

Identifying the Main Idea

Title, subtitle, and headings	First sentence of each paragraph	Last sentence of each paragraph

Introduction	Ending

Conclusion: What are the most important ideas in the article?	Important Pictures
1. 2.	

Name: _____
Date: _____

Organizer: Synthesis

Inquiry Question:	
Summary from the text	My Thinking
•	•
•	•
•	•
Transformed Thoughts:	

Name: _____
Date: _____

Synthesizing

Inquiry Question:	
Personal point of view and beliefs	Ideas to support this found in research evidence
1. 2. 3.	1. 2. 3.
My initial position was ‘yes/no’	The research evidence shows...

Name: _____
Date: _____

Drawing Conclusions

Inquiry question:	
What I already knew	**What I learned**
I now think - conclusion	

My Inquiry Log

My Inquiry Question:
_____
_____
Name: _____
Date/Time: _____
Location: _____

Today's Goal
_____
_____
_____
Steps to help me meet this goal:
1. _____
2. _____
3. _____

How confident are you that you can meet this goal today?
Circle a number (1 is no confidence, 10 is very confident)
1 2 3 4 5 6 7 8 9 10
If you are a 5 or lower, what do you need to do to build your confidence? (pick one or more)

- ☐ Make my goal smaller
- ☐ Change my goal
- ☐ Change my inquiry question
- ☐ Change my learning strategies
- ☐ Get help from the teacher
- ☐ Find a new location to work
- ☐ Manage my time better
- ☐ Deal with the distractions around me
- ☐ I need more time
- ☐ I don't know where my supplies and work from last day are

Last session, I did/didn't meet my goal. (Circle one)

If I didn't meet my goal, it's probably because (pick one or more):

- ☐ I didn't have enough time
- ☐ There were too many distractions
- ☐ My goal was too big
- ☐ I didn't understand my goal
- ☐ My choice of location was not great
- ☐ My online searches weren't effective
- ☐ I don't understand my inquiry question
- ☐ My work and supplies are not organized
- ☐ Other:

Today's Possible Distractions:
Around me:

Inside me:

Name: _____
Date: _____

My Inquiry Goal

My Goal (inquiry question) is:	
To reach this goal, I need to do the following things: 1. 2. 3.	
I will know I have reached this goal by:	Adaptations (place post-it note here):

Name: _____
Date: _____

My Daily Goal

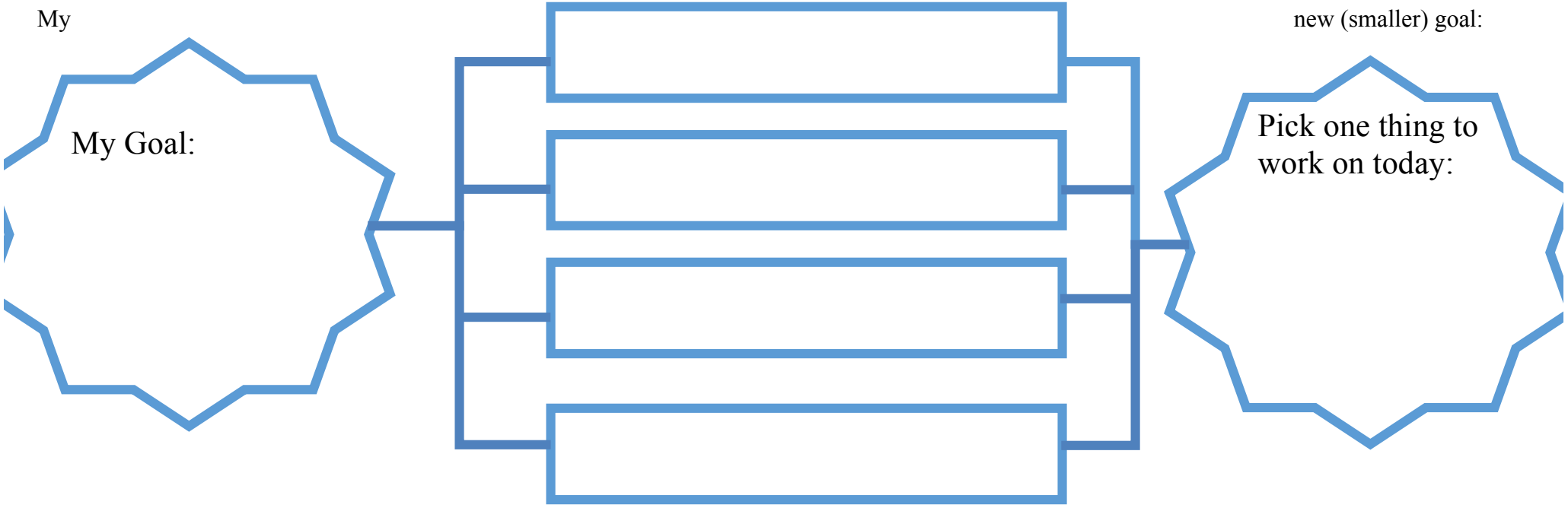
Today's goal is:	
To reach this goal, I need to do the following things: 1. 2. 3.	
I will know I have reached this goal by:	Adaptations (place post-it note here):
Two things that will help me achieve my goal: 1. 2.	

Name: _____
Date: _____

My Goal is Too Big!

List 2-4 things that need to be done to meet your goal

My



new (smaller) goal:

_____

_____

Name: _____
Date: _____

I'm Distracted!

Distractions (list as many as you can)	**Strategies I can try (Brainstorm 2-3 ideas)**	**Today I will try (Pick 1 strategy to try)**
Outside my head:		
Inside my head:		

** see back of this page for distraction examples and strategy suggestions

Distractions Inside Your Head

Examples:

- Lack of confidence in achieving your goal (belief that you can't do what you need to do today)
- Feelings of frustration, anger, sadness, loneliness, anxiety, etc.
- Feelings of excitement for an event that is happening tonight or next week (birthday, Christmas, etc.)
- Something that happened at home that you are thinking about (fight with brother, pet is lost, etc.)

Strategy suggestions for distractions inside of your head:

- Go for a walk to get some fresh air
- Take several deep breaths
- Talk to a friend or teacher for a couple minutes
- Make your goal smaller so that you don't have to do as much today (if you are very distracted by other things in your life or feelings of not being able to accomplish your task)
- Write your thoughts down on a paper or journal
- Find something that gets your mind off of these distractions (read a book, draw a picture, etc.)
- Others?

Distractions Outside Your Head

Examples:

- Friends are talking to you
- Too loud in classroom
- You are sitting beside someone who makes you feel mad or irritated
- You get distracted by other websites on the computer (Facebook, Google, YouTube, etc.)

Strategy suggestions for distractions outside of your head:

- Choose a new location to sit in the classroom
- Ask the teacher if there is a different room you can work in
- Bring headphones or earplugs to school
- Have an accountability partner who checks to make sure you are focused in your computer work
- Have an accountability partner who reminds you to get back on task

Name: _____
Date: _____

Managing My Time

	Date: _____	**Date: _____**	**Date: _____**
Things to do tonight			
Colour Legend Pick a colour scheme to organize your activities: • Things that I HAVE to do (family or afterschool commitments) • Things that are a priority to do • Things I want to do			

Managing My Time Instructions:

You are filling out this form to help you learn to manage your afterschool time in a productive way. This form will become your planner for this week. The following steps will help you learn to manage your time better:

1. Start by writing today's date in the first column.
2. Take a couple minutes to write down all the things you have to do tonight. This may include soccer practice, eat dinner with family, watch favourite TV show, homework, play with toys, etc… Anything you would like to get done tonight.
3. Pick three different colours to highlight or star your items. With the first colour, circle or highlight all the activities that you MUST do tonight. These might be family commitments or extra-curricular activities like dance or soccer. With the second colour, look over your remaining list and circle or highlight the activities that need to be priority. This will be any homework that is due tomorrow, practicing a musical instrument, chores, etc… Take your last colour and circle all the things that you'd like to do.
4. Take it home, and complete the activities in order of importance. Those activities that are mandatory or priority should happen first, and then feel free to do the things you want to do. Check each thing off as you go!
5. Return it to school to show your teacher.
6. Repeat for the next two days

Binder Organization Suggestion

When students struggle to find their work and supplies, they waste endless amounts of times searching or redoing work. Becoming an organized learner is an important SRL skill and students that struggle in this area need one-on-one support to make sure papers go in the correct place each day and that supplies are put away correctly. Inquiry learning is dependent on the student's ability to be organized. They need to be able to take notes as they research and come back to those notes many days later to synthesize and analyze them for further use.

It is suggested that students use a separate 1-inch binder (or smaller) to keep track of their inquiry work. This binder should be separate from other school subjects such as Math and Language Arts to help them keep focused. Here are the suggested tab headings to help students keep their work organized

Inquiry Binder:

1. **General** - project requirements, teacher expectations, timelines, inquiry question brainstorming, etc…
2. **SRL Support** - Inquiry Goals, Inquiry Logs, and SRL support forms
3. **Research** - notes and sources
4. **Synthesize** - handouts that help students analyze and synthesize their work
5. **Other** - project creation or other items that need to be kept on ha

Name: _____
Date: _____

Inquiry Learning: Self-Assessment

Inquiry Learning			
I can...	Yes	Sometimes	I need further support in this area
learn new things.			
generate an inquiry question.			
collect and critically interpret multiple sources.			
keep detailed track of my progress.			
evaluate evidence in my research information and draw conclusions.			
generate questions for further inquiry.			
investigate and obtain information independently.			
create an end-product that answers my inquiry question.			
share my end-product with a larger audience.			
use feedback given to me by my teacher throughout the inquiry			
critically reflect on my learning.			
show interest and curiosity in learning.			

Name two areas mentioned in the above list that you would like to improve in:

1.

2.

Name two areas mentioned about that you think you are excellent at:

1.

2.

Name: _____
Date: _____

Self-Regulated Learning: Self-Assessment

Self-Regulated Learning			
I can...	Yes	Sometimes	I need further support in this area
develop my own learning goals.			
make a plan and identify steps to achieve my goals.			
adapt goals when they are too big or too hard.			
persevere with a task when it seemed difficult.			
focus during my work.			
complete tasks and assignments within established timelines.			
identify and understand my skill strengths and the areas where I need			
use class time appropriately to complete tasks.			
ignore distractions enough to complete my work.			
encourage others to ignore distractions			
be responsible for my own learning.			
ask questions when I do not understand something.			
follow schedules and use my planner to organize time effectively.			

Name two areas mentioned in the above list that you would like to improve in:

1.

2.

Name two areas mentioned about that you think you are excellent at:

1.

2.

Name: _____
Date: _____

Now What?

From my inquiry I learned…. (include words, pictures, thoughts, feelings, etc.)
Now I am wondering….
Some things I could do to further my learning on this topic are: (For example, books to read, movies to watch, people to talk to, places to visit, etc.)
Future Goal: Of these things, one thing I will commit to doing to continue my learning is:

Sample Inquiry Questions By Core Subject Area

Numeracy

How do we collect and interpret information about people's lives?

How do we measure the height of a mountain?

How big is one billion?

What is the relationship between the area of circle and circumference?

Social Studies

Is Canada a great country?

Is illegal action ever justified when trying to cause political change?

What will Canadian communities look like in the future?

What is it like to live in each of the Canadian Regions?

Will democracy die due to citizen apathy?

Literacy

What can the reader learn from the behaviours and decisions of this protagonist?

Discuss the author's purpose or theme in your book. What is he/she saying about society? Adolescents? Humanity?

Describe the most important relationship in the novel. What is most important about it? What does it tell us about relationships in general?

What makes one writer more powerful than another?

Science

What would it feel like to travel in space?

What are some important moments in space history and space exploration?

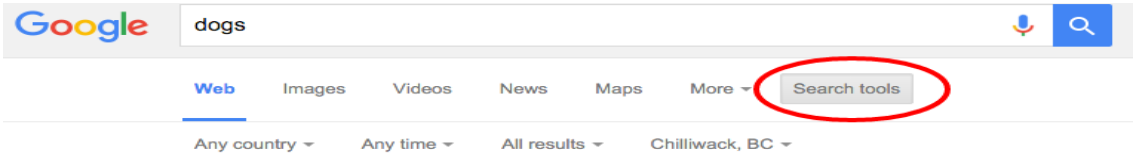
How do we care for the world?

How easy is it to be green?

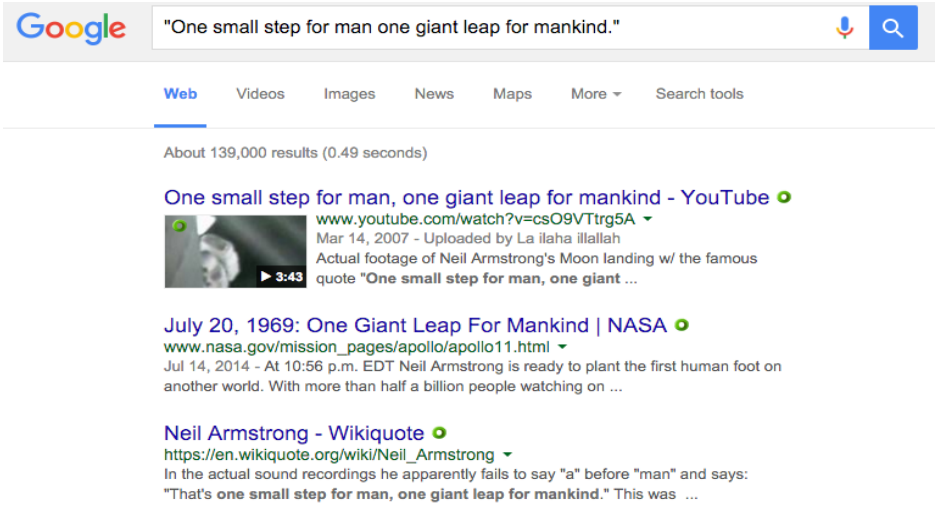
How high can you build a pyramid of plastic cups?

Google Search Techniques

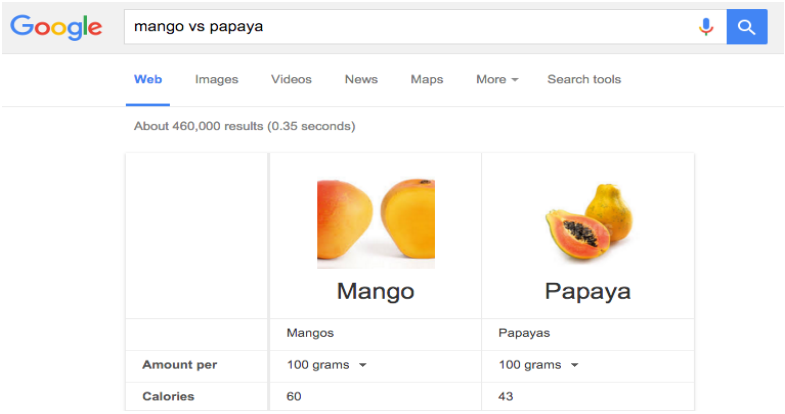
1. Use the additional search options such as ‘web’, ‘images’, ‘news’, ‘videos’, ‘more’, and ‘search tools’ to refine and narrow down your search parameters.



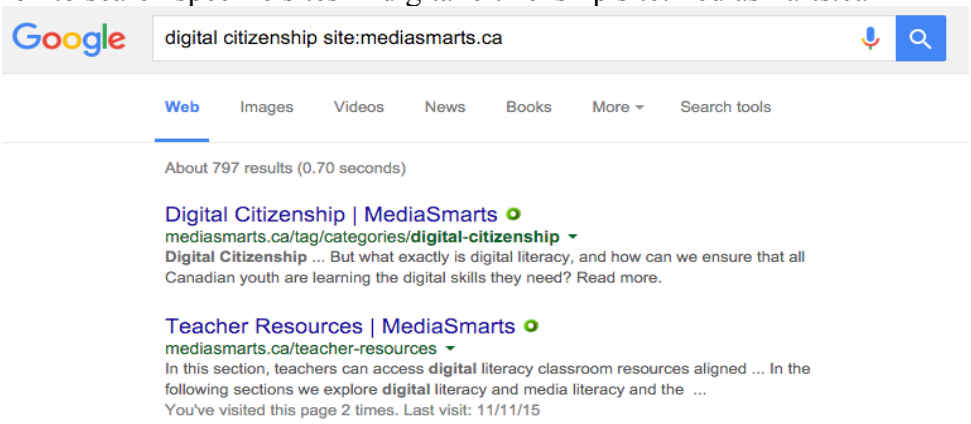
2. Use quotes and quotation marks to locate information. When you put your search parameters in quotes, it tells the search engine to search for the whole phrase. This can help locate specific information that may be stored under other content.



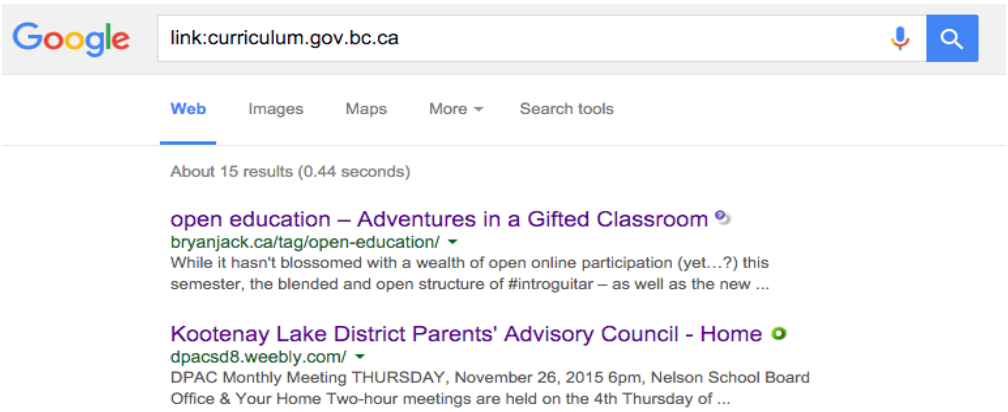
3. Compare and contrast items using versus - “mango vs. papaya” returns a nutritional comparison between the two fruits.



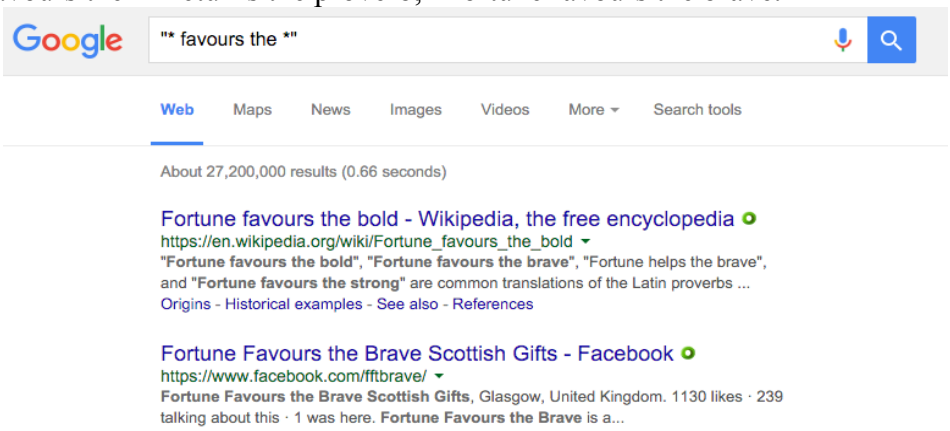
4. Use a colon to search specific sites - “digital citizenship site:mediasmarts.ca”



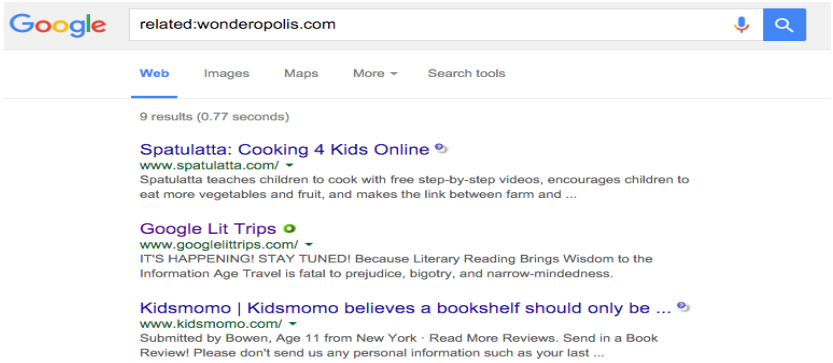
5. Find a page that links to another page - “link:curriculum.gov.bc.ca” returns websites that link to the new B.C. curriculum.



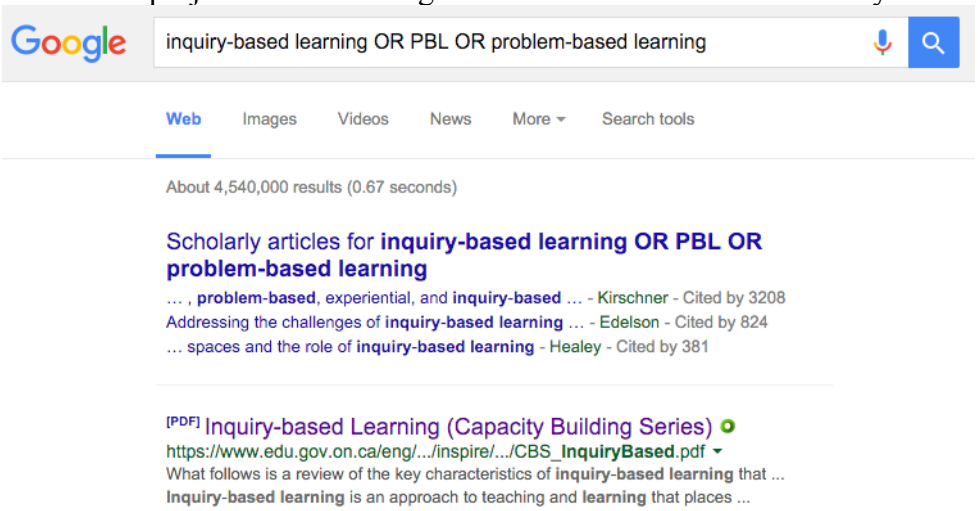
6. Use the asterisk wildcard. Used to find missing terms when you cannot remember the whole string- “* favours the *” returns the proverb, “Fortune favours the brave.”



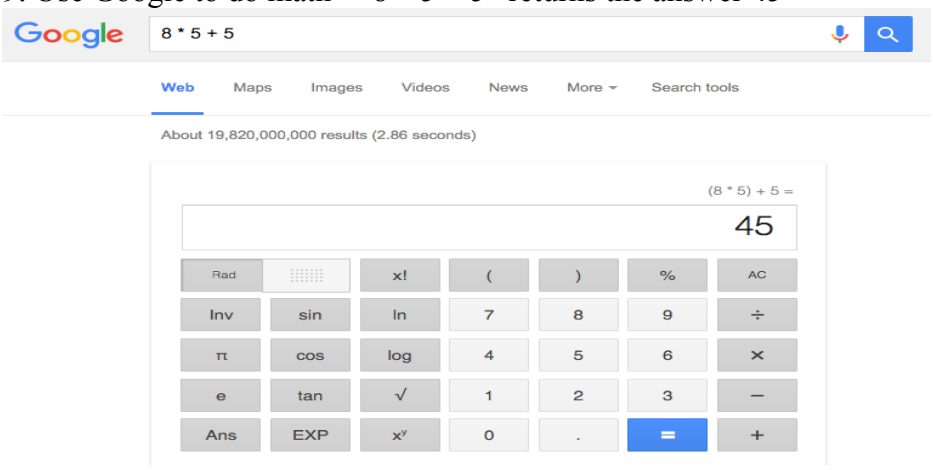
7. Find sites that are similar to other sites - “related:wonderopolis.com” returns sites related to Wonderopolis.



8. Find websites that may use one of several keywords you need information on. “inquiry-based learning OR PBL OR project-based learning” will return results on all three keywords.



9. Use Google to do math - “8 * 5 + 5” returns the answer 45



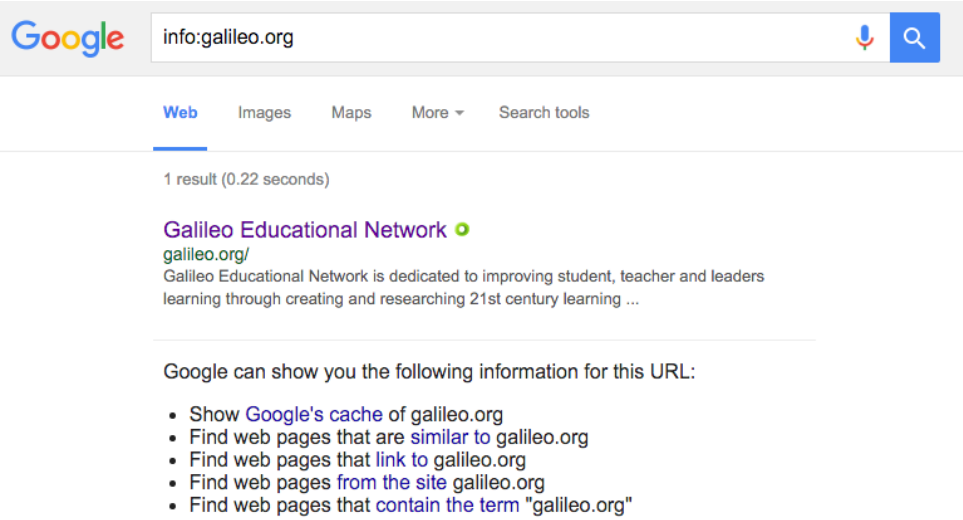
10. Keep it simple
Google search knows how to search for a lot of things. What this means is you don't need to be too specific. If you need a pizza place nearby, use this to search: *"pizza places nearby"*

Google search will detect your location and deliver a variety of results about pizza places that are near you.

11. Gradually add search terms
There may be time when Google search does not return the results you expect. In this instance, keeping it simple may not be the best option. As Google itself suggests, the best method is to start with something simple then gradually get more complicated. See the example below.

First try: job interviews
Second try: prepare for job interviews
Third try: how to prepare for a job interview

12. Use "info:" to get information about websites - "info:galileo.org" returns information about related sites, linked sites, and related sites.



13. Use important words only
The way Google search works is to take what you search for and match it with keywords in online content. When you search for too many words, it may limit your results. That means it may actually take you longer to find what you're looking for. Therefore, it is best to use only the important words when searching for something. Let's see an example.

Don't use: Where can I find a Chinese restaurant that delivers.
Instead try: Chinese restaurants nearby.
Or: Chinese restaurants near me.

14. Use advanced search - https://www.google.ca/advanced_search

Recommended Websites for Research

The Readability Test Tool - http://read-able.com/ - provides a quick and easy way to test the reading level of your work. You can test portions of what you are reading on a web page and give you information about the readability for your students.

Newsela - https://newsela.com/ - Newsela offers a variety of non-fiction and current events articles at various reading levels. This is a great site that offers students a chance to read about the same content at a variety of reading levels.

ThinkCERCA - http://www.thinkcerca.com/ - An online literacy platform to help teachers personalize literacy instruction for students.

ProCon - http://www.procon.org/education.php - This website that provides research (pros and cons) on over 50 controversial issues.

The Critical Thinking Consortium - http://tc2.ca/ - This website focuses on providing critical thinking skills to students in post secondary education environments.

Wonderopolis - http://wonderopolis.org/ - Provides multi-disciplinary content that aligns with US Common Core Standards. This website helps students become critical thinkers and encourages students to wonder about and explore the world around them.

Kid Friendly Websites for Research

- KidsClick! - http://www.kidsclick.org/
- KidRex - http://www.kidrex.org/
- KidzSearch - http://www.kidzsearch.com/
- Kid Friendly Search - http://www.kidfriendlysearch.com/
- National Geographic Kids - http://kids.nationalgeographic.com/
- Kidtopia - http://www.kidtopia.info/
- Safe Search Kids - http://www.safesearchkids.com/
- GoGooligans - http://www.gogooligans.com/
- Ask Kids - http://sp.askkids.com/docs/askkids/
- Mymunka - http://mymunka.com/
- Quintura - http://quinturakids.com/

Prompting Questions to Initiate Student's Reflections

Reflecting back

1. How much knowledge did you have about the topic before we started?
2. What steps did you go through to produce the end product?
3. Have you done a similar kind of work in the past (earlier in the year or in a previous grade; in school or out of school)?
4. How are you now better at this kind of work?
5. In what ways do you think you still need to improve?
6. What problems did you encounter while you were working on this topic? How did you solve these problems?
7. What resources did you use while working on this piece? Which resources were especially useful? Which ones would you recommend to others and use again?

Reflecting forward

1. Given more time, what is one thing you would like to improve upon?
2. What would you change if you could do this project over again?
3. What is something that you have seen in your classmates' work or process that you would like to include in your future projects?
4. What's one thing that you would like to try to improve upon?
5. What goal would set for yourself for next time?
6. What are some areas of your learning you need more help with?

Reflecting internally

1. How do you feel about this project? What parts of it did you enjoy? Dislike? Why?
2. What was satisfying to you about either the inquiry process or the finished product?
3. What did/do you find frustrating about the inquiry process or the finished project?
4. What were your own expectations for this project?
5. Did you miss/meet/exceed your own expectations?
6. Did you meet your goals for this project? If not why not?
7. What does this project say about you as a learner?
8. What did you learn about yourself as you worked on this project?
9. Have your opinions about the topic changed?

Reflecting externally

1. Did you do your work the way other people did theirs?
2. In what ways did your work on this project differ from another student's work?
3. In what ways was your project or inquiry process similar to other students?
4. If you were the teacher, what comments would you make about this piece?
5. If you were to self-assess yourself, what would you say? Why would you say that - what is the evidence?
6. What is the one thing you would like people to notice about your project? Why?
7. What do your classmates notice about your project when they look at it?
8. In what ways did your work meet the teacher goals for this project?
9. In what ways did your work not meet the teacher goals for this project?
10. If someone else were looking at your project, what might they learn about you?

Chapter Four: Personal Reflection

Project Summary

Deciding on a final Master's of Education (MEd) project was no easy task. I wanted my final product to be the starting point in an area of my instructional practice that aligned well with my own pedagogy around learning, and something I could continue to shape and refine as I developed a deeper understanding of the topic. I am firm believer in providing opportunities for my learners to explore their own interests in the classroom. From my personal experience, I have found that the quality of learning that occurs during these times is often more meaningful and authentic than when I direct my students learning. Daniel Pink's (2011) book, *Drive*, opened my eyes to the possibilities that can occur when people are given time to follow their passions. If the education profession wants to empower its learners to be powerful critical thinkers, and foster innovation and creativity in the classroom, then we need to provide environments and instructional practice that encourages and nurtures these skills rather than stifles them. My graduate program exposed me to a variety of innovative and thought-challenging educators from a variety of backgrounds and learning environments, and born out of these experiences I developed an interest in exploring the topic of IBL.

I was not entirely new to forms of IBL. In fact, I had attempted to introduce an inquiry block named C.H.O.I.C.E (Children Have Ownership In Choice Education) into my weekly schedule several years ago. I told my students that for an hour and a half every Thursday I was setting aside time for them to follow their passions. Initially, there was much excitement on my part and on the part of my students. Some students wanted to learn about art while others wanted to learn how to use Windows Movie Maker to produce videos. The first mistake I made was spending more time figuring out a cute acronym for the block rather than preparing my students

for a new way of 'doing' school. Upon reflection, I got my priorities all wrong. Naively, as we moved through the project, I realized that students were left behind and I did not know how to support them. At the same time, I had a small number of students who could learn independently and for them this time was precious and much sought after. However, the majority of my learners found the experience too unstructured and 'open' for them to effectively cope with. I needed to change my practice to support all my learners. What I did not know at the time was that many of my learners lacked the SRL skills required to be successful with this type of learning.

Fast-forwarding a couple of years to the latter stages of my MEd program, I was introduced to the process of SRL by Suzanne Bartel. Suzanne was working on a project around SRL and I had decided to explore the topic of IBL. Through the process of reading each other's literature reviews and sharing our findings we soon realized that it was impractical to think that an entire class of students could be successful engaging in IBL without being supported by a framework of SRL skills. We then decided to work together to produce a resource for teachers in grades 4-6, which breaks down and explains the steps of following a cycle of IBL, supported at each step with specific SRL skills to ensure more learners can experience success with this style of learning.

Experiences

My experiences in this MEd program have been both varied and thought-provoking, and left me in a state of cognitive dissonance around the terms 'learning and 'school.' I used to think that these two terms were one in the same; that learning exclusively occurred at school, but I now know that school is just one small piece of the puzzle when it comes to understanding how and when we learn. Learning is omnipresent and should not be thought of as an act that happens in isolation in school. Do not get me wrong: there is much learning that happens in school, but I

have come to realize that in equal measures school gets in the way of the act of learning. I leave this program with four main areas of interest that will continue to shape my pedagogy:

1) extending my personal learning networks

2) using digital technologies to improve communication and collaboration

3) creating learning environments that encourages innovation and creativity

4) encouraging learners to engage in acts of thinking and responding in public.

Personal learning networks. In isolation, my ability to reach all my learners' needs and provide the best learning experience for my students is impossible. However, with the help of the staff in my school, school district, and the wonderful connections I have developed through personalized learning networks (PLN) on social media, I feel supported in my attempts to be the best educator I can be. This graduate program connected me with countless influential voices in education, who were willing to share their ideas and experiences in order to help improve the classroom experience I provide for my own learners. Educators like Alan Levine who led me to think about recognizing and giving credit to informal learning experiences, and Sylvia Libow Martinez who spoke about the importance of tinkering and harnessing the prevalence of cheap digital technologies which can be used to create objects and engage in experiential learning opportunities. Working with Dr. Alec Couros, who helped me to develop a richer digital identity and encouraged me to be more myself and less professional in my interactions with my PLN on social media. I have discovered that the most impressive aspect of engagement in a healthy PLN is the willingness of contributors to help, provide resources, and challenge thinking. For these reasons, it is important to me to continue to grow as a connected educator and be available to lead and follow as the opportunity and needs arise.

Digital technologies. Another area of this graduate program that inspired me was the use of digital technologies to connect, create, and collaborate. There was no 'shoe-horning' of these powerful tools into our courses at all. Rather, it was just how we went about our business. Using the theory of multimedia learning as a guide to evaluate when and how to introduce a digital tool proved useful. Also, having a framework such as the SAMR model when infusing technology into teaching and learning also helped. The model proved useful when designing, developing, and infusing digital learning experiences that utilize technology into classrooms. Without a framework like this, it is possible to use digital technologies as direct replacements for analogue tasks rather than using the technology to create an entire new process to address the task. I have also learned a great deal from my colleagues in this cohort. There were plenty of informal learning opportunities for sharing about digital tools and technologies. Techniques used for collecting, collating, and sharing information were the most useful.

Innovation and creativity. Innovation and creativity are synonymous with play and exploration. I have a whole new appreciation for play and allowing time for my learners to explore new concepts and processes without the rushing for the sake of a comment or grade on a report a card. As a result of this slow pace of work, I get less things done but I feel like my students and I immerse ourselves in topics to a deeper level than I have previously experienced. Will Richardson's (2012) book, *Why School?,* was an important reference point and the quote, "The world doesn't care what you know. What the world cares about is what you can do with what you know" epitomizes how I feel about the need to constantly reexamine my practice and evaluate its effectiveness. Movements like Maker Education, Genius Hour, and Hour of Code support my thinking that learners can benefit greatly from guided and unguided exploration, and

develop a sense of wonder and curiosity from opportunities to mix learning and play together in informal ways.

Thinking and responding in public. Another area of interest for me that has grown throughout the graduate program is the idea of 'thinking and responding in public.' For many years, I have seen my learners think in isolation, or 'think' within the four walls of their classroom. Thinking and responding in public can be easily achieved with the use electronic portfolios, but creating opportunities for this to happen in the classroom, school, and local community is a little more complex. In a very basic sense, learning environments that facilitate 'thinking and responding in public' are safe spaces where students are encouraged to take-risks with their learning. These spaces are generally student-centred not teacher-centred, and the message that resonates in these environments is that learning is a collaborative and shared experience where everyone is invited to contribute. Questioning and reflecting are also two important strategies that are encouraged when 'thinking and responding' in public. When classrooms engage in the act of thinking and responding in public, attention is shifted from the teacher to the other voices in the room. That shift is an important one, because it promotes the fact that the teacher is not the center of all learning, and it recognizes that all occupants of the classroom are teachers and learners at different times and in varying capacities.

Looking Ahead

The journey of completing my graduate degree has led to more questions than answers. More than ever, I find myself questioning my own instructional practice, what it means to 'learn,' and what qualifies as 'good teaching.' One of the most valuable skills I have developed in this graduate program is the ability to locate, critically read, and synthesize the latest educational research and make decisions about my practice based on peer-review evidence-based

research. These skills will help me make informed decisions about my practice moving forward. Throughout this graduate program, I have developed a comfort level with methods of synchronous and asynchronous learning. I would like to use this experience to add to the ways in which I interact with parents and students. I would like to explore more methods of synchronous learning with my students and more flexibility around when and how we learn. Exploring the field of educational technology has been exciting, but it is still an emerging and evolving practice in many schools in my region. Moving forward, I would like to combine my passion for empowering youth around issues of social justice with the power of digital technologies to help my learners create awareness and change in their local and global communities.

IBL Implementation Recommendations

Engaging learners in methods of IBL can be a complex process for the best of educators. It requires students to have or be able to develop the specific self-regulated learning skills to become independent and thoughtful learners and requires teachers to be less explicit and to foster a sense of curiosity and wonder in their workspaces. In order to help those who have an interest in student-centred learning, I can offer the following recommendations:

1. Make sure educators carefully guide their learners in the development of strong self-regulated learning skills, which are critically important to the success of IBL.
2. For educators who may be new to IBL, I recommend starting slowly. Avoid the temptation to jump into ‘open’ IBL, and start with ‘structure’ or ‘guided’ IBL to increase the chance that all students experience success with this style of learning.
3. Lead by example. Model what it looks like to be curious of the world, demonstrate what it means to be a lifelong learner, do not be afraid to share your passions with your class, and create opportunities to question at deep and meaningful levels.

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