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Inquiry-Based Learning: Observations and Outcomes

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Abstract

Herein we set out to argue that the current Full-Day kindergarten (FDK) in Ontario, Canada situates the inquiry process within early learning, and initiates an Ontario students' educational journey by having new students construct meaning in a collaborative, developmentally appropriate manner. Among the major benefits of learning through inquiry is increased student engagement (community of learners) and decreased student anxiety. Students suggest Inquiry-Based Learning (IBL) is authentic, natural and IBL profits from its genuine connections with the real world. When students are given the chance to enhance their learning through real-world problems, the authenticity of the activity shines through, as students are able to see how learning the intended concepts will be of use to them outside the classroom.

Key words: Inquiry-Based Learning, Full-Day Kindergarten, Authentic Learning, kindergarten

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Full-day kindergarten (FDK) in Ontario, Canada is currently grounded in play-based learning, embracing the notion that "early learning experiences are crucial to the future well-being of children, and establish the foundation for the acquisition of knowledge and skills that will affect later learning and behaviour" (Ontario Ministry of Education, 2010b, p. 2). At the early stages of a child's formal education, the FDK program ensures that learners are offered choices of learning activities that reflect their developmental stages. The learning activities are designed by the Early Learning–Kindergarten team to encourage the children to think creatively, to explore and investigate, to solve problems and engage in the inquiry process, and to share their learning with others (p. 13).

FDK situates the inquiry process within early learning, and begins an Ontario students' educational journey by having new students construct meaning in a collaborative, developmentally appropriate manner. When appropriate, "explicit instruction is used to clarify steps, extend an idea in a particular direction, or demonstrate a skill that may be used in a broader context" (p. 12). This approach to teaching and learning is presumed to better prepare students to become independent, life-long learners and leads to successful transitions (Nicolucci, 2010). If the Ontario Ministry of Education expects greater success in Grades 1-12 based on a strong foundation of inquiry established in Kindergarten, then there must be plans to revise the curricula for all grades to reflect the principles of co-construction of meaning and inquiry we believe.

Purpose

Our purpose herein is to examine student achievement and related outcomes via inquiry-based learning environments. This approach to education is not new, however it has gained much attention recently in the province of Ontario within Canada since the rollout of the new Early Learning Kindergarten program in 2010 (Ryan & Date, 2012). In this new program, children are at the center of the learning that occurs in the classroom, as learning opportunities revolve around their interests (Ontario Ministry of Education, 2010).

Children are curious and teaching through inquiry helps teachers "facilitate students' learning by providing a variety of tools, resources, and experiences that enable learners to investigate, reflect, and rigorously discuss potential solutions to their own questions about a topic the class is studying" (University of Toronto, 2011, p. 7). The Inquiry-Based Learning (IBL) approach is not limited to kindergarten

classrooms; in fact, it can be applied to other grades. Recently, Ontario's Literacy and Numeracy Secretariat (2013) explained:

> Inquiry-based learning concerns itself with the creative approach of combining the best approaches to instruction, including explicit instruction and small-group and guided learning, in an attempt to build on students' interests and ideas, ultimately moving students forward in their paths of intellectual curiosity and understanding. (p.2)

Learning through inquiry has been heavily promoted in recent times due to "its potential to lead to the understanding, competences and attitudes that are needed by everyone in increasingly technology-based societies" (Harlen, 2013 p. 10). According to Saunders-Steward, Gyles and Shore (2012), learning through inquiry showed positive results in 23 of the outcome categories that were studied (p. 16). However the positive effects achieved through inquiry pedagogy were lost when students made the switch to more 'traditional' classroom learning environments (p. 16).

Despite research that demonstrates positive effects on learning, there are many educators and critics that question the practicality and effectiveness of the inquiry approach. Hung (2009) counters; educators believe students struggle with self-directed learning as the method provides pupils with "minimum guidance . . . [and] is not compatible with human cognitive architecture" (p. 118). Nonetheless, the potential that this pedagogical approach can provide students and educators in kindergarten and other grades includes the development of communities of learning, multifaceted assessment and documentation opportunities as well as enhanced student achievement.

Background

Abrams, Southerland, and Silva (2008) claim "inquiry in the classroom takes on several different forms and functions depending upon who is offering the definition" (p.xii). The links between an inquiry approach and the sciences is evident. Harlen (2013) suggests learning through inquiry not only helps satisfy the curiosity of children but can later on, translate into an advantageous skill for future contributors in our society (p. 11). Through inquiry, students are able to experience joy and satisfaction through the means of learning about what interests them (Harlen, 2013, p. 12).

As students have the opportunity to explore some of their own questions through the inquiry-based learning model, much of their knowledge is acquired throughout the process of research. Saunders-Stewart, Gyles, and Shore (2012) claim that inquiry has been proven to have positive effects on student achievement (p. 16). These effects were especially evident in inner city and rural schools where "meta-analyses revealed that nontraditional, inquiry forms of instruction provided the greatest benefit for underprivileged students" (p. 17). Understanding how beneficial the inquiry model can be in the classroom is important as the word 'inquiry' can be found countless times in Ontario's evolving educational framework, curricula and policy.

Inquiry-Based Learning (IBL)

IBL is a multifaceted process where students "formulate questions, investigate to find answers, build new understandings, meanings and knowledge, and then communicate their learnings to others" (Government of Alberta, 2014, para. 1). This process is analogous to the scientific method, and leads to further queries that inform and direct learning. It is essential that "in classrooms where teachers emphasize inquiry-based learning, students are actively involved in solving authentic (real-life) problems within the context of the curriculum and/or community" (Government of Alberta, 2014, para. 1). In an inquiry-based educational setting "the educator's main responsibility is being a filter of the world to the learner, which goes beyond simple information processing, transmission and storage" (Bartholo, Tunes & Tacca, 2010, p. 872). Saunders-Stewart, Gyles and Shore (2012) conclude, "inquiry-based education is a learner-centered form of teaching and learning that enables students to tailor at least some of their learning experiences to their own interests and curiosity" (p. 7). While learning through inquiry is associated with the development of scientific knowledge, Saunders-Stewart et al. (2012) remind us that it is well-suited for other subject areas such as language and mathematics (p. 5).

In an inquiry-based education setting, student-lead investigations begin with their questions about a particular subject and/or topic (Abrams, et al., 2008). Teachers then provide students with tools, insight and learning opportunities that will help guide them as they explore topics of interest (University of Toronto, 2011). IBL focuses on the processes of knowledge as opposed to the explicit teaching of curriculum expectations (p. 8). In an inquiry-based classroom, desks are arranged in groups so that students can build on their knowledge together. The classroom walls serve as a bulletin board showcasing students' acquired knowledge and show the progression of their understanding with regards to a subject (or subjects) being explored (p. 14).

Early Learning Kindergarten (ELP) Program

The ELP in Ontario consists of the amalgamation of the former Ontario Junior and Senior Kindergarten classrooms. A Teacher and an Early Childhood Educator (ECE) run the classroom as a team. In this new program, children learn through play-based learning activities and through inquiry. Their interests drive the instruction as Early Learning educators carefully select materials that will help further promote student thinking about a given topic and may even entice pupils to ask new questions (Ontario Ministry of Education, 2010).

According to Saunders-Stewart, Gyles and Shore (2012), the push for the inquiry-based approach dates back the 1900s and was backed by John Dewey (p. 7). Their research suggests "learning is optimal when individuals interact through dialog, ask questions, and actively construct their own knowledge" (p. 7). It was Dewey who argued that students' best acquire knowledge through the act of 'doing' (p. 7). His ideas have been widely stated as reasons behind the importance of learning through the inquiry (Ryan, 2008).

Learning and Pedagogical Approach

The art of questioning is a very important aspect of the inquiry learning process. 'Open' questions promote dialogue among students. Questions that are more enclosed will lead to a stricter focus but may not open the door to new ideas. Formulating questions around the Big Ideas that can be found in the curriculum will cover a larger scope of the expectations that students must learn as they ask questions, investigate and debate their findings (McTighe & Wiggins, 2013).

While inquiry will certainly look different in classrooms from K-12, its core philosophy remains the same. Its real-world approach promotes collaboration among students. Wenger (1998) makes the case that we must see learning as a social phenomenon. As we are social beings, it only makes sense that we acquire knowledge through dialogue and discovery with one another. No matter where we are, we are engaged in communities of sorts whether we are at home, at work, at school or out in public (p. 6). Wenger's ideas lend themselves well in inquiry classrooms as collaboration and the idea of building community and working together to achieve a common goal are key components.

Like many other educational philosophies, the ultimate goal is to achieve student success and solicit student engagement (Ryan, 2008). Research has shown that the experimental process that is encouraged through the IBL model has helped alleviate negative behaviours in the classroom and has even improved student engagement (Sever & Güven, 2014). When conducting experiments in a science lesson for instance, students are actively involved in their learning experience. The re-iteration of Dewey's educational philosophy that students learn best when they are 'doing' is popular today (Ryan, 2008). We can attribute the larger scope of student engagement by the fact that students are essentially putting the theory into action and experiencing it for themselves (Wang, Yen, Wu, & Wu, 2011). When students are engaged in their learning, the possibilities of achieving higher test scores are greater.

Despite the research that supports the Inquiry-Based Learning approach, there are still many educators that are skeptical about this practice and even doubt its ability to be effectively used in the classroom setting. Because many educational professionals have been using traditional methods of teaching for years, learning through inquiry appears to be a foreign concept to them. It may be intimidating to someone who does not completely understand the philosophy behind this pedagogical approach. A lack of structure has some fearing that the implementation of inquiry in the classroom would lead to chaos. Proper implementation of inquiry in the classroom is vital to its success. Understanding what inquiry is and what it is not is also of use. To determine the true efficacy of the inquiry model, one must take a closer look at the existing literature surrounding this topic. It is of the utmost importance to form an opinion based on facts and not around the negative thoughts of those around us.

Methodology

Extant data were accessed online through the EBSCO Host database. In order to access scholarly articles about inquiry, the Education Research Complete database was accessed through the E-Resources section of the University's library website. To locate articles, the following words and terms were typed into the search engine: "inquiry", "inquiry-based learning", "education", "early learning inquiry" and "student outcomes". Various articles were located via this method of research. The database in which the articles were stored allowed us to download the PDF of the article and compare, contrast and build this integrative review.

Inquiry in the Early Years

The new Ontario Early Learning Kindergarten Program is centered upon the child and his/her development and gains much inspiration from the Reggio Emilia educational philosophies which began in Italy. In this new program, a large portion of the day is devoted to play. While some may argue that learning does not occur in this type of a program, what the critics do not take into account is the work that educators do to setup the classroom in such a way for intended learning (Hope-Southcott, 2013). The *Commission of Inquiry into the Education Needs of the Young Child* stated in their findings how "research on the cognitive development of young children points clearly to the need for intellectual stimulation through active learning" (Federation of Women Teachers' Association of Ontario, 1986).

Early learning research suggests young children, for the most part, are not cognitively ready to stay seated for long periods of time while listening to their teacher speak about a given subject (Federation of Women Teachers' Association of Ontario, 1986). For many years we have read how "children cannot learn by being passive role learners, that they must be able to learn through language, imitation and play. Children learn through trial and error as they actively pursue their learning goals" (p. 6). In parallel, the new Ontario Early Learning Kindergarten Program supports the suggestion that, "children need opportunities to explore and investigate. These experiences allow children to build on existing knowledge, create and clarify their own new understandings, and experience a variety of approaches to a problem or question" (Ontario Ministry of Education, 2010, p. 12). Much like the Reggio Emilia inspired schools; the child is at the centre of the learning in the new kindergarten classroom (Project Zero & Reggio Children, 2001). The use of open-ended materials allows children to utilize them in many ways to represent their thinking and express themselves.

Among the many important skills that children will begin to develop in the new kindergarten program is collaboration. Vygotsky (1978) supports this theory of learning and child development via the zone of proximal development as, a dynamic zone of sensitivity in which learning and cognitive development occur. Tasks that children cannot do individually but they can do with help from others involve mental functioning that are currently in the process of developing, rather than those that have already matured. (Berk & Winsler, 1995, p. 26)

As children in kindergarten learn through play, educators must begin to shift the way learning is perceived and look for evidence of growth, achievement and learning. Student artwork is a great source of information that depicts student understanding.

According to Pelo (2007), "when children draw, they create representations of their experiences, observations, theories, and emotions" (p. 85). In kindergarten, there are many opportunities to find student understanding through the arts many children at that age are not capable of writing yet. Works of art "tell stories and communicate particular perspectives" (p. 85) as noted in the sample of student work.

Student Work. (2012). *Flower Bouquet* [Painting]. Used with Permission.

In this piece of art, the student drew a bouquet of flowers that was placed on the centre of a table located in the art centre of the classroom. The student began drawing the bouquet of flowers in pencil and then proceeded to paint it using watercolor paints. Following this process, the student used a black marker to trace the outline of the images on the paper. When asked why she had done this, the student responded by saying that the black lines around the pictures make the flowers standout. Perhaps the most interesting observations however came from the drawings around the bouquet: the rain and the sun. When asked why the student had included those images on the artwork, the student responded by referring to the fact that flowers need sunlight and lots of water to grow. This is a prime example of how learning can be made visible in a variety of ways if teachers give students opportunities to express their learning in a variety of ways but more importantly, question them and engage them in conversation to better understand what they are

thinking. The drama centre in the kindergarten classroom is another great place to look for student learning.

Hope-Southcott (2013) explores the possibilities that play and inquiry can bring forward in the kindergarten classroom and more specifically, that learning that is showcased in the drama centre. In this area of a kindergarten classroom, students re-enact scenarios, tell stories, explore open-ended materials through pretend play, use their imaginations and become problem-solvers (p. 39). While important learning takes place at this centre, parents and guardians have often questioned its relevance to their children's education. In many schools, the result was a strong focus on academics and 'school readiness' without taking the development of the child into consideration when really thinking about the types of activities that are beneficial for four and five year old children (p. 39). The varying points of view regarding play, inquiry and academics are echoed when it is stated that "some teachers struggle with the practical implications of play and inquiry as vehicles for learning . . . Some teachers feel that play takes away from academic learning in the classroom" (p. 39). Despite these feelings, research concerning the critical role that play has on the development of the child supports play and inquiry-based instruction (p. 40).

A prime example of children at the kindergarten level exploring their own inquiry can be seen at the drama centre where materials were used to turn a section of the class into a bakery. At this centre, students 'baked' various goods, took orders, set prices for their offerings and even developed social language used when placing an order in a public place (Hope-Southcott, 2013, p. 42). A trip to a local bakery helped enhance this experience for children and gave them a sense of authenticity (p. 42). Various connections to specific expectations in the Early Learning Kindergarten Program document can be made if educators trust in the children in their care and give them the opportunity to explore and play.

Weisman Topal & Gandidi (1999) illustrate the rich learning opportunities that can occur when children have access to open-ended materials. With these objects, children are able to explore their textures, sort them based on various properties, and use them for imaginative play and more (p. 14). The possibilities with these non-prescriptive objects are endless. As one educator stated during her reflections on the use of open-ended materials in her class, “some children were interested in constructing with the materials… Some children seemed to be interested in design and in setting up a pleasing composition. Other children used the materials to tell a story” (p. 48). Because play is such a large part of the kindergarten program’s design, questioning children as they express themselves is important to realize insight into what they may be thinking.

While research supports the idea of play and inquiry at the kindergarten level, educators in the Primary grades have been known to question the effectiveness of this approach and ask whether it readily prepares children for a more structured approach or not. While research that supports this train of thought is difficult to find, it is a frequent topic of conversation in staff rooms we have visited. Now that the new Ontario Early Learning Kindergarten Program has finally been rolled out across the province, it will be interesting to see how children in this program achieve in the Education Quality and Accountability Office, provincial testing in grade 3. Data collected during this assessment would certainly be helpful in determining the effectiveness of the current practices in kindergarten.

Building a Community of Learners

Wenger (2000) articulates the notion that humans are social beings and as social beings, learn best when working alongside others (p. 1). Indeed, engagement in all contexts involves a dual process of meaning making. On one hand, we engage directly in activities, conversations, reflections, and other forms of personal participation in social contexts. On the other hand, we produce physical and conceptual artifacts that reflect our shared experiences and around which we organize our participation (Wenger, 2000, p. 1).

Theories of human interaction support the benefits of working with others to create meaning. With this in mind, it is easy to make connections to the interpersonal connections students will make when working together to achieve a common goal or to further their own personal inquiries.

McTighe & Wiggins (2013) make the case for educators needing to look beyond socioeconomic boundaries. Their research brings forth examples that prove that the idea that a low-income status is equated with a lack of engagement and low academic results. In fact, research has shown "teachers in low-performing schools … have had extraordinary results with Socratic and project-based learning" (p. 82). The problem with this type of a mentality is that it is educators, and society in general, that are putting limitations on the learning of underprivileged children. Statements like "My, I had no idea our kids could actually think!" certainly strengthen the resolve for a need to have confidence in the abilities of the children in our care as it gives them a chance to speak up and be heard (p. 83). Children bring an abundance of knowledge with them to class each and every day. It is up to educators to tap into this knowledge to inspire students to want to learn more. The major hurdle however in building a community of learners in the classroom is that "many common classroom routines and teachers actions do undercut a culture of questioning" (p. 82).

If students are to work together to find the answer to a particular question posed by the teacher, then it is necessary to establish ground rules first. Creating a classroom climate that invites learning and differences of opinion is vital to a smooth transition to the Inquiry-Based Learning approach. It is crucial that students understand that:

> Discussion is not about scoring points; genuine inquiry is not a debate; false confidence in one's answers is not a virtue; too much participation is to be frowned upon if it closes off the participation of others. All these must be turned into formal rules and rubrics. (McTighe & Wiggins, 2013, p. 88)

Criteria-building with students is an important first step in creating a respectful learning environment for all to grow and prosper. It is said that the discoveries of the individual members of the group help move the thinking forward. It is as a group that students can learn from each other (Project Zero & Reggio Children, 2001). There are instances in which learning from a peer may be more meaningful than learning from the classroom teacher.

Wenger (1998) explains that it is the experiences that students bring with them that enhance the learning that takes place within learning communities. It is stated however that in order for the building of knowledge to continuously progress, there must exist tension between knowledge and experience (p. 214). This is not to say that students thrive on argument-quite the contrary. It is that in order for thinking to move forward, students must be trained to question the world that surrounds them, including the theories that their own peers may have on a given subject. If we accept things as status quo, then we essentially become 'stale' (p. 214). Learning is what happens when questioning, experimenting and investigating are at the forefront of the inquiry process.

It is evident that much practice and training must be put in place in order to establish this desired community of learners in the classroom. In theory, this may seem like an easy feat however in practice it is more difficult. Each classroom composition is different. Areas of need will differ from year to year. Marshall (2013) expresses the fears that teachers have when it comes to inquiry: The thought of losing control of their classroom causes "some teachers [to] say, 'Inquiry works with students of high ability but not students of lower ability, because of behavioral issues'" (p. 109). He furthers his point by contradicting the first statement when he writes "other teachers say, 'Inquiry techniques work best with students of lower ability because inquiry provides a way to engage these students in learning, some for the first time'" (p. 109). The key to success in inquiry is the establishment of effective classroom discipline (p. 110).

While the literature surrounding inquiry makes a strong case for its implementation in the classroom due to its ability to build a community of learners, there are gaps in this research. Understanding that there is no 'one size fits all' approach to teaching should be applied here as well. This is not to discredit the points made by the researchers on this matter. It is important to realize that every classroom will be different and as educational professionals, it is our duty to meet the needs of those students as best we see fit. In some cases, a more structured approach to teaching may be needed. For those educators feeling uncomfortable with the Inquiry-Based Learning approach, setting aside a time, perhaps even the largest block of the day, to give students time to further their investigations. Discussion at the end of the inquiry block is also recommended so that students can verbalize their observations and findings for the day (Natural Curiosity, 2011). Much like we have come to realize that not all students learn the same way, educational philosophies should be treated in the same light.

Inquiry in Mathematics and Science

Allowing students to learn concepts of mathematics through inquiry will lead to a greater understanding of mathematical concepts (Harlen, 2013). The "inquiry-based approach will improve students' mathematical understanding, which will result in their mathematical knowledge becoming more robust and functional in a diversity of contexts" (p. 18). Students learn to solve problems through trial and error and are given the time to develop their own algorithms. When taking a closer look at mathematics in the primary grades, traditional methods of teaching saw students solving addition and subtraction problems by vertically aligning the numbers based on their place value and using the carry-over or borrowing method to find the answer. When teaching students standard algorithms however, students do not always understand why numbers are carried over for instance as they have not developed a solid understanding of number sense.

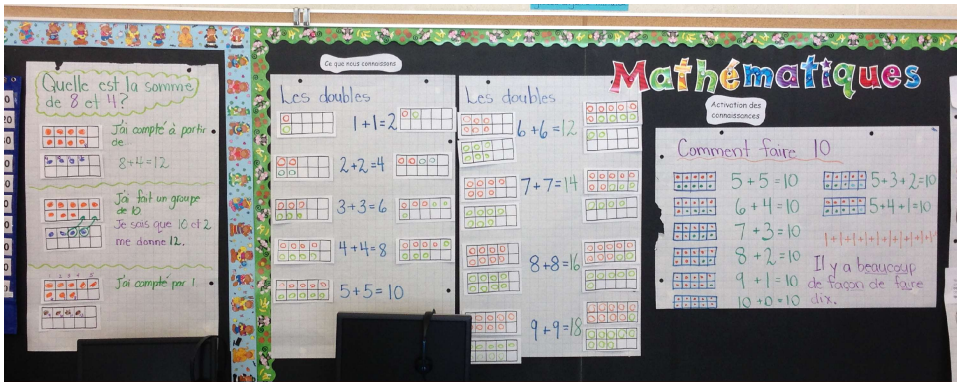
The benefits of learning mathematics through inquiry are numerous. One very important feature is that students experience "enjoyment and satisfaction in finding out for themselves something that they want to know" (Harlen, 2013, p. 12). It is the process in which students are able to experiment with mathematical manipulatives and develop their own strategies that will make the acquisition of learning certain notions more meaningful and authentic.

The inquiry process is best showcased when looking at its potential in the realm of the sciences. The Natural Curiosity (2011) teaching resource makes a case for the importance of the inquiry pedagogical approach through environmental inquiry. Its hope is that through the experimental process of engaging with their natural surroundings, children will gain a better understanding of the world that surrounds them. In the resource, ecologist and scholar David Orr, explains how climate change as well as a lack of care for our natural world are problems that will affect the future for our children (p. 1). The resource gives educators much to think about stating:

> Imagine children who continually question why things look and function the way they do. (…) Where information is investigated, analyzed, and negotiated between students. Where children are invested in the learning process because they have been given a key role in directing how they will learn. (…) This is Inquiry-Based Learning. (p. 1)

The common tone in much of the literature on this subject is that our rapidly changing society calls for the innovative skills that are acquired through the process of inquiry especially for those who will further their studies in the sciences during their post-secondary years. The research stresses that learning through inquiry helps students take control of their learning and work with others to achieve common goal-skills that students will need once they enter the working world (Harlen, 2013).

The idea that inquiry is simply a process that can be used in science is false. There are an abundance of opportunities to integrate other subjects into a scientific inquiry be it language, math or art. When asked to solve a problem involving the concept of two-digit addition, grade two students placed counters on two separate sets of ten frames. In the beginning stages of their inquiry about addition, students were not using many strategies to help them add more efficiently. As time went on however, students discussed the possibility of making groups of ten with the counters on the ten frames in order to help them determine the sum more quickly (see story of learning given below). This process also eventually helped them come up with strategies such as using compensation to make a number friendlier (for instance making eighteen twenty by adding two but taking it away from the sum at the end). Ultimately, it was the process of learning through inquiry and discussing strategies with their classmates that promoted this form of higher order thinking among students.



Student Learning (2015). *Math: Story of our Learning.* Used with permission.

Note: Learned strategies as students delved into their inquiry on adding and representing quantity: Making Ten, Doubles/Near Doubles, One More/One Less, Counting On, Counting by 1.

Sever and Güven (2014) conducted a study to determine the effects on IBL on student resistance in the science classes in grade seven. Students who participated in their study had demonstrated a lack of interest in the course, exhibited lack of respect towards the teacher and were not participating (p. 1603). Their study had both a controlled group and an experimental group. The experimental group scored higher results in comparison to the controlled group (p. 1603). When asked about their feelings towards experimental-learning, many said that "they enjoyed conducting experiments the most, and in general, they did not give negative feedback" (p. 1603). These findings make a case for the benefits of inquiry in the classroom. Questions surrounding assessment (gathering data) come to mind when looking at these results.

There is no mention of the type of assessment that was conducted in the Sever & Güven (2014) research experiment only that the experimental group scored higher (p. 1603). The question that educators and researchers should be asking themselves however is if traditional methods of assessment are effective when children are learning through inquiry. A focus on the process of acquiring knowledge becomes a key factor in inquiry and moves away from the traditional teaching of memorized facts. Because representation of one's thinking can come in many different forms such as through discussions or hands-on experiments for instance, the question surrounding the use of paper/pencil types of tests to assess student learning is heavily debated (Harlen, 2014).

Assessment and Documentation

Due to the fact that the IBL approach focuses so much on the individual as a learner, traditional assessment methods, like quizzes and tests, may not be the most effective tools at measuring a student's academic progress. Wien (2011) makes a strong case for documentation. She states that it helps educators take a closer look at the process of learning that children are exhibiting in the classroom (para. 4). Wien suggests that educators need to understand documentation as a process that will guide educators as they design a classroom environment that will peak the curiosity of children.

Of course to see a visual representation of the learning taking place in the classroom, teachers need to train their students to document their work (para. 9). Wien (2011) claims that it "creates a representation of children's learning--the development of their imagined theories and their movement between fantasy and what they understand to be reality" (para. 9). The documentation of findings will not necessarily look the same. In the kindergarten classroom for instance, some students may express their discoveries through writings while others may represent their findings through the medium of the visual arts. On the other hand, some may even act out their discoveries in the drama centre (Hope-Southcott, 2013).

The strained relationship between inquiry and standardized testing however has been heavily debated in the literature surrounding the Inquiry-Based Learning approach. A common finding is that our education system needs to rethink its position on standardized testing in the wake of the rise towards the inquiry model (Abrams & Southerland, 2008). The argument is not that assessment should not occur but rather that standardized measuring tools are no longer seen as relevant. Teachers are encouraged to use differentiated instruction in the classroom in order to accommodate the varying learning styles of their students. This push is heavily contradicted when one takes a closer look at the provincial testing in Ontario where paper/pencil types of activities are the only options of expression for students.

In the context of a science class for instance, research has shown that students' best demonstrate their understanding of their scientific knowledge through discussions with others (Abrams & Southerland, 2008). The sentiment of educators is that standardized testing does not accurately measure what the student has learned. In many cases, teachers train their students by teaching to the test. Educators in the United States agree that "inquiry skills and knowledge about inquiry are often difficult to assess through multiple-choice formats, so inquiry is de-emphasized in most state assessments" (p. 152). While here in Ontario, schools are not funded based on student performances, public accountability is the driver behind standardized tests.

In the context of the kindergarten classroom, recounting one's learning during community time at the classroom's meeting area, is a great opportunity to document a child's understanding. In accordance with Abrams and Southerland's (2008) research, talking is great opportunity for students to share their understandings with others and even debate with their peers as they question their own opinions and must support their thinking with evidence. Students who are sitting in a circle at the carpet feel a sense of equality (Natural Curiosity, 2011). It is said, "as members of this egalitarian knowledge building community, students learn from, and contribute to, each other's understanding" (p. 12). This statement resonates with me as during my experience teaching kindergarten, I often found that classroom discussion was a great way of documenting and assessing the evolution of a student's thinking.

During an inquiry about "growth," students provided their theories about how things grow. Student ideas were recorded in a KWL chart that was left posted in the classroom. As the inquiry moved forward, student findings and ideas were added to the chart (see Table 1 for KWL chart).

Table 1
KWL Chart "How Things Grow"

Know	Want to Know	Learned
- Our hair grows when we wet it in the bath. - Leaves grow when we water them. - Your body grows when you eat food, breathe some fresh air and drink liquids. Your red blood cells help your blood circulate to various parts of your body and to your brain. - Baby animals grow because they eat.	- Why do humans need water? - Why do plants need water? - Why do we need to plant seeds? - How does the sun help us grow?	- Water keeps us hydrated - Water keeps the soil moist so that plants don't dry up - Seeds need soil in order so that their roots can grow - The sun provides heat for living things - Exposure to the sun gives us important vitamins

Note: Our table above is a translation from French to English of a KWL chart. Information in the chart represents student ideas and theories pertaining to the topic of growth.

Regardless of whether or not theories about the inquiry in question were right or wrong, no child's ideas were made to be foolish. Students learn from their mistakes and these misconceptions are what drive the inquiry forward (Marshall & Horton, 2011). This in large, will help students come to more meaningful conclusions

about given subjects as they are the ones findings the answers. As students learn 'by doing,' this process is much more effective then expecting students to absorb knowledge transmitted to them by the classroom teacher without any concrete example of what is being presented (p. 94).

In my view, an overhaul of traditional assessment needs to occur. Adapting and even expanding one's assessment tools is necessary in an inquiry-based learning environment. A child who may struggle in reading and writing, may not be able to express his/her scientific understanding to the best of their abilities on a paper/pencil assessment task. This same student however may have acquired the knowledge about a given subject but not be given an adequate mark during a paper/pencil task due to a deficiency in reading and writing. Rethinking the way we assess students is something that educators need to consider if they hope to accurately measure the learning that has taken place in the classroom.

Student Outcomes

When discussing student outcomes in the context of Inquiry-Based Learning, we must not simply focus on student achievement alone but also on students' ability to think critically, as such a skill will help them solve problems and consequently, improve overall student achievement.

It is "deep conceptual knowledge over surface, rote learning" that will help develop the ability to problem-solve and make connections to the material that they have learned (Marshall & Horton, 2011, p. 93). Higher order thinking can be achieved when students lead the discussion taking place in the classroom while the teacher essentially takes the role of the mediator (see Table 2 for progression of Higher Order Thinking).

Ideally, the learning that takes place in the classroom is much richer when teachers allow students to provide the explanation regarding the material being explored (p. 95). Indeed,

> …to help students achieve deep understanding of concepts, teachers may be advised not only to provide time for Exploration before the concepts are Explained but also to ensure that the time allowed for this Exploration is sufficient, even if it replaces time that may have been planned for Explanation. (p. 99)

Table 2
Inquiry and Student Thinking

Construct Measured	Pre-Inquiry (Level 1)	Developing (Level 2)	Proficient Inquiry (Level 3)	Exemplary Inquiry (Level 4)
Order of Instruction	Teacher explained concepts. Students either did not explore concepts or did so only after explanation.	Teacher asked students to explore concept before receiving explanation. Teacher explained.	Teacher asked students to explore before explanation. Teacher and students explained.	Teacher asked students to explore concept before explanation occurred. Though perhaps prompted by the teacher, students provided the explanation.

(Marshall & Horton, 2011, p. 95).

The challenge that exists for teachers is taking the backseat and allowing dialogue to flow between students. Time is what they need to learn new concepts. Thus, if the education system is moving towards inquiry-based instruction, the concept of making long-range plans seems outdated. There is no way of knowing where student learning will guide teachers—especially in an inquiry-based environment where the learning is unpredictable and totally student-directed.

Wang, et al. (2013) conducted a study that proves the effectiveness of inquiry-based instruction in the classroom. Their findings indicated an improvement in goal-setting and self-directed learning in relation to the motivation to learn science. The pretest and post-test results involving cognitive ability among high school aged students showed great improvement. The mean score of the tested group improved from a score of 23 to 96.6 (p. 19). Levels of anxiety among students decreased slightly. Naturally, the levels of self-confidence among students improved likely because:

> (…) inquiry-based instruction encourages students to adopt different approaches in the service of developing a better understanding of the subject, helps students familiarize themselves with ongoing experiments and areas of inquiry, and enables them to obtain better scores on examinations. (p. 21)

Of course, the results of this experiment would have been much more useful had two groups, both experimental and control groups, to better compare and contrast inquiry-based learning environments and non-inquiry environments.

Saunders-Stewart, Gyles, & Shore (2012) as well as Marshall and Horton (2011) both point to the fact that time to investigate, study and interpret collected data helps students develop their higher order thinking skills. It would be interesting to see if students who are immersed in inquiry-based learning environments, perform better than their counterparts who are not when looking at standardized testing scores.

Conclusion

The IBL literature has shown many of the merits that this pedagogical approach can bring to the classroom. The research points to the fact that inquiry's success is deeply rooted in the fact that students are at the forefront of their learning by taking charge of their learning through investigation and dialogue with their classmates. Thus, this process allows them to build on their knowledge and learn through hands-on experiences rather than simply being fed this information by the classroom teacher (Saunders-Stewart, Gyles, & Shore, 2012). As a result, the teacher takes on a much different role, albeit an important one. It is this person that must "teach the students strategies to reflect, process, and evaluate what they are reading so that the students may 'teach' each other" (p. 22). In turn, this social interaction between students allows them to develop their higher order thinking skills. Of course, teachers must ensure that the questions they ask students are pertinent and will engage them in thought. When educators form questions in an open-ended manner "students experience far less pointless drudgery because they are acquiring knowledge and skills for more obvious and worthy reasons" (McTighe & Wiggins, 2013, p. 19). It is the questions that make students think critically and entice them to further their investigation that will help them grow as learners. The learning process that occurs through inquiry promotes life-long learning as well as helping students develop important skill sets that will assist them throughout their academic journey (University of Toronto, 2011, p. 9). Students learn to work with others, question their own conceptions about the world and learn to communicate and defend their findings.

Among the major benefits of learning through inquiry is increased student engagement (Southerland & Silva, 2008). Because inquiry focuses so much on the process of learning in contrast with memorizing facts; studies have shown that students feel less anxious when learning through inquiry. When looking at the subject of science for instance, students who were learning the subject matter through the inquiry process found it to be less difficult to learn as a whole. As a result, their interest in learning science increased dramatically (Wang, et al., 2013, p. 21). Much of the success of the Inquiry-Based Learning approach derives from its connection with the real world. When students are given the chance to enhance their learning through real-world problems, the authenticity of the activity shines through, as students are able to see how learning the intended concepts will be of use to them in

the present or later on in life (Hung, 2009, p. 129). It is also worth noting that there exists a correlation between student engagement and classroom management issues. Marshall, Lotter, Smart, & Sirbu (2011) explain that when students are engaged and motivated to learn, they are less likely to be disruptive in the classroom and show disrespect for their teacher.

Classrooms that employed the inquiry learning method also demonstrated gains in student assessment scores. Sever and Güven's (2014) comparative analysis between an experimental group and a control group showed that students learning through inquiry (experimental group) showed the most score increases when comparing their pre-test results to their post-test results in comparison to students learning through traditional means (p. 1603). Other literature on the subject matter agrees that student achievement has been met with positive results as demonstrated by improvements in test scores and projects that are more in-depth (Saunders-Stewart, Gyles, & Shore, 2012). We must remember however that while the research has shown that Inquiry-Based Learning has not only improved student academic performances but also engagement, the data on the subject matter is still limited. Therefore, because the research on inquiry was done on a small scale, we have yet to see if its positive effects will be felt on a much larger scale in the system as a whole. With the implementation of the new full-day Early Learning Kindergarten program, which incorporates inquiry in its daily routines, now fully rolled-out, educational researchers need to focus their attention on following the progress of these students in order to best be able to measure the effectiveness of inquiry in the classroom.

It is also worth noting that much of the literature on the subject has been very positive on the benefits of inquiry. It was a difficult to find a balance of the pros and cons for this pedagogical approach due to the abundance of supportive literature. Of course, its rise in popularity in the last few years and also the fact that inquiry is such a new approach to learning for many educators means that researchers are limited when it comes to studying the effects of the approach on pupils.

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