KNOWLEDGE BUILDING IN ACTION

Transformative Stories That Inspire Innovation From Leaders At All Levels Of Education

Bringing IDEAS to life!

INTRODUCTION

Innovation pervades our everyday lives and is necessary for the prosperity and growth of our society. How do we bring innovation into education? This task can seem quite daunting at times. As educators, we want our students and our teams to thrive in a collaborative culture where they can share their ideas and theories openly, and build on as well as challenge one another's ideas in order to reach new and deeper levels of understanding. In essence, we want to empower them to take collective responsibility for idea improvement, as in innovative knowledge-creating organizations. Knowledge Building provides the context to support these goals, while fostering high levels of agency and well-being for all.

KNOWLEDGE BUILDING IN ACTION

Knowledge Building in Action is a companion guide to the Knowledge Building Gallery. Written by Ontario educators, it is a collection of stories, about knowledge creation from all levels of schooling: primary, junior, intermediate, secondary, and leadership. In their own words, teachers and educational leaders share their first-hand experiences with the Knowledge Building principles and elaborate on the practices that led to the creation and transformative growth of their Knowledge Building communities. The stories in this collection are designed to help inspire you to find meaningful ways of engaging the principles of Knowledge Building in order to overcome the challenges of bringing innovation into education. As you will see, there are multiple entry points, and each story will provide effective strategies across a range of grades and contexts, as well as reflections about how the KB principles help to drive innovations in educational practice.

We hope the **Knowledge Building in Action** resource will encourage you to design new opportunities to build a foundation for innovation, co-create knowledge within and across your learning communities, and ultimately, inspire new innovations in education.

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1.1 KNOWLEDGE BUILDING IN SENIOR KINDERGARTEN

This case study is adapted from Tarchi, C. Chuy, M., Donoahue, Z., Stephenson, C., Messina, R., & Scardamalia, M. Knowledge Building and Knowledge Forum: Getting Started with Pedagogy and Technology. LEARNing Landscapes | Vol. 6, No. 2, Spring 2013

STARTING WITH KB PRINCIPLES

Real Ideas, Authentic Problems: "Often visiting teachers to the school will ask, 'How do I start? What's the beginning?' We explain that we have the children begin with an experience that generates questions of understanding, areas of learning that they want to learn more about. The 'theories' of the children at the beginning of the study [are] the starting point of the Knowledge Building process. As new information is acquired (through consulting authoritative sources, experimentation, and developing a collective knowledge through the Knowledge Building discourses) new theories develop, allowing the students to refer back to their initial theories and understand how they have evolved—helping them to understand the Knowledge Building Principle that 'all ideas are improvable.'"

Community Knowledge, Collective Responsibility: "Traditionally, students are responsible for their own learning only. In Knowledge Building students learn for their own sake but also to contribute to the knowledge of the community...New information cannot be only shared at the end of the unit such as is often done in Project-Based Learning but instead continuously so that everyone shares a breadth of understanding along with a specialized deep knowledge based on their research interest...making the individual's learning visible to everyone else in the classroom for the benefit of all."

Knowledge Building Discourse: "is more than sharing knowledge; the ideas of the group actually get refined and transformed through the discourse over time. Additionally, important facets of Knowledge Building work include engaging students in designing experiments and reading books to try to find some answers to their questions."

Constructive Use of Authoritative Sources: "Even experienced Knowledge Building teachers grapple with the appropriate time to introduce authoritative sources: too soon, and you risk hindering the flow of the children's theories and ideas. Too late, and the children's ideas might stagnate, or lose momentum. It is really a hard thing for teachers new to Knowledge Building to delay introducing authoritative sources. Teachers on our staff who are new to Knowledge Building might come to meetings early on in their inquiry topic and say, 'I was thinking of introducing authoritative sources now'. I can remember one teacher asking about this, and many of the other experienced Knowledge Building teachers around table answered, 'Just wait, just give it a few weeks, let's see where the kids go with it.' The new teacher did, and it worked beautifully."

Epistemic Agency: "If we start with Epistemic Agency, we might scare teachers new to Knowledge Building. This principle is actually about what the role of the teacher is in the inquiry process. This is truly saying, 'give children the power to design.'"

KB PROVOCATION

To start, the teacher engaged the students in a whole class discussion — what the children refer to as KB Talk (Knowledge Building Talk). The children typically sit in a circle and share their ideas while the teacher writes down each idea and engages each child. In the case reported here the question "Why do leaves fall?" became the focus for the children's study of trees. Soon after generating ideas, the students walked to a neighbourhood park and were asked to decide which tree in the park was their favourite. Each child then photographed that tree, and collected one leaf from the tree to bring back to the classroom. The children then carefully traced their leaves and drew in the lines, or veins, as some children already knew to call them. The photographs and traced leaves were then prominently displayed where the children could make comparisons and connections based on shape, size, and colour (see Figure 1).
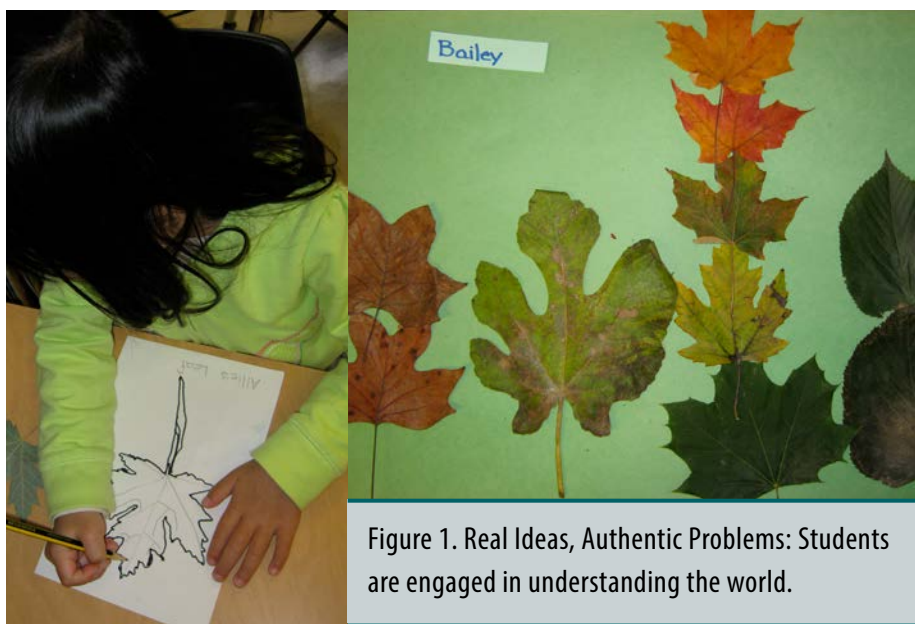

Figure 1. Real Ideas, Authentic Problems: Students are engaged in understanding the world.

At the beginning of the school year during the Fall season, children viewed leaves changing colour and falling down. Leaves changing colour takes place over many weeks — a period of time that allows the children to note and observe leaves that are still on the tree beginning to change colour, then starting to fall from the tree, then the rate of falling increasing until there are no more leaves on the tree. The children may also observe the temperature changing, rainfall, or the wind blowing stronger. Their exploration reported here took place September through December, with the work growing organically as ideas and questions arose. Typically, students were actively involved in experiments, reflections, and discussions multiple times throughout the week, but a week could pass without further exploration. The fact that phenomena of interest occurred outside each child's home and school engaged students in exploration of natural phenomena, and things they wondered about and wished to understand — a productive context for exploring **Real Ideas, Authentic Problems** (Zhang et al., 2007).

A few days later, the teacher proposed that the children collect 10 different leaves. Back in the classroom, the children were asked to create a poster grouping their leaves in some way—for example, by kind or shape (see Figure 1). The teacher emphasized the importance of each child's contribution because everyone in the classroom needed to benefit from his/her work. This is a possible way to address the principle of community knowledge; collective responsibility; (see Scardamalia, 2002; Zhang, Scardamalia, Reeve & Messina, 2009). By engaging students in grouping leaves by size and shape the teacher made it easy for students to share their ideas during group discussions. Indeed, the group discussions were animated and rich in content. The children discussed why leaves were falling, why they changed colour, why they got wrinkled. Each child expressed ideas; the teacher helped each

child give voice to an idea and be understood by everyone. In this way, the teacher addressed the issue of **Democratizing Knowledge** (also see So, Seah, & Toh-Heng, 2010) while students learned that every idea can be shared and developed, regardless of the speaker's personality and preferred mode of communication.

The students were also made aware of the existence of different ideas. First they would hear the idea from a peer, then re-voiced by the teacher, and accordingly be in a better position to understand that others in their community have ideas that are different from theirs. This is one of the possible ways to get started with the principle of idea diversity (see Law & Wong, 2003). By making sure that each child was heard and fully understood, the teacher had her students actively working toward reciprocity in knowledge advancement. The students get a start on the Knowledge Building Principle of **Symmetric Knowledge Advancement**, learning that to give knowledge is to get knowledge (Scardamalia, 2002). Although important, this principle can be difficult to implement in a classroom.

The children in the class, encouraged by the teacher's enthusiasm for the ideas and observations they brought to the class, added to the conversation from conversations they had at home. For example, based on conversations at home with their parents some children introduced information about oxygen and root systems and some worked with their parents to further classify the leaf they brought to class. By emphasizing and encouraging connections and differences between ideas expressed in class and at home, and at different times and places, the teacher conveyed **Pervasive Knowledge Building** (see also Nirula, Woodruff, Scardamalia, & Macdonald, 2003).

STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT

In the Senior Kindergarten class, the teacher helped the students keep track of their Knowledge Building Discourse by archiving it and making it visible in the classroom (e.g., transcripts of discussions on chart paper) or by simply reminding the children orally during a discussion of what they had previously thought/shared. This led to the formation of new questions. The teacher re-read the ideas expressed by the children in their previous discussion, to help them keep track of the starting point of their ideas, and to be aware of the improvement of their theories (see Figure 2).

Teacher: "How does chlorophyll travel? We have come up with three 'maybes': maybe the chlorophyll wipes off; maybe the chlorophyll goes down the veins back to the tree; maybe the chlorophyll turns into humus and then goes back to another tree."

Through observations, experiments, reading, reflections — and discussion throughout — children come to see ideas as improvable; in some cases they were able to find answers to their questions and throughout they generated new questions. It is important to note that the ideas offered by individuals become deliberately "detached" from a particular student and "owned" by the group as a whole. The continuous reference to the ideas of the group created a psychologically safe environment for the students, where they could feel free to express their ideas without immediately being labeled "right" or "wrong," and then work on those ideas to improve their quality, coherence, and utility (Scardamalia, 2002).

Teacher: "Yes, [the leaf] is almost black. Last time we talked about two possible explanations why it had stretched. Someone suggested it grew longer because it flattened out...the other suggestion was that maybe it is growing."

At various points in their Knowledge Building Discourse, students addressed high-level ideas and difficult concepts such as oxygen or chlorophyll. At this point, the teacher believed that their idea improvement depended on Constructive Use of Authoritative Sources. For this reason, the teacher explicitly told the children that she would read a book where they might be able to find some answers to the questions raised during the last discussion.

Teacher: "No matter how long we watch the leaf, we don't see the chlorophyll. I found a book that could help us and give us some answers. It's not a story, it has information in it, so it will sound a bit different."

In introducing authoritative sources it is important to emphasize that use of the resource is not simply to answer questions but to engage students in constructive use of resources (see Zhang et al., 2007) — to understand better the present state as well as the growing edge of knowledge in the field (Scardamalia, 2002) — also feeling free to question information there and work toward refining understanding of it. Thus students were encouraged to discuss new ideas, especially ones they had raised, that were not addressed in the resource at hand.

Teacher: "Now, how should we find out what happens when the leaves die?"

Asking children to help design experiments represents an early effort to transfer high-level agency for knowledge work to students so that they are in position to assume epistemic agency (see Nirula et al., 2003). In a group discussion, the teacher reminded the children of their own questions, and the students were asked to design a way through which they could test their ideas. The teacher encouraged the children to reflect on different variables and options to be considered when designing an experiment. Leaves were placed in bowls of water, in sand, and dry leaves were put in a bin with toys to stomp over them, like feet. Predictions were made for each experiment, such as the prediction that leaves in water would grow. By designing experiments, the students were "empowered" to address their personal questions rather than having the teacher design all experiments and learning experiences (see Figure 2).
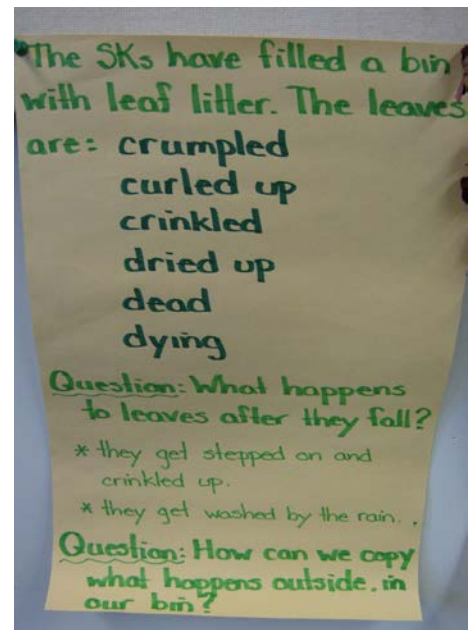

Figure 2. Improvable Ideas: Poster of children's discussion of the improvement of their theories.

Teacher: "Someone suggested we put it back in water. Do you think it will be shorter or longer now, or maybe the same length?"

After the teacher had commented on the breadth of understanding demonstrated during a discussion, including how leaves make sugar for the tree, and how water and oxygen travel through leaves, one student asked if the class last year had learned as much. When the teacher noted that the other class had focused on roots, not leaves, the student responded: "Well, that's what we should study next. How do roots grow?" In Knowledge Building, the class may move on to a new area of inquiry but as this example suggests, an effort is made to provide an account of the current state of understanding as well as noting more to be learned. Students are also encouraged to return to ideas from different vantage points and at different times, and link those ideas to support ever-deepening and connected knowledge advancement.

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1.2 KNOWLEDGE BUILDING IN PRIMARY: WHAT MAKES A COMMUNITY?

Written by Mubina Panju and Angela Hoffman, Senior Kindergarten and Grade 1 teachers, HWDSB

INTRODUCTION

After being introduced to the principles of Knowledge Building at an information session, Mubina, a Full Day Kindergarten teacher and Angela, a Grade 1 teacher, looked through both their curricula to determine a commonality where both classes could participate in a Knowledge Building Journey.

KB PROVOCATION

Mubina and Angela: As we went through the curriculum, we landed upon the social studies expectations of the local community.

- **Kindergarten Education:** Overall Expectation 3: demonstrate an awareness of their surroundings

- **Grade One Expectation:** B2. Inquiry: use the social studies inquiry process to investigate some aspects of the interrelationship between people and different natural and built features of their local community, with a focus on significant short- and long-term effects of this interrelationship.

We combined the two classes and asked the question, **"What makes a community?"** One of the theories was that "People make a community." From there, we invited guest speakers from the community (parents) to discuss their jobs. Some of our guest speakers' jobs included: pizza maker, produce manager in a grocery store, engineer, personal support worker in a nursing home, paramedic, volunteer at Good Sheperd, actor, etc.

STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT:

Move 1

As each speaker came in, the two classes were combined and as one teacher facilitated the discussion, the other teacher documented students' ideas and questions in the Knowledge Forum (see Figure 1). One of the ideas that students were really interested in was about recycling in the grocery store. The parent who worked as a produce manager had explained what happens to all of the boxes when produce is unloaded and put on the grocery store shelves. During a Knowledge Building Circle, students indicated that they wanted to know what happened to the boxes in the grocery store. This led to a discussion about recycling and garbage. Students then inquired about what happened to the garbage in our school. Students conducted a 'garbage audit' of our school playground. Students went outside and sorted the type of garbage they found on our playground into either 'garbage' or 'recyclable material.' Afterwards, the findings were tallied (we incorporated a lot of math during this time!), and another Knowledge Building Circle revealed that students wanted to know where the recycling and garbage ended up. Students watched videos and read books about garbage collection, landfills and recycling stations. This led to deep discussions about reducing, reusing, and recycling. We continually added students' ideas and questions to Knowledge Forum.
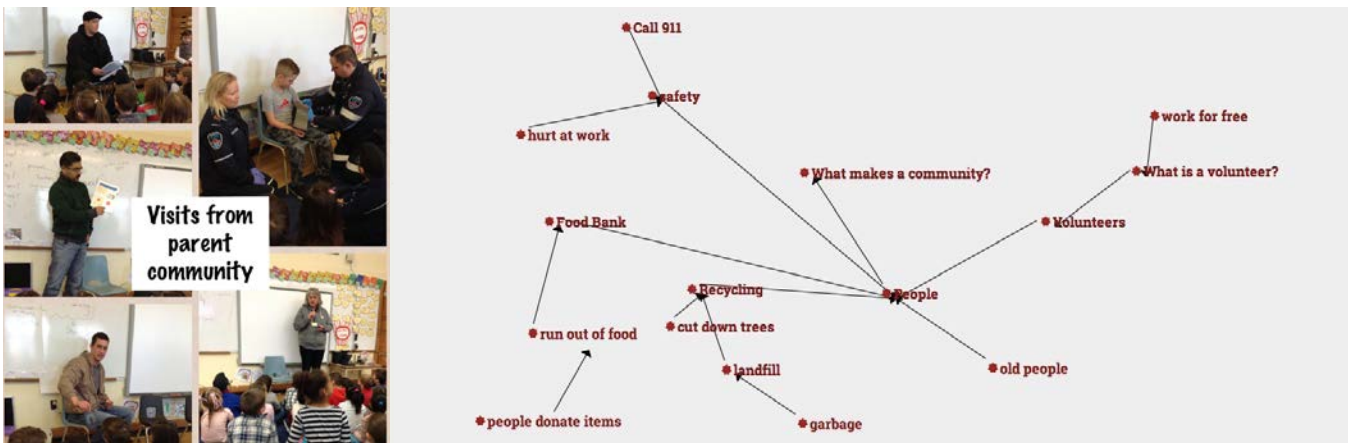
Figure 1. Parents visited the classroom to talk about their jobs in the community (left) and our Knowledge Forum "view" exploring the question, *"What makes a community?"* (right).
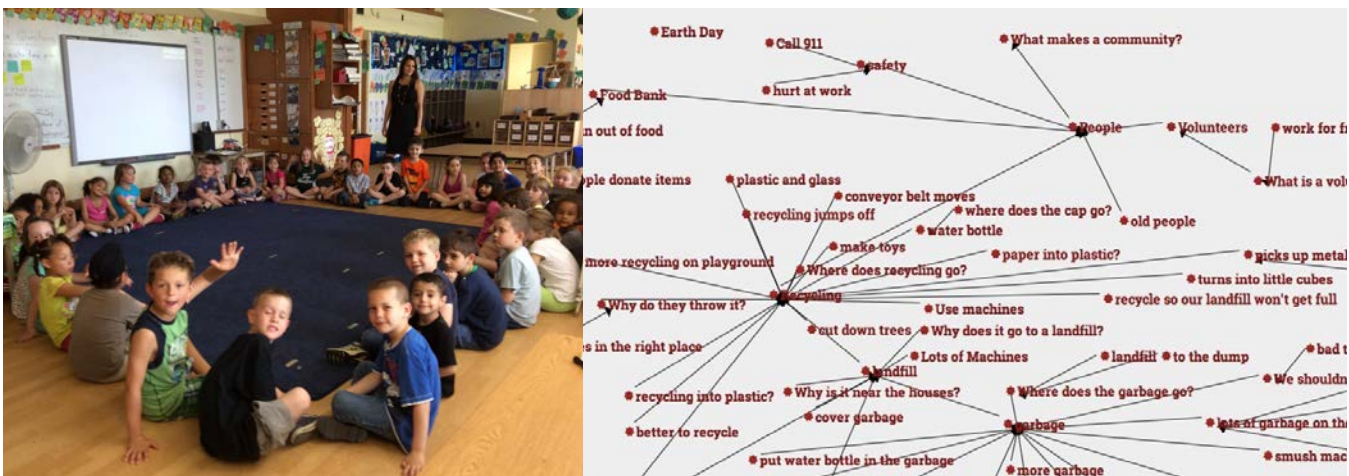
Figure 2. A Knowledge Building Circle (left) and our Knowledge Forum view exploring recycling and garbage (right).

Move 2

We decided to investigate another question that the students had asked earlier, "How do they keep the workers safe at work?". A Health and Safety expert in the electricity field came to the class and presented how his job helps monitor workplace safety. He brought equipment, showed pictures and discussed the importance of his job. This led to various questions and theories about electricity. We added students' thinking to the Knowledge Forum. While the inquiry began with the Grade 1 Social Studies strand: The Local Community, the focus changed to the Grade 1 Science strand: Energy in Our Lives. Students investigated how electricity is used in their daily lives. They also shared their ideas about how to stay safe around electricity.

Move 3

Students then began to ask questions about how to save electricity and energy. We ran a Knowledge Building Circle and student ideas and theories were added to the Knowledge Forum. These discussions led the classes to investigate ways to save energy and to learn about renewable and nonrenewable resources.

The Health & Safety expert showing the class some equipment used to keep workers safe.

Student work on renewable energy (left and right).
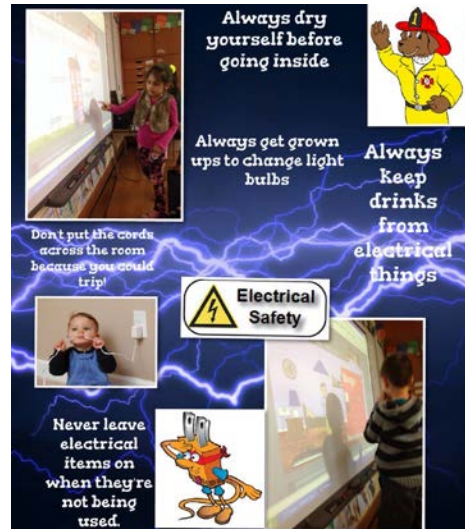
Staying safe around electricity.

Move 4

We created a Community Knowledge Building Board in the main hallway of our school. The intent was to highlight student thinking and explain more about the process of Knowledge Building. Parents also enjoyed the visual display and it fostered a stronger connection between home and school learning.
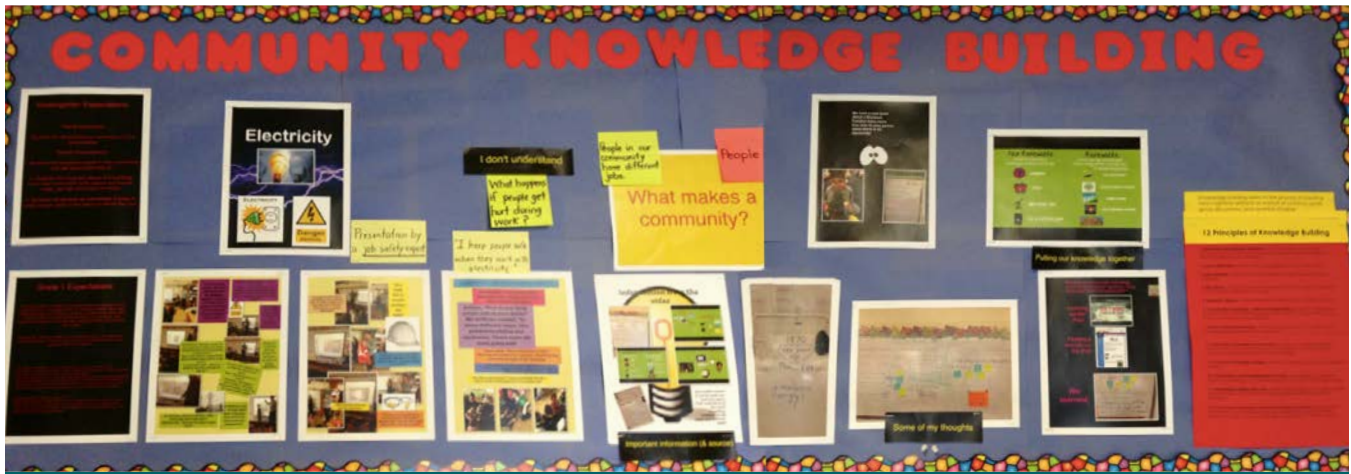
The Knowledge Building Bulletin Board

REFLECTING ON THE KB PRINCIPLE(S)

Idea Diversity: Students were encouraged to contribute their ideas throughout the process and their ideas were all documented on the Knowledge Forum. Students felt a huge sense of empowerment when they saw their ideas represented on the Forum; it made them feel like their thoughts were valuable and important for the whole class. Having their ideas presented in a visual format also helped springboard other students' ideas.

Democratizing Knowledge: Getting a range of ideas was important as it helped students understand that everyone was a contributor in this process. As teachers, we modeled this throughout by adding our own ideas to the Knowledge Forum and being participants in the learning.

Real Ideas, Authentic Problems: "Identifying problems to understand the world": Students are highly engaged when they can relate the issue to their daily lives. Exploring the garbage in our school playground and discussing electrical safety as applicable in their own lives, really motivated students to take charge of their own learning.

What Did our Students Learn/Gain from the Knowledge Building Process?

- We learned how to listen each other's ideas

- We learned to question and build upon ideas

- We changed our thinking

- We raised awareness in our school community about waste management

- We advocated for litterless lunches

- We learned that what happens to the Earth is in OUR hands

- We developed empathy and awareness for people who use food banks

- We collected food to donate to our local food bank

- We wondered how people stay safe at work and who keeps them safe

- We questioned our energy sources and wonder why we don't always use renewable sources

- We wondered if we can make our own renewable energy

- We learned not to be wasteful of electricity to protect our environment

- We learned how to research ideas

- We worked to improve our ideas

- We shared our knowledge with each other and other classes

- We took ownership over our learning

Integrating the learning into report cards was initially a challenge as we had amassed a lot of documentation. Learning Skills are a great place to document observations about students during a Knowledge Building Inquiry.

Sample Report Card Comments

Kindergarten
(Science and Technology)_____is encouraged to communicate her ideas clearly so that others can understand her thought processes and build/respond to her ideas. This helps to solidify understanding of concepts and will help_____think of new ideas for further inquiry. _____investigates and uses the computer and iPad with assistance, and is working to build independence when using these tools for Knowledge Building.

Grade One
(Learning Skills)_____ is able to use his own ideas and experiences to support his learning. _____ demonstrates curiosity and an interest in learning about the world around him. He is also open to new ideas and takes appropriate risks. During our Knowledge Building Inquiry Unit about the community, _____readily participate and provided interesting and insightful comments and questions. _____will be encouraged to think of new ideas to further inquiry.

1.3 EXPLORING CYCLES USING KNOWLEDGE BUILDING AND KNOWLEDGE FORUM IN GRADE 1

INTRODUCTION

The Grade 1 students were involved in a year-long inquiry focused on "cycles in nature." Their first Knowledge Building study began in the winter with the subject of **water and the water cycle**. In this case study, we highlight how the teacher integrated Knowledge Forum into the Knowledge Building process to engage students not only in generating their own questions and ideas but in sustaining efforts to improve those ideas as a community.

KB PROVOCATION

The students explored **Real Ideas, Authentic Problems**, by starting with an experiment. A plastic cup half full with water was placed in a resealable bag and the bag was taped onto a window in the classroom. The level of water was marked on the cup. After a few days the children noticed water pooling in the bottom of the bag. Students were fascinated and wanted to know:

WHERE DID IT COME FROM?	**HOW DID IT GET THERE?**

The students' wonderings and questions were the beginning of an inquiry into water that lasted three months!

Move 1: Introducing Knowledge Forum
Students began generating a few ideas. The teacher demonstrated how Knowledge Forum can help them in recording ideas, so their ideas could be preserved and improved in a community space.

The first Knowledge Forum session in Grade 1 lasted 45 minutes. During the first 10 minutes of the class, the teacher invited students to sit on a carpet while she was projecting a blank Knowledge Forum view onto a big screen. The teacher explained that every child has access to this electronic space to record ideas so that his/her ideas can be preserved and improved. It was important that students had ownership over this community space. So, together, the teacher and children collectively decided to name this new view "Grade One Water Experiment." Then she explained how to record a note, give it a title, and save it.

Move 2: Posing Theories

The next day the teacher worked with each child, encouraging each child to state his/ her best theory—a theory that would explain why there was water in the bottom of the bag. The teacher typed everything the child said in a Knowledge Forum note, under the student's name (their writing skills were too limited for them to record the ideas on their own), and contributed it to their "Grade One Water Experiment" view. To help students elaborate their theories, the teacher asked clarifying questions:

Teacher: "Tell me more about where you think the water came from?" "How do you think the water got there?"

She did not push them towards any particular answer. Students were free to go in any direction with their ideas. Once the student had finished telling his/her theory and it had been recorded, the teacher asked each child to think of a title. She stressed the importance of the title to every child she worked with, and defined it as a main idea, or "What's important in your theory?" Students need to navigate the vast information they have access to and summarize; creating a title is a developmentally appropriate way to begin to develop such capabilities. They can quickly see that a generic title such as "Water" will not be helpful for others who may be searching for specific information, as they are all working on water. Thus students need to think deeply about what is unique about their note. Once a note had been posted, the teacher showed the child how to open and read the notes produced by other students, explaining that others may have different ideas. The teacher emphasized that Knowledge Forum is a place to record ideas so that they can be reviewed later.

The teacher also encouraged children to use the Knowledge Forum Scaffold supports. To do this, she sat with each child, reflected on a note he/she had written, and decided together which scaffold should be included.

Move 3: Developing Ideas

During the next two days, every child had an opportunity to write a note with the help of the teacher. The children used Knowledge Forum two times a week over the next several weeks for 15 minutes a session. Priority was given to their own ideas and authentic problems of understanding. Authoritative sources, including books, were not introduced right away; rather, the children had a chance to present their ideas, read each other's notes, and try to improve their theories before

A Knowledge Forum note with the Knowledge Building scaffolds framed in yellow alongside the note editor.

having their ideas potentially overshadowed by more formal, "correct," or accepted ideas. Children continued to closely observe as water kept accumulating in the bottom of the bag. They also noticed streaks of water droplets on the sides of the bags, and that there was less water in the cup itself. The teacher typed the children's improved theories into a "build on" note. There were some children whose theories were similar to their initial theories, while other children's theories reflected their improved understanding of where the water in the bag came from:

> **"The water evaporates to the top of the bag and then it falls to the corner of the bag."**
>
> **"My theory is that the water vapour goes up and changes its state, and turns into liquid and goes down and falls into the bottom of the bag."**
>
> **"My theory is that the water from the top of the bag dripped down into the cup. P.S. How did the water get to the top of the bag?"**

STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT:

After the initial excitement about recording, reading, and building on ideas in Knowledge Forum, the challenge is to incorporate community dynamics that allow students to take on the more difficult processes of idea improvement, and make this process commonplace and enjoyable (Scardamalia & Bereiter, 2010).

Constructive Use of Authoritative Sources: To develop understanding of the important role authoritative sources might play in Knowledge Building, the teacher read to the children from a variety of sources. In this case, the teacher only introduced authoritative sources after students had an opportunity to contribute and play with their own original ideas and questions. In order to help students to improve those initial ideas, the teacher began to introduce diverse authoritative sources. She even presented contrasting data and information from different books to highlight for students the need to deal with supportive as well as conflicting information.

Students were able to work more independently on Knowledge Forum by spring. They were excited about this new adventure — their theories had a place to "live" — a community space that meant their ideas were not simply expressed and forgotten, but recorded and available to be built on by others. The students seemed to especially appreciate "build on" notes to their own notes. Their engagement in reading and writing on Knowledge Forum motivated them to continually exercise literacy skills, dramatically reducing the need for additional, unrelated reading and writing activities in the classroom. As the teacher read aloud to students, she stopped often to allow them to ask questions, make comments, theorize, and relate what they were hearing to their own lives and experiences. This injection of new ideas and information sparks the principle of Idea Improvement.

Knowledge Building Discourse: The interplay between work on and off the database and between student ideas and authoritative sources is critical in helping the children develop their theories and ideas. Toward this end, student time on Knowledge Forum was intermixed with KB Talks, also referred to as KB Circles, which occurred twice a week for varying amounts of time. In KB Talks, children had the opportunity to listen to each other's theories and questions and build onto each other's ideas. Often ideas generated in KB Talks would be recorded in Knowledge Forum at the next opportunity.

> "Knowledge Building Discourse is the core of a Knowledge Building class. It is the way to hear about the diversity of ideas in the classroom and the diversity of research experiences that is needed to develop the shared community knowledge. It is how we learn from each other and contribute to the learning of each other. While there may be different activities and experiments occurring in the classroom, KB Talks help focus the identified learning goals of the community. KB Talks help ensure accountability of the members of the learning community—we meet to learn from and with each other. KB Talks may be about concepts the students are trying to understand but they can also be about the process of learning and how we are operating as a Knowledge Building community. They give us the opportunity to reflect on our learning methods and see what needs to be improved."
>
> — Zoe Donahue, Grade 1 teacher.

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1.4 KNOWLEDGE BUILDING IN A GRADE 1 MATH CLASS

Written by Cindi Chisholm, Grade 1 teacher; Heather Fleming, Student Success Teacher; Lizanne Lacelle, Leading Student Achievement (LSA) District Facilitator, RCDSB

INTRODUCTION

At the time of this case study, Cindi Chisholm was a Grade 1 teacher at Herman Street Public School in Petawawa. Heather Fleming was the Student Success Teacher with the Renfrew County District School Board, assigned to the school to support teachers in professional growth to deepen the learning in the classroom. Heather worked closely with Cindi to implement Knowledge Building as a new way of learning that helped make student thinking more visible. The class consisted of 19 students, including three students with specials needs working on an Individual Education Plan.

STARTING WITH KB PRINCIPLES

The team targeted four KB principles and aimed to:

- Engage **Real Ideas and Authentic Problems** in math.

- Find ways to get everyone involved by **Democratizing Knowledge** and building **Community Knowledge** through activities that promoted **Collective Responsibility**.

- Encourage the use of new math language through **Knowledge Building Discourse** in KB circles.

KB PROVOCATION

The decision to do Knowledge Building in math was based on the board-wide focus on math. It was felt that many students were not engaged in their learning, and behaviours had become apparent. Learning of Grade 1 expectations as foundational blocks was not happening for all students, and retention of concepts along with transfer of knowledge (making the connections between concepts) was often not apparent.

STRATEGIES TO SUSTAIN IDEA IMPROVEMENT

Move 1

The first activity was based on the work of Marion Small and comprised the presentation of a single math question to students: "Take 20 counters and separate them into 3 piles. One pile must be double another pile. What are the possibilities?" Partner turn-and-talk was used to provide opportunities for idea sharing and to practice the use of Accountable Talk. Students were encouraged to explain their thinking and the strategies they used with each other. Student conversations were videotaped. Teachers listened for use of math vocabulary, insights and misconceptions. Upon reflection, it was evident that the original problem was not authentic to the students.

Although frontloading had been presented, students did not connect the frontloading activity to the problem. The students were confused by the way the problem was worded and had difficulty with the language "doubles" versus "twice as many." This caused some disengagement. The videotapes of peer-to-peer discourse helped pinpoint where things broke down, namely the struggle of understanding the difference in math concepts that resembled each other in students' minds, such as concepts like double of, twice as much and splitting. The decision to scaffold the activity to work on clarification of math language was made, with check-ins in place for every student.

As part of the learning experience, the team was then left with the following thoughts:

● When do you intervene to guide students who have misconceptions and how much do you tell them?

● It is important to stand back, but bring in timely intervention by using questions that support student thinking and encourage them to improve, such as "What is your thinking? What is your strategy?"

● A math journal helps students record the thinking, which in turn also helps them to reflect on their thinking.

Move 2

The second activity was built around three improved ideas: Give more opportunity for students to participate in dialogue and use new math terms; make the problem more authentic to the students; and engage students in spatial reasoning by focusing on geometry and visualization of shapes.

Working individually, students were given four 3D cubes and asked to create as many different shapes as possible with the cubes. They were encouraged to show different ways of placing cubes together to form different keys by placing the cubes in different formations. Students were asked to describe to the student beside them how they approached

What was your greatest challenge?
Getting students to think deeply and resolve the problem themselves. Even at such a young age, some had already learned that the answer would be given to them eventually.

What surprised you?
- How difficult it is for students to make their thinking visible.
- How much thinking/processing is going on in some of the quieter students and those not necessarily deemed strong in math.
- How some of the 12 KB Principles surfaced throughout the activities.

What was your deepest learning?
- The importance of setting a growth mindset in a classroom where everyone "can."
- Misconceptions ¨ are built on, and if not corrected, could cause students to believe that they are "not good" in math.
- Through community knowledge where everyone contributed, voices were heard and acknowledged, and students were able to think about their own thinking.

the task. Students could build on their repertoire of possibilities through the sharing of shapes formed by their elbow partner. When it was evident that the group was starting to get stuck, all the students went for a Gallery Walk to look at their peers' structures and talk about how each had built their keys. Students then went back to their own desks to improve their designs by building their keys in new ways.

Through this activity, students learned how they could grow their own ideas through community knowledge, and how others in the class possess knowledge that can help them as well. Reflections from this activity:

● Lots of modelling is essential.

● Allowing time for the students to do the thinking, and ensuring the teacher does not jump in to rescue the students is critical. When answers are given, students learn to expect them without doing any work or thinking.

● Accountable Talk between students reveals incredible amounts of information about the thinking and allows for timely and meaningful intervention from peers.

Move 3

This activity was designed to scaffold on the previous math problem. It involved students working with 2D tiles. Students were presented with the following problem: "We need to make keys for the tooth fairy's treasure box. How many keys can you make?"

For this activity, students were partnered up again and were given a set of keys that were hidden from view. Each partner took turns creating five different key shapes from the 2D tiles, in efforts to try to create one that might be included in the set that they were given. The other partner then duplicated the shape. As a team, they then had to find out which key was in the pile and compared the masters to their own. They worked until most of the keys were assembled. Following this, the class discussed all the different configurations of keys.

It was during the community sharing circle that discussions arose about keys being the same but made in different directions. As a result of this discovery, math language emerged to express the position of the tiles, such as flips and turns. Each student was then given a large piece of grid paper and five tiles and asked to construct different keys and to draw them onto the grid paper. Students were given back their pieces of grid paper with feedback showing whether keys were duplicated and how many other possible configurations there were. Students were then grouped together strategically in teams of four so that each group contained students who had created a different amount of keys (e.g., one person with ten keys, one with seven, one with five and one with four). Students compared their work, shared ideas and drew more keys. The shared goal was to have everyone possess all 12 keys for the tooth fairy.

KEY FINDINGS

- We realized the importance of authentic problems and of frontloading expectations.

- We were able to stand back and bring in timely individualized interventions by using questions that facilitated student thinking and encouraged them to improve on each other's ideas.

- We realized the importance of not rushing in to rescue students but allowing them to successfully work things out by talking problems through with their peers.

- Students were more focused, involved, and engaged, and demonstrated perseverance throughout the process.

- Activities allowed for differentiation. The task was open-ended, which allowed an entry point for every student. They were able to move at their own pace and process in different ways to solve the problem.

What did you learn about yourself in the process?

I assumed that when a problem was presented or even read together that students understood what was asked of them. Now I realize that it is essential to read the problem together in order to ensure that all students understand the problem and what is asked of them.

NEXT STEPS

- Introduce the same concept of flips and turns with a different story to affirm transfer of knowledge.

- Continue to build on the importance of community knowledge through communication of their thinking

- We would like to try this activity again in the spring to see what was retained through the process.

RESOURCES

Small, M. (2012). Great ways to differentiate mathematics instruction. New York: Teachers College, Columbia University.

SECTION 2: JUNIOR (4–6)

2.1 BOB CAT'S DEN: EXPLORING INNOVATION, ENTREPRENEURIALISM AND IDEA DEVELOPMENT IN THE JUNIOR YEARS

Written by Stephanie Haber, Grade 6 teacher; Matthew Scheben, Grade 6/7 teacher; Michael Schilthuis, Grade 5/6 teacher; Marissa Murphy, Grade 6 teacher; HWDSB

INTRODUCTION

This case study tells the story of four Junior teachers and their students at W.H. Ballard School in downtown Hamilton: Michael Schilthuis, Gr. 5/6, Matthew Scheben, Gr. 6/7, Stephanie Haber, Gr. 6, and Marissa Murphy, Gr. 6. These four classrooms collaborated on the Bobcats' Den project, which was originally proposed by a couple of students as a way to engage the Media Studies component of the Language curriculum. The Bobcats' Den is a take on the popular TV show Dragons' Den, where participants pitch inventions and ideas to prospective business investors. The four teachers did the initial planning together and then introduced the idea to their classes, with the understanding that there was an underlying design component to the project, and that they would have to go back and redesign their plans as the project unfolded.

START WITH THE KB PRINCIPLES THAT MEAN THE MOST TO YOU:

The teachers identified the following three principles as key drivers for their work:

Improvable Ideas

Real Ideas, Authentic Problems

Epistemic Agency

KB PROVOCATION

The initial big, framing question that was posed to students was:
Where does innovation come from?

- The video "Top Twelve Things Invented by Kids" showcases entrepreneurial young people who became millionaires with their ideas. This video was used as a provocation to try to get students thinking about where ideas come from, and to help spur explicit discussion about improvable ideas. The video was also used to help students start understanding the concept of seeing a need and filling a need, as the young people featured in the video found their success by identifying a problem and attempting to solve it. The teachers found that the video was effective, and was very motivating for the students to be able to see such young people be so successful.

- This activity was done just before the March Break. Students were asked to go home and spend some time during the break identifying some problems out in the world and in their daily lives that they could try to create solutions for when they got back to school and started their design work.

STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT

Move 1: See a need, fill a need!

When the students returned from March Break, the classes created Problem Walls, posting the various issues students identified around the classrooms.

Recognizing a community issue that needed solving was the first step in terms of the marketing aspect of the work. The second step would be to start designing solutions. The third step would be creating a marketing campaign to get their idea out and create a successful product.

The students were asked to take a number of questions into consideration: How common did they believe their different problems to be? Who would be able to help make the solutions a reality? Who would be the target audience? Which demographics of the population had a stake in the problem and solution?

During this process, many ties to the Social Studies curriculum were made naturally. For instance, students conducted surveys, considered environmental impacts related to making products "green," and so on.

Move 2: Practising a media campaign!

Students practised creating a media campaign by taking an existing cereal box and designing a better one. Students had to create a prototype and a media campaign. This activity was designed to engage the students more deeply in their media studies and in exploring marketing.

Students were paired across classes.

Groups had to present their ideas in the Dragons' Den style to a panel of their peers. When judging time came around, there would be 13 presenters (7 groups) in each of the two classrooms. In this way, every student was both a presenter and a judge at some point.

Move 3: Designing Solutions!

Having had the practice run with the cereal boxes, now came the time for students to work on the problems that they had identified during the March Break.

Students self-selected groups of 2 or 3 to work in. Some students worked individually. In total, there were over 70 students participating in the design competition.

Students' proposed initial design ideas.

What surprised you?

The range of ideas, the level of enthusiasm, and some kids that you didn't think would be engaged really got into it. Some students who are used to always being right had a bit of a struggle because they had to learn to take critiques and critique themselves too. But all students were fully integrated because they all had a choice about what to work on, and there was a lot of help available from other kids, from the homeroom teacher, and from their own teachers.

Students were also encouraged to think about the "cons" of their solutions in a positive way, e.g., How would we market it acknowledging these things and account for them?

The design process was organized so that students would be able to complete multiple iterations of their designs, be able to give and receive feedback, and share their ideas with one another throughout the process.

Focus groups were formed based on alternating configurations of different student groups across all participating classes. One student group would do a practice presentation of their design idea, and the others would serve as a test audience and offer friendly criticism.

What was one of your greatest challenges?
Our greatest challenge was organizing the classes together, which was logistically very hard to do! But we thought it was worth it to help increase a sense of community among the students.

The peer-regulated feedback technique helped students in a number of ways:
1. It helped students get over their shyness.
2. It allowed them to practise speaking about their design idea in a persuasive and clear manner. Focusing on the "Media Triangle" helped students to develop a better understanding of how to use persuasion to help improve their campaigns.
3. It helped students learn to critique productively, since at one time or another all students would be on the receiving end of critical feedback offered by their peers. Students really learned how to hone their questions to be nuanced and deep.
4. It allowed students to cultivate a safe environment and a standard of professionalism (e.g., students wearing ties and even in the classrooms, when it came to presentations)

They focused quite a lot on marketing, persuasion, and the use of the Media Triangle.

Move 4: Prototyping and Practising
Students moved from working out designs to building prototypes of their ideas. The critiquing process continued throughout this phase of the work.

● Students were encouraged to develop methods of communicating their problems and solutions to the judges, and to implement those methods when presenting to the judges. Conceptual drawings, diagrams, virtual models, and videos, as well as physical models and working prototypes were presented.

Advantages, disadvantages, and limitations were considered by the students in choosing their formats. Many chose a combination of a few methods to create the most successful impact.

Move 5: Major presentation

Each group was responsible for pitching their product to the rest of the students and teachers.

As an outcome of so much practice presenting, students came up with creative coping techniques to help them put on a presentation with as much professionalism as possible (e.g., I'm just going to read from cards, I'm just going to look at the presentation, not the audience, etc.).

Similar to the style in the Dragons' Den TV show, students had 1-3 minutes to pitch their product successfully.

Move 6: The Bobcat's Den!

The winning groups presented at a final competition round. This time, the presentations took place in front of all of the participating classes (and any other classes that wanted to watch) and in front of a panel of expert judges from the local business community. Modeling from the show and the students' own input, professionalism and preparedness were stressed. Students knew that they needed to be prepared to answer questions posed by the panel of judges.

> **What was one "Aha!" moment?**
> It was the students themselves who helped move us towards being facilitators. We learned that you don't have to be directly over them all the time because they have great ideas themselves – ideas we would have never had! The students will get where you want them to go and likely even farther without you directing them constantly.

The judging panel included a manager from the local Boston Pizza, a local businessman who had patented a number of successful inventions, and the principal of the school. Many parents were eager to come and watch the final round of judging. Some community members have since found out about Bobcat's Den (e.g., a local photographer, members of the school board, and some members of the Marketing and Advertising faculty at Mohawk College), and they have kindly offered their services for any future rounds of judging that will take place.

ASSESSMENT:

Students co-created the evaluation guides that would be used for judging their final products. At the onset of the work, students watched episodes of the Dragons' Den and discussed how the participants on the show were being evaluated by the judges. They came up with a list of criteria and built those into an evaluation framework that they would use in their own competition.

Practice presentations gave teachers a good time to assess students' level of questioning. The practice presentations allowed students to give generalities about their products without having to nitpick the details, but the teachers could see if there were gaping holes in students' thinking.

Assessment also came in the form of constant conferencing with student groups.

Second Year of the Bobcat's Den!

The Bobcats' Den project was done two years in a row. Students were really excited about the project, and every student bought into the work. The teachers also found that it really helped to build community within the school.

The students themselves made the project more personally authentic in the second year. For instance, students struggled in the first year with how broad the scope of the project was — the design solutions ranged from a cure for cancer, to a teleporter, to a specialized wet sponge. Some students became frustrated because it didn't make sense to them that while the idea of a cure for cancer surely ought to win, the actual product had many design flaws and so lost out to a wet sponge, which actually became the winner because it offered a creative, feasible product within a well-executed campaign. In this way, they identified a disconnect between concept/idea and product/solution, and so they decided that the design competition should focus on concepts that could in fact be prototyped and designed to work. For the second year, the scope of the project was narrowed so that design problems and solutions had to be ones that were more realistic and doable, with a workable prototype that could be built within the necessary time frame.

2.2 EXPLORING ELECTRICITY: A KNOWLEDGE BUILDING APPROACH TO SCIENCE IN GRADE 6

Written by Elaine Heaver, Grade 6 teacher, HWDSB

INTRODUCTION

The following case study describes part of a Grade 6 Science focus on Electricity at Guy Brown School in Waterdown, Ontario.

START WITH THE KB PRINCIPLES

Community Knowledge — All students would be responsible for advancing our class's knowledge and understanding of electricity by sharing their findings, seeking connections to other students' findings, and using their knowledge to contribute theories and solutions to other students' problems or wonderings.

Epistemic Agency — Students would set their own goals based on their individual wonderings, then through ongoing sharing and monitoring of each other's progress, they would decide how to further our class's collective knowledge and understanding.

KB PROVOCATION

After exploring with static, batteries, and circuits, students had some understanding of how electricity was generated and transmitted. Students then identified questions they still had related to electricity (e.g., How do you get a battery to power a vehicle? How does an electric eel make electricity? Why doesn't the CN Tower catch on fire when hit by lightning?). Students sought to find answers to their questions through experiments, models, experts, and research. Each student kept an ongoing record of his/her learning "journey" by representing it as a roadmap, showing their detours and dead ends.

STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT:

The most important part of this process was the ongoing sharing of discoveries and difficulties with each other. We regularly stopped our explorations to circle around someone who was experiencing an "aha! moment" or was encountering an obstacle. Together, as a learning community, we made connections between our independent findings and applied these findings to brainstorm solutions to each other's obstacles.

What surprised you?

I was surprised by the perseverance and motivation students demonstrated as a direct result of being part of a collaborative Knowledge Building community. Students looked forward to a classmate encountering a problem so we could circle around, listen to the problem, and try to pool our knowledge in order to pose theories, propose options, and solve the problem together. This gave a real sense of **collective responsibility** so that all students felt valued and part of the problem-solving process.

The conversations took many twists and turns as they represented the authentic wonderings and current understandings of the students. All students had responsibility for advancing our class's knowledge. The ongoing engagement in **Knowledge Building Discourse** moved our thinking forward and challenged students to think deeper about how their own explorations were related to others in the class. Most notable was how the learning was driven by the students' efforts to understand the world around them. One specific example of this is described below:

Jenna wondered, "How can I make Alessandro Volta's wet battery?" After having some success experimenting with salt water, aluminum foil, and pennies, Jenna decided to demonstrate her makeshift "battery" to the class. Unfortunately, she had stored her extra materials in the bottom of her backpack for several days. Upon pulling them out, she discovered the salt water had leaked into the aluminum foil, turning it a brown, rust colour. Unsure if this would affect the outcome of her demonstration, Jenna shared her unexpected discovery with the class. When the class saw the discoloured aluminum foil, a lively discourse began. Here are some ideas and theories that came out of the conversation:

- "Salt on the road rusts cars, so the salt in the water rusted the aluminum foil."

- "But a bike left in the rain can rust, so just the water could have rusted the foil — not the salt."

- "Maybe there's salt in rain water, because the water cycle means water from the ocean travels in the clouds."

- "When saltwater evaporates, does the salt make it to the clouds?"

- "We can conduct an experiment to see what causes rust. We can put metal objects in a dish of salt, a dish of water, and a dish of salt and water combined."

- "How do you know for sure if water has salt in it? Salt is found in the ground, so maybe tap water has some salt in it."

- "I think bottled water is the purest. It wouldn't have any salt in it."

- "But I'm reading the Nutrition Facts on this bottle of water, and it says it contains 10mg of sodium."

Students designed and conducted an experiment to find an answer to their question, "Was it the salt, the water, or the combination of both that caused Jenna's aluminum foil to turn brown?"

SOME REFLECTIONS

As the teacher, it can be a challenge to keep student conversations 'on track' while allowing student wonderings to drive the learning. Our curriculum focus was Electricity, but the conversation above resulted in students wondering about chemical reactions and changes in state of matter. I didn't intervene or dissuade this new train of thought for the following reasons:

What was one "Aha!" moment?
Many students far exceeded their original plans due to the fact that they had the support and input of the entire class. Students saw obstacles as an opportunity to reflect and collaborate — not a reason to quit.

1. Students were demonstrating and practising investigation and inquiry skills. They designed and conducted an experiment to answer their questions, which is an important learning and life skill.

2. 'Changes of matter' and 'understanding the characteristics of matter' are areas of focus in Grades 5 and 7. This impromptu exploration of matter demonstrated that what they learn in other grades is meaningful and related.

3. Our work with Electricity continued in full force. This experiment took its place along with the electricity-related experiments that lined our counters and tables.
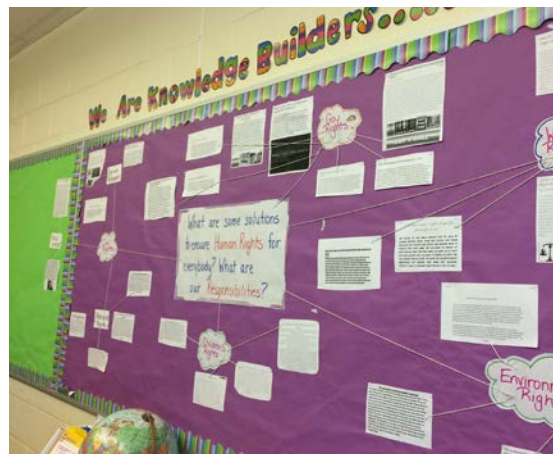
2.3 EXPLORATIONS IN SOCIAL JUSTICE: KNOWLEDGE BUILDING IN GRADE 6

Written by Darlene Martin, Grade 6 Teacher, HCDSB

INTRODUCTION

Darlene Martin teaches Grade 6 at St. Anne School in Burlington. St. Anne is a Catholic school that promotes integrating Catholic faith in various subjects. The Focus on Faith theme for the Grade 6 curriculum is "Human Rights and Responsibility" and "Living According to God's Will." Darlene's goal was to integrate this faith-based theme in the Language program pathway. During the Term 2 language pathway, she performed many read-alouds of various mentor texts on courageous heroes who fought for their human rights during the Civil Rights Movements. Students had the opportunity to develop their own inquisitive questions, triggered by their own natural curiosity. To promote student voice, this was followed by students working on improvable questions, which led to students sharing their new knowledge in Knowledge Building Circles.

Knowledge Building Wall focused on the questions: What are some solutions to ensure human rights for everybody? What are our responsibilities?

Before the culminating reading and writing assessment (near the end of the term), students engaged in KB Circles using the KB Scaffolds (prompts). The students developed inquiry questions using the questioning grid as well as the Inquiry Process Anchor Chart that were posted on the classroom walls.

START WITH THE KB PRINCIPLES

Democratizing Knowledge — All students have the right and are welcome to participate and share their ideas in Knowledge Building Circles. Darlene's goal was to get everyone involved in conversation, especially those who were shy and/or unsure of their ideas. Some students felt empowered in taking the lead and contributed with confidence while others remained quiet even though they may have had valuable comments and ideas. In order to achieve equality for all, the teacher makes it clear that all students are to signal cues to a quiet student so that they have an equal chance to contribute their productive thoughts/evidence.

Idea Diversity — During Knowledge Building Circles, students shared the new knowledge they gained from the various mentor texts. They provided and built a classroom community that supported diverse ideas as well as respectful listening skills. Darlene's goal was for her students to realize that there is more than one possible way to view ideas. Many explained that they never thought of some of these shared ideas before when it came to Human Rights and Responsibility.

Rise Above — During KB Circles, students shared and provided countless evidence on how inequality existed before the Civil Rights Movement. There was competition among ideas and the teacher's goal was for students to rise above and develop higher levels of thinking and deeper ideas/comments that focused on how people in the present day could work toward rectifying inequality and ensuring that

Human Rights exist for everybody in our world. Students were to take this conversation to a whole new level by moving beyond their present thinking towards generating ideas about solutions and strategies for achieving social justice.

KB PROVOCATION:

Darlene's goal was for her students to engage the Big Ideas of Social Justice on "Human Rights and Responsibility" through the following Big Question: Explain how the figures from the various mentor texts showed courage during the Civil Rights Movements. She formulated this question so that students could relate to the Grade 6 faith-based theme on "Human Rights and Responsibility". The following is an outline of the teacher and student moves that ignited the KB Circle discussion.

1. The teacher posted the Big Question on the white board and displayed all the mentor texts that were read aloud previously to students along the ledge of the whiteboard. Also posted on the classroom walls were Knowledge Building Prompts, Thinking Charts, Inquiry Grid, Inquiry Process Anchor Chart, and a Word Wall. These classroom anchor charts were used as effective visuals that would stimulate ideas that the class would build conversations from. The teacher started to lead a 40-minute KB Circle discussion. The students shared a detailed discussion, comparing how the figures (e.g., Rosa Parks, Martin Luther King, Nelson Mandela, etc.) from the various mentor texts showed courage while fighting for their rights during the Civil Rights Movements.

2. The students discussed a number of social justice issues that took place in these mentor texts. These themed issues discussed by students were recorded and grouped/categorized on a Thinking Chart with example characteristics and non-example characteristics. This chart was then posted on classroom walls.

3. Students were then assigned to use the Questioning Grid while coming up with their own inquiry questions which elicited students' further personal wonderings and higher level of thinking questions on this theme. These questions were written either on cue cards or post-it notes, and then they were taped onto the large laminated Inquiry Grid posted on the bulletin board in the classroom. One example of a higher level critical question was: "How do we ensure Human Rights and Equality for all people in our World?"

4. Each student answered their personal inquiry questions based on their background knowledge from the mentor texts as well as any new information they had researched and gathered by following the Inquiry Process Anchor Chart posted on the bulletin board. Some students made real life connections to current events as well as National Aboriginal History Month. This triggered rise above questions, answers and comments.

1. As a culminating assignment, the students were to write an explanation essay on these issues, wonderings, and newfound research. Support/proof and evidence was expected by all students.

What surprised you?

What surprised me the most is how much I learned from my students! The conclusions and analysis my students drew from their researched inquiry questions were incredible. Their attempt to answer real world Human Rights problems and finding solutions to these issues made it purposeful for them. My students realized that this social justice issue is an ongoing problem. The students learned to respectfully build onto each other's ideas and challenge one another's theories. They loved to learn together collectively.

Classroom visuals supporting Knowledge Building work exploring the theme of Human Rights and Responsibilities.

STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT

The teacher provided many assistive visuals posted on classroom walls and bulletin boards. These included: A list of Knowledge Building Prompts, Expectations/Learning Goals, a large laminated Inquiry Grid, Inquiry Process Anchor Charts, and Thinking/Concept Charts showing students' ideas. Students would often refer back to these visuals if they felt the need to backtrack, find meanings, before reaching the next improved idea/question.
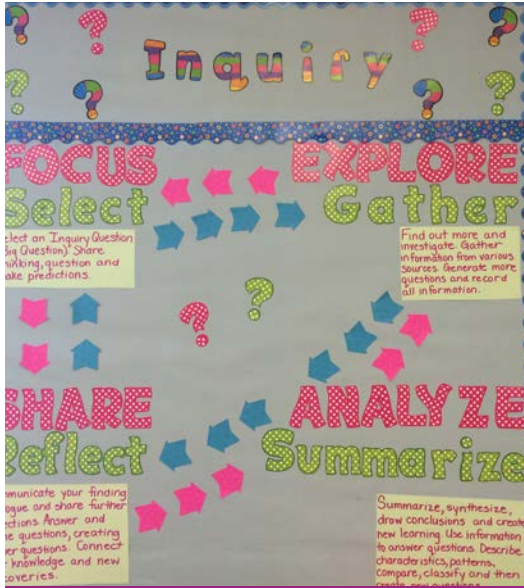
The Inquiry Process Anchor Chart

What was your "Aha!" moment?

My deepest learning moment is that I now have learned how to assess my students' progress through the higher level of critical thinking inquiry questions they formulate and comment on. As a teacher, I previously assessed how my students answered GIVEN critical thinking questions, and now it's fabulous evaluating the different types of inquiry questions they come up with, research, analyze and draw conclusions from.

ASSESSMENT AND EVALUATION

- **Observation** — The extent to which students participated in and contributed to KB Circle Discussions.

- **Written Responses** — Students were to develop their own set of inquiry questions and answer them accordingly by using background knowledge from previously read mentor texts or any new researched information (e.g., current events).

- **Culminating Assignment** — Students were to write an explanation essay on these categorized issues, wonderings, connections, and newfound research. Support/proof and evidence was expected by all students.

What did you learn about yourself in the process? What are your next steps?

I learned that I actually now prefer implementing this inquiry-based teaching process in my classroom. In the process, I learned that I do not have all the answers. I learn along with my students. This is the part I love the most. My students now have the opportunity to provide answers to their own inquiry questions. ALL of my students are more focused, engaged, interested, and eager to learn since they are given the opportunity to take ownership of their own learning. My next steps are to continue to guide and facilitate the process by modeling and asking open-ended questions.

2.4 GRADE 6 KNOWLEDGE BUILDING USING KNOWLEDGE FORUM: A TEACHER-LIBRARIAN STORY

Written by Nancy Raynor, Teacher-Librarian, TDSB

INTRODUCTION

Nancy Raynor is a Teacher-Librarian at George P. Mackie Jr. P.S. in the Toronto District School Board. She began her first Knowledge Building journey while partnering with the Grade 6 teacher for the Science Unit: Electricity and Electrical Devices. After the first two weeks, the classroom teacher was on leave and Nancy worked with an O.T. for the remainder of the unit.

START WITH THE KB PRINCIPLES

Improvable Ideas — Nancy wanted to begin with the students' understanding that all ideas are treated as improvable. She knew that it was very important to build a culture that supported free expression of ideas, theories, and knowledge in a public forum, in order for risk-taking to take place.

Real Ideas, Authentic Problems — Learning is not done in "silos." Students need to understand that all learning is interconnected and related to their lives. Making a personal connection to what they are learning will help to inspire and captivate student learning. Energy and the use of electricity affect us all and will have an impact on students' lives both now and in the future. So, Nancy chose to try out Knowledge Building and Knowledge Forum with her students for the first time with the Electricity and Electrical Devices unit, in the "Understanding Matter and Energy" strand in the Grade 6 science curriculum.

Knowledge Building Discourse — It's the discourse itself that really helps students to revise, refine, reference, and build community knowledge as they read each other's questions, ideas, theories and information. They then refine their ideas and add to their own databank of information, while bringing new questions they have to the forefront of their thinking and to the community. Brief in-class discussions and the daily use of Knowledge Forum software supported both individual and community knowledge.

> **What was your greatest challenge?**
> Having taught K–6 for 25 years, I had a number of apprehensions about using Knowledge Building and Knowledge Forum. How comfortable would I be giving a much greater release of responsibility to the students? Would the learning be on track or would it spiral too far away from the curriculum expectations that needed to be met? How long would this process take? How would I assess and evaluate student thinking and learning? I learned that sometimes I need to have faith and courage to try something new and to step outside of my own comfort zone.

Constructive Uses of Authoritative Sources — As a Teacher-Librarian, Nancy knows all too well the importance of using authoritative sources. While initial ideas and theories can be presented based on previous knowledge or experience, as the knowledge is refined and built upon, "true facts," which give credibility to the information presented, need to be annotated for others to see and reference. It's important that lessons be taught to help students learn how to find and critically evaluate sources so that they can be successful in quoting their information and demonstrating digital citizenship. The TDSB has set up a Virtual Library for students to help with this effort. This Library includes online encyclopedias, databases, links for learning that are curriculum and grade specific, as well as safe student search engines.

Rise Above — Working with the senior students of the K–6 school, Nancy wanted to raise their thinking to the highest possible level. Once the students had worked for a while in Knowledge Forum, class discussions ensued where group and class evaluation of ideas were discussed. Students were encouraged to follow the threads of discussion and pinpoint contributions that consolidated ideas and moved theories forward, as well as questions that moved ideas to new directions/planes and knowledge. These ideas were considered "Rise Above" and were moved to a new view where, again, the ideas could be built upon and improved.

KB PROVOCATION

1. The students had just completed a science unit on Biodiversity, so Nancy wanted to capitalize on their prior knowledge, while teaching them how to use Knowledge Forum software and the tools within it, before launching into the unit on Energy. She showed them a YouTube video of old subway cars being dumped into the ocean. This generated a great deal of discussion within the first view of Knowledge Forum. The students learned that after 5–10 years, those old sunken subway cars had become wondrous coral habitats. All students had much to say on Knowledge Forum about this topic. They were given the time to focus on and practise using the tools to gain a comfort level with making contributions, building on the contributions of others, adding images/videos, and citing sources of information. These were important steps, especially for the shy or weaker students, to provide the necessary scaffolds to lead them further into the main discourse in Knowledge Forum.

2. At this point, the students were ready to move onto the first main view of the Electricity Unit. They had been working with their classroom teacher doing some experiments to learn about electricity and circuits, so they had a brief introduction to electricity and electrical devices. Nancy seeded a question in Knowledge Forum so that when students logged on for the first time, they could see and respond to the initial question: "Where Does Electricity Come From, and Why Should You Care About It?" The first part of the question could be easily researched, however, the latter part was added as a means of having students analyze their information and make the connections between energy use and their own lives, now and in the future.

3. The class was provided with some non-fiction books and a few websites to get them started. They began to research the many ways that electricity can be generated. After a while, they began to wonder which sources were better than others. They did cross-comparisons and started to examine the pros and cons of everything from availability of resources, renewable and non-renewable resources (short- and long-term impact), costs of generating electricity,

1. access to electricity in remote areas of the world, newly developed energy sources for generating electricity and the environmental impact of creating and using electricity. Nancy didn't have to direct them to do this. Their own natural curiosity, research and the class discourse within Knowledge Forum generated their questions, theories, ideas, discussions, affirmations, and new understandings.

2. The students were asked to decide which energy source would be "the best" to use for their own future and generations to come. This culminating task was integrated with Media Literacy. For example, students were asked to represent themselves as scientists who were contracted by the Canadian Government to recommend one or two sources of energy needed to create electrical energy for the future. Canadian taxpayers' money needed to be taken into consideration. The students were asked to create a PowerPoint presentation that included two videos, which they needed to edit in Moviemaker. This became the media text students created to demonstrate their learning.

STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT

The discourse that was happening on Knowledge Forum was a powerful motivator for participation and building knowledge. Each student knew that they had the ability to make contributions to the class community and that their ideas were heard, read and valued. Scaffolds and writing supports built within Knowledge Forum (e.g., "My theory," "New Information + Source," "This Theory Does Not Explain," etc.) provided students with starters to help them formulate their ideas or questions. Being able to add images such as illustrations, photos, diagrams and videos also helped students to further communicate their ideas and better understand those of their classmates.

The students found "Rise Above" ideas in Knowledge Forum interesting. They enjoyed examining the contributions and looking for those questions, insights, and new pieces of information that helped move the community learning to a new plane.

What was your "Aha!" moment?
I learned that KB and KF can inspire all students to learn by tapping into their natural curiosity and interests.

Teacher feedback using the "Remarks" feature in Knowledge Forum, along with teacher-student conferences, provided the students direct feedback to help them reflect upon their strengths and set goals and strategies for improvement of their ideas.

ASSESSMENT AND EVALUATION

Nancy wrestled with how she was going to assess and evaluate student participation, thinking, and learning using Knowledge Building and Knowledge Forum. Much of what was used was created by her or modified from an existing document.

- **KWL Chart** (What I know, What I understand, What I learned) to tap into the students' background knowledge of electricity and circuits before using Knowledge Forum

- **Learning Logs** to track questions, reflections and new knowledge from each student at various points throughout the unit

- **Knowledge Forum** to monitor student questioning, build-on notes (connecting with other students), level and quality of contributions and participation in discourse

- **Knowledge Forum** to follow the development of ideas in contributions; the "Contribution Summary" feature for the teacher administrator was extremely valuable to extrapolate individual students' notes for conferencing to determine growth in questioning/thinking

- **Teacher Constructive Feedback** — 2 Stars and a Wish in the Learning Logs. Additionally the "Remarks" feature in Knowledge Forum (a feature embedded in notes allows private, individual commentary between student and teacher regarding the content of that note)

- **Student-Teacher Conferences**

- **Rubric** to track i) participation; ii) questioning; iii) build-ons; iv) contribution of research; v) use of supporting evidence for research (e.g., photos, diagrams, videos); vi) digital citizenship (e.g., citing sources used from print and electronic sources) (Learning Commons & Virtual Library)

2.5 GETTING KNOWLEDGE BUILDING STARTED IN MATHEMATICS

Written by Suzana Milinovich, Grade 6/7 teacher, HWDSB

INTRODUCTION

Suzana Milinovich is a Grade 6/7 Teacher at W.H. Ballard School in Hamilton, Ontario. Her class consists of 25 students: 16 males and 9 females. There are five children with Special Needs, three of whom are working on an Individualized Education Plan with modified expectations in Mathematics.

START WITH THE KB PRINCIPLES

In Suzana's classroom, it was a significant challenge to ignite mathematical conversations between a diverse set of learners in order to advance an entire group's knowledge. Suzana decided to narrow in on setting the conditions for **Knowledge Building Discourse**, that would lead to **Democratizing Knowledge** within the group. It was critical for students to understand that all learners in the classroom are relevant contributors to the group's learning, and have the opportunity to experience this.

KB PROVOCATION

The majority of students (88%) commenced the year with a negative attitude towards mathematics; in an informal survey Suzana asked students to fill out at the onset of the year showed that 85% of the students felt that they exhibited no strengths in the entire subject area. Suzana identified this as her problem of practice and began to embark on a professional inquiry that would shift the attitude and learning of mathematics with these students.

> **What was your greatest challenge?**
> Students had deep rooted opinions and beliefs surrounding their individual place in a mathematics classroom… They viewed mathematics as a subject in which they either excelled or struggled … Statements such as, "I can't do this" and, "This is too hard" echoed in the room daily. A student even dressed up as an "I hate Math" Calculator for our Halloween festivities!

STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT

Move 1. Encouraging KB Discourse through Number Talks!

With the understanding that student discourse is a highly effective principle in learning, Suzana looked for ways to encourage this in her math class. She provided opportunities for students to learn how to effectively collaborate by having better conversations where all students could be accountable. During mathematics class, she introduced Number Talks (3-5x week) in which students, without the teacher, were encouraged to share their individual strategies when solving a number problem.

The purpose of Number Talks was to deepen conceptual knowledge of numbers, and number sense AND to intentionally create a Knowledge Building culture by teaching effective knowledge building discourse in the mathematics.

When sharing, students were encouraged to explain their thinking as though they were trying to convince a room full of skeptics. As **students discussed**, Suzana sketched/recorded responses. **Simultaneously, students were encouraged, as listeners, to become skeptics of their peers' strategy and respectfully question each other's ideas in order to build critical thinking skills**. Suzana would pose questions such as:

- "Can someone re-phrase_____'s strategy?"

- "Can anyone build on_____'s theory?"

- "Would anyone like to ask_____ a question about their thinking?"

Other Important Elements of Number Talks:

- **Learning Goals and Success Criteria** were clearly communicated, re-visited and articulated at start of each Number Talk session.

- **KB Scaffolds:** All Knowledge Builders (students, teacher) model/use KB scaffolds during each discussion

- **Reflection and Self-Assessment:** Students were encouraged to reflect on the key KB Scaffolds that they used and were comfortable with. Students reflected on the use of a scaffold in their math journals (e.g., setting a goal to use a specific scaffold next time, how one was used and how it helped the learning/understanding of the knowledge community).
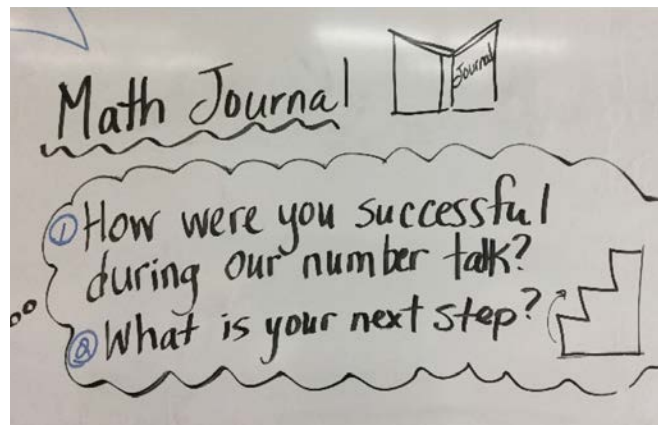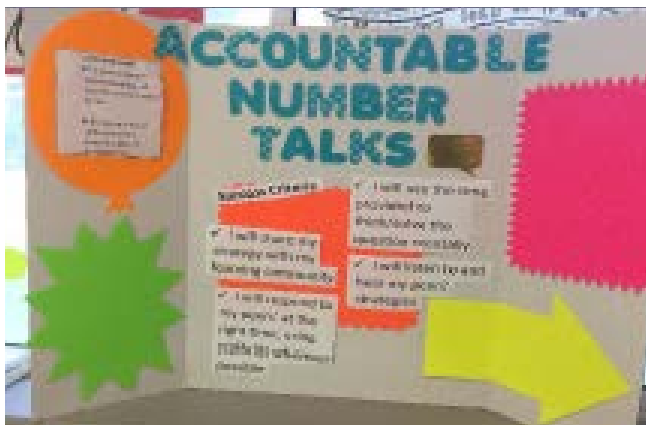
Accountable Number Talks Success Criteria and Learning Goals (left); Math journal prompts (right).

Move 2. Creating a Non-Threatening Classroom Environment
Creating a safe culture in which students would feel open to share and address problems with one another was something Suzana identified as a need for the group. She took some time to help students better understand the role of a skeptic that fostered citizenship skills in the learning environment. This included dressing up as a skeptic, posing for a photo shoot, creating dramatic role play scenarios, and reflecting on these during a KB circle. Suzana provided a deep integration of Character Education

in the learning community throughout all subject areas studied. The group of students became the leaders of the Positive School-Wide Culture Initiative, as they created #choosekindWHB with student voice concurrently deepening their individual knowledge of specific traits: Respect, Optimism, Compassion, and Kindness.

As the culture grew stronger, the number of student contributions to the group discussions increased. As accountable number talks and KB Circles progressed, Suzana documented and summarized each student contribution and posted them to a visual conversation bulletin board about 3-5x a week.

Move 3. Democratizing Knowledge with the T.O.G.A. Table!

With anticipation of developing a collaborative learning space while transforming the environment, Suzana positioned a double table with whiteboard placed over top at the centre of the classroom. Students gathered around this central table to share, reflect, explore, and create during their KB circle. Suzana identified the success and significance of this new space, **and** encouraged the class to develop a name for it. The students coined the name T.O.G.A. (Table of Great Achievement). This marked a memorable moment during Math class, as the students felt a sense of connectedness as they giggled, and chanted its name alongside their teacher.

Suzana added new KB Scaffolds gradually to the T.O.G.A table as they arose in the students' discourse. In the image to the right, the Knowledge Building Community is at the preliminary stage of discourse, as represented by only two scaffolds on the T.O.G.A Table.

● "I agree/disagree with_____
_____'s solution because…"
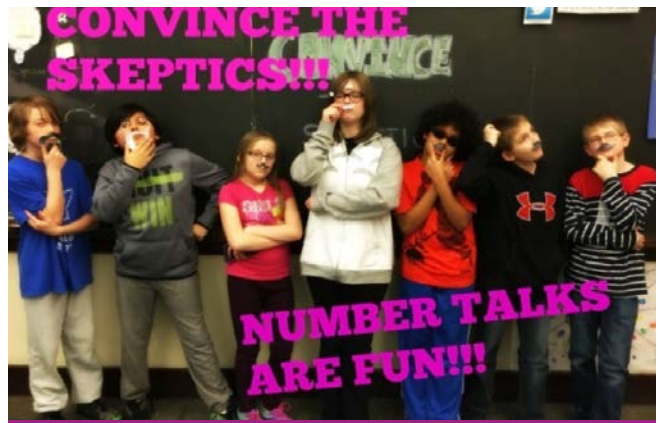
Students dress up as "skeptics" as part of the learning taking place around community-building and citizenship skills through Number Talks.
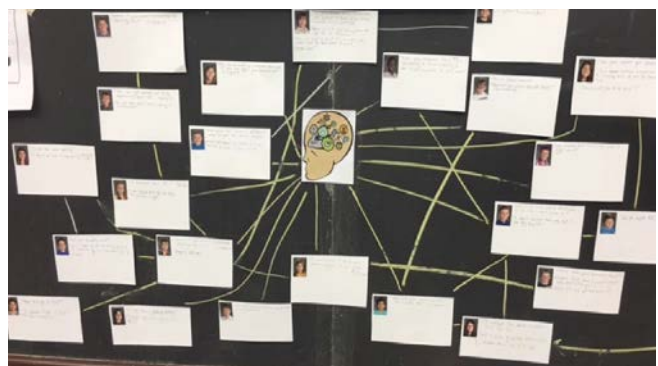
Visual conversation bulletin board.

Initially, the T.O.G.A. table has only two scaffolds (top). As the discourse deepens and the Number Talks progress, additional scaffolds are added to the table (bottom).

Over time, however, several other **scaffolds emerged and naturally became a part of the community members dialogue. These scaffolds were written down on coloured paper and pasted along the outside of T.O.G.A.** to create accessible visuals for students. Students became increasingly empowered to contribute to the shared goals of the **Knowledge Building community**.

The teacher gradually releases responsibility in the discourse, promoting peer-to-peer mathematical interactions.

The students were encouraged to reflect on the success of their KB Circles regularly. They clearly identified that everyone's idea **was** needed and desired, and Idea Diversity **occurred naturally during the discourse**. Suzana also encouraged her students to reflect on the key scaffolds that they used and were comfortable with. Students became increasingly empowered to contribute to the shared goals of the **Knowledge Building community**. As students gained the confidence and ability to take pride in contributing to collaborations during a study of fractions, decimals, and percentages, Suzana turned over the KB discussion entirely to the students. It was a huge Aha! moment for Suzanna, to finally release her responsibility during knowledge building circles. The students had arrived at a destination where they could freely explore big ideas and value each other's strengths throughout the learning process.

Move 4. Constructive Use of Authoritative Sources

Students were encouraged to use and evaluate source materials to further refine their ideas around decimal theories and principles. With the help of Dr. Monica Resendes, Suzana provided an expert vocabulary word cloud that highlighted key mathematical terms extracted from authoritative sources, such as textbooks and Ontario Curriculum Guides. The students were also provided the opportunity to view a word cloud **based on their own vocabulary** that was generated on Knowledge Forum. This was a non-evaluative assessment for students to connect terms to principles, deepening their understanding of the mathematical procedures with the vocabulary during investigations and communications. Students used this feedback to further explore and refine their understanding of mathematical concepts that additionally resulted in the use of more mathematical vocabulary when justifying solutions in mathematics.

Word cloud based on expert vocabulary from authoritative sources.
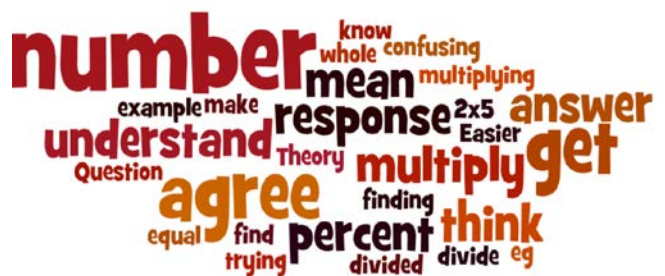
Word cloud based on students' online discourse.

Move 6. Assessment and Evaluation

Using data collected from **assessments** such as Student Journal Reflections, and KB Circle/Number Talk observations, Suzana provided feedback to students on an ongoing basis. She met with guided groups to explicitly teach concepts students were struggling with, as identified in journal entries, observations, and conversations that took place both in KB Circles/Number Talks and on Knowledge Forum. (The assessment tools Suzana used can be found at the end of this case study.)
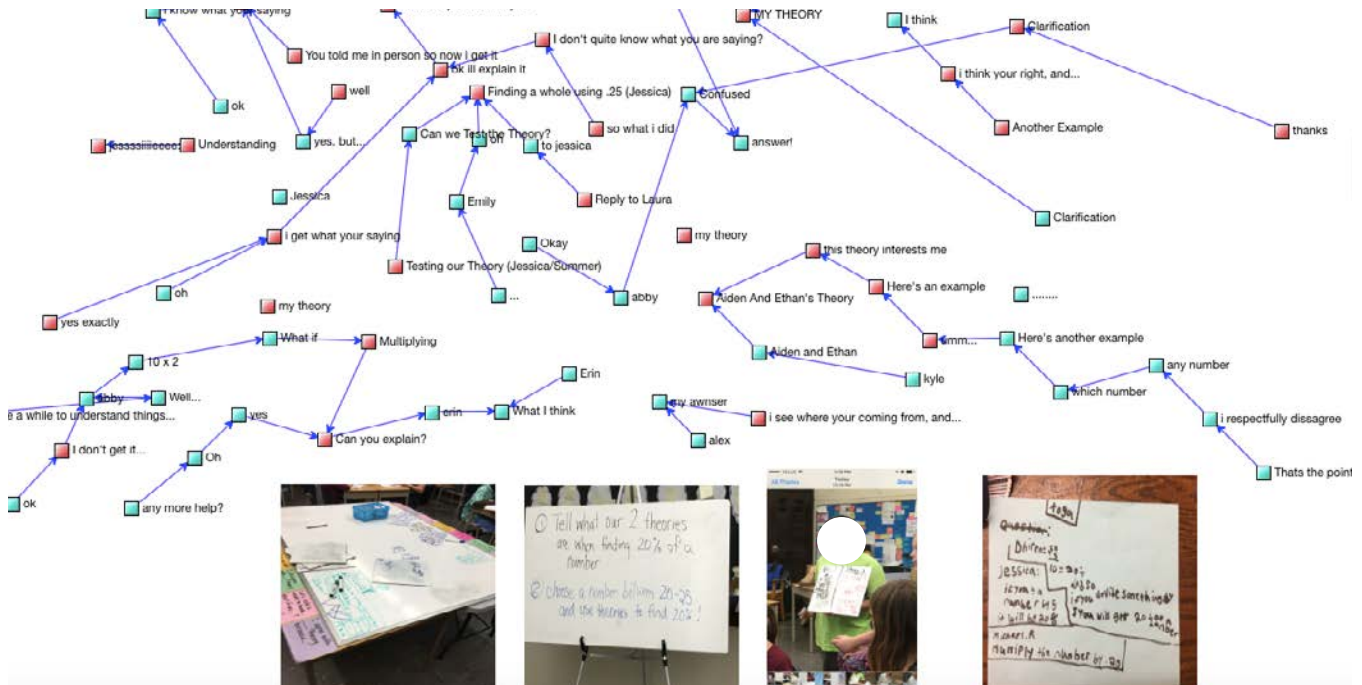
Students discussing their Decimal Theories on Knowledge Forum. The red and blue squares represent notes that open up when clicked. Red notes have been read, while blue notes are yet to be opened and reviewed. Images from classroom work are lined up along the bottom to spur ideas and thinking.

NEXT STEPS

Suzana's next step will be to focus on increasing **Democratization of Knowledge** by fostering greater student-to-student connectedness in the KB community. Student achievement will increase in mathematics as she continues to provide opportunities for her students to connect math pervasively. KB in mathematics will expand so that it not only involves the single subject with the set particular group of learners. Involving experts, parents, and even students in the greater global community will deepen all stakeholders' knowledge, understanding, and values in mathematics.

*See following two pages for assessment tools referenced in this case study.

What was your "Aha!" moment?

Releasing the responsibility during Knowledge Building discourse was a great moment. Allowing for students to find their own place in the Knowledge Building community was something I had to learn to be patient with by allowing for it to naturally occur. I had modelled, encouraged and lead the students to this point of discourse, and didn't quite let go until another educator, Denis Maika, pushed my thinking when he suggested the idea. The students reveled at the idea of engaging in the KB circles without my presence.
As I stepped out, students were able to further explore theories around the mathematics. The transition was seamless, and this proved that the Knowledge Building community was advancing knowledge effectively.

ASSESSMENT TOOLS

KB CIRCLES/ACCOUNTABLE NUMBER TALKS RUBRIC

Criteria	Level 1	Level 2	Level 3	Level 4
Student demonstrates knowledge of math content during Number Talks	Student demonstrates little understanding of number concepts when sharing information during Number Talks	Student demonstrates some understanding of number concepts when sharing information during Number Talk**s**	Student demonstrates an understanding of number concepts when sharing information during Number Talks	Student confidently demonstrates an understanding of number concepts when sharing information during Number Talks
Student expresses mathematical thinking with clarity and logical organization when communicating in number talks	Student expresses thinking with clarity and organization with limited effectiveness	Student expresses thinking with clarity and organization with some effectiveness	Student expresses thinking with clarity and organization with considerable effectiveness	Student expresses thinking with clarity and organization with a high degree of effectiveness
Student communicates orally to justify a mathematical solution, or express a mathematical argument, using mathematical vocabulary	Student communicates using mathematical vocabulary with limited effectiveness	Student communicates using mathematical vocabulary with some effectiveness	Student communicates using mathematical vocabulary with considerable effectiveness	Student communicates using mathematical vocabulary with a high degree of effectiveness

ASSESSMENT TOOLS

KB CIRCLES/ACCOUNTABLE NUMBER TALKS – STUDENT REFLECTIONS

Criteria	Level 1	Level 2	Level 3	Level 4
Student expresses mathematical thinking with clarity and logical organization when communicating about number talks in written form	Student expresses thinking with clarity and organization with limited effectiveness	Student expresses thinking with clarity and organization with some effectiveness	Student expresses thinking with clarity and organization with considerable effectiveness	Student expresses thinking with clarity and organization with a high degree of effectiveness
Student communicates in written form to justify a mathematical solution, or express a mathematical argument, using mathematical vocabulary	Student communicates using mathematical vocabulary with limited effectiveness	Student communicates using mathematical vocabulary with some effectiveness	Student communicates using mathematical vocabulary with considerable effectiveness	Student communicates using mathematical vocabulary with a high degree of effectiveness

SECTION 3: INTERMEDIATE (7–8)

3.1 A KNOWLEDGE BUILDING BUFFET! WORKING WITH IDEAS IN GRADE 7

Written by Allison Kemper, Grade 7 teacher, HWDSB

INTRODUCTION

Allison Kemper teaches Grade 7 core at W.H. Ballard Elementary School in Hamilton. Ballard is an inner-city school with a very diverse population, and a focus on developing positive mental health strategies and well-being in its students. Allison wanted to make learning in her classroom relevant and engaging for her Grade 7s, and to bring student voice and choice to the forefront through both hands-on and minds-on projects and high-interest topics. She also wanted to deepen a culture of inclusion and respect along with her students.

START WITH THE KB PRINCIPLES

Improvable Ideas — there is no right or wrong answer, all ideas can be improved and built upon. To Allison, this meant that everyone felt empowered to share their ideas, even if they weren't sure they were on the right track, because this might inspire ideas and thinking in someone else. She wanted to model being a life-long learner to help students develop a growth mindset.

> **What was one of your deepest learnings?**
> Often students know more about a topic than I do, and that's ok. I don't need to be the holder of the knowledge in my room. I encourage my students to become the experts and ask adults in their community or home to share their insights.

Knowledge Building Discourse — This encourages students to justify their ideas and opinions with evidence; Allison typically ends learning time with KB Circles, and has found that short sharing time is more effective with her class (10 minutes) on a daily basis, rather than long sharing time. She has also found starting the conversations with the following prompts work very well to kick off student dialogue:

What did you learn today? Can anyone build on what_____said? Did anyone's research or anyone's ideas connect with what_____ shared? How has your thinking changed?

Real Ideas and Authentic Problems — Probably one of the most important things for intermediate students is the question: "Why are we learning this?" because they need to see an immediate connection between what they are learning and their personal connection to it. We are always looking for opportunities to extend the learning outside the classroom and into the community. Being in the city means Allison can walk her class to the local pizza shop to learn about heat in science, or take the city bus to the art gallery to meet an artist-in-residence.

CONNECTIONS TO THE CURRICULUM

Allison wanted students to engage with two particular reading expectations in the Grade 7 Language curriculum:

> - **demonstrate understanding of increasingly complex texts by summarizing important ideas and citing a variety of details that support the main idea**
>
> - **extend understanding of texts, including increasingly complex or difficult texts, by connecting the ideas in them to their own knowledge, experience, and insights, to other familiar texts, and to the world around them (Ontario Language Curriculum Grades 1-8, 2006, pp. 127-128.)**

KB PROVOCATION

Allison wanted students to engage the Big Ideas of social action and civic engagement through the question: What inspires someone to step up and take a stand? This question was inspired by the Step Up! unit in the Nelson Grade 7 literacy resource (Hume & Ledgerwood, 2007). The following is a brief outline of the teacher and student moves that propelled the Knowledge Building work forward from this initial question.

Move 1

We started with the question: What inspires someone to take a stand? Allison posted this question on a sheet of paper on one wall of the classroom. This post served as the visual anchor for the KB Wall that the class would build together on that wall. During a 60-minute period, Allison led a discussion to brainstorm topics and issues that represented things that the students did not like to see in their community, in their personal lives or in the media, something that they wanted to take a stand on or something that inspired them to take a stand.

What surprised you?

How Knowledge Building can work for any student. My level 4 students can dig really deep, create complex theories and build on each other's thinking independently, while my students who are on IEPs or who have learning or behavioural needs, can focus on just one idea that interests or inspires them. I can easily modify for these students. For example, they can create one "I wonder…" card, and find research to help them respond to their question and deepen their ideas on the question.

Move 2

The students helped Allison group issues together into themes. She then wrote the main themes on separate sheets of paper, and posted them around the main idea on the KB Wall (see Figure 1 on the next page).

Move 3

To demonstrate to the students how they ought to begin using authoritative sources constructively, Allison looked for current news events on cbc.ca and found an article and some video clips of Miley Cyrus taking a stand against the wolf cull in BC. Allison completed a modeled reading activity where she highlighted the important information and then summarized the information onto a Summary Card. This card would be used to elicit students' wonderings and questions related to the issue or problem they find personally meaningful.

Figure 1. The Grade 7 KB Wall focusing on the Big Question: What inspires someone to take a stand?

Move 4

Each student then picked an issue that they were interested in or had a personal connection to, and then went onto cbc.ca to find an article about their topic. They printed off the article, highlighted the important information, and summarized the main ideas onto the Summary Card.

Move 5

Students then had to create three "I wonder" tags and post the tags beside their articles.

Move 6

Students spent the next three periods, answering their own questions or moving onto their peer's articles and questions. Students were encouraged to look for connections between articles posted by their peers and also use the "Connection" tag to make a text-to-text, text-to-self, or text-to-world connections.

STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT

Move 7

In order to encourage students to engage in sustained Knowledge Building Discourse, Allison gave students sustained opportunities to post their ideas and research discoveries on the classroom KB Wall. To help students do this, Allison created colourful paper "tags" based on the Knowledge Building Scaffolds in the Knowledge Forum online platform (see Figure 2). These "tags" included space for students to write as well as the KB Scaffolds, which included the following dialogue moves:

- I Wonder…

- My Theory is…

- Evidence to Support:

- Evidence to Discount:

- Building On/New Learning:

- A Definition:

- Did You Know…

Figure 2. The Knowledge Building "buffet" comprised of squares of paper colour-coded with different KB Scaffolds.

Allison organized the coloured tags into trays, which she coined their "Knowledge Building Buffet" (see above.) Each group of students got a Knowledge Building Buffet tray.

Move 8

Students were encouraged to create contributions to post on the KB wall to help them advance their ideas about the central question, "What makes someone take a stand?"

Students selected the correct tag/scaffold to help share their thinking and learning.

Students needed to be concise, and summarize or synthesize their ideas when writing on the tags. Students were encouraged to build on the ideas of others, make connections, keep posing wonderings, find their own evidence to support or discount theories, and continually dig deeper and build collective knowledge on their shared question.

A close-up of the KB Wall showing students' discussion around a news article.

ASSESSMENT AND EVALUATION

Conferencing: Conferencing was one main assessment strategy Allison used to understand depth of student understanding, to identify student misconceptions and to help students deepen their ideas.

Written Response: Additionally, students were asked to respond individually in writing to a final question, as posed in the Nelson resource: What inspires you to step up and take a stand? Allison added one element to this question, and asked her students to "use evidence from your own research and the work of others in the class to help explain your thinking." At this point, every student in the class was able to respond to this question and had tools for how to lay out and structure their ideas in their written response.

Culminating Assignment: The high engagement with different kinds of media text helped students to prepare them for their summative assignment which incorporated persuasive writing. The goal was to apply their ideas and understandings about what causes social action and change and to create a media text to inspire others to take a stand on an issue.

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http://www.edu.gov.on.ca/eng/curriculum/elementary/language18currb.pdf

3.2 KNOWLEDGE BUILDING WITH EXCEPTIONAL LEARNERS

Written by Austin Kjorven, Grade 7 teacher, TDSB

INTRODUCTION

Austin Kjorven is a middle school teacher in the Toronto District School Board. He began introducing Knowledge Building to a class of Grade 7 students who thrived on the student-led collaborative approach to learning. In a recent relocation within the TDSB, Austin's teaching assignment transitioned to an Intensive Support Program of 13 Grade 6–8 exceptional learners; students who have learning strengths and needs that are individually specific. Within this environment, Austin realized that once his students were able to identify their personal strengths and needs as learners, and empathize with other learners in the class, Knowledge Building would provide a framework for rich, student-led collaborative learning.

START WITH THE KB PRINCIPLES

Improvable Ideas — From the onset of our learning, whether from an informal discussion about an interesting topic or a major project, students know that ideas are never complete. I often have students continue to research information, or continue to follow news stories about their projects, long after they have been submitted and have been graded.

Real Ideas, Authentic Problems — By introducing students to the Big Ideas from the curriculum that address authentic current problems, and by allowing them to create questions and pursue answers collaboratively, the learning process becomes self-actualized and appreciated.

Democratizing Knowledge — In my experience with KB, emphasizing the importance of shared ideas and collective contributions not only leads to rich idea development, but also highlights the role that students play as contributors in building ideas. Students come to realize that they are not only valued, but relied upon as integral parts of the process. Like any team, without all members actively present and participating, then KB can't reach its full potential.

Idea Diversity — As students develop a deeper understanding of themselves as learners, particularly with regards to their strengths and needs, they are able to contribute their insights, while at the same time, inquire about and review ideas they do not fully grasp. While working together with their peers, all students understand the importance of collective advancement, and placing emphasis on group understanding. A quote I often use to accentuate this is, "We're not good unless we're all good!"

KB PROVOCATION

Knowledge Building was used as an entry point for a Social Studies/Geography Science/Collaborative Inquiry unit addressing Canada's Responses to Global Issues and Biodiversity (Grade 6), Physical Patterns in a Changing World and Interactions in the Environment (Grade 7), and Global Development: Patterns and Sustainability and Systems in Action (Grade 8). Students continued Knowledge Building throughout the unit, synthesizing and building upon information they had gathered.

Move 1: The Wonder Wall and Big Ideas

To introduce the idea of **KB Discourse**, I shared with students some of the Big Ideas from the curriculum on my classroom wall. I also began a Wonder Wall on a bulletin board next to it where students could post questions. Because I was teaching integrated units between three grades, I introduced Big Ideas that could not only connect on a cross-curricular level, but also across the three grades.

Some examples of Big Ideas for Science included:

- Grade 6: Biodiversity includes diversity of individuals, species and ecosystems; and, humans make choices that can have an impact on biodiversity.

- Grade 7: Ecosystems are in a constant state of change, and the changes may be caused by nature or by human intervention.

- Grade 8: Systems are designed to optimize human and natural resources.

> **What surprised you?**
> The ideas that come from students in Knowledge Building always surprise me because I am always learning something new. Often I learn the most when I see questions that appear to be very simple at first glance (almost to the point where I want to skip them). From the discussion that ensues I realize how my own bias can prevent me from considering the variety of perspectives that can only materialize from a group discussion.

Examples from Social Studies and Geography included:

- Grade 6: Global issues require global action. How have natural disasters affected Canada and the world?

- Grade 7: Natural events and human activities that change Earth's physical features can have social, political, environmental and economic consequences. Why do earth's physical features change?

- Grade 8: Human settlement patterns are affected by the natural environment and also affect the natural environment. In what ways does Canada's environment affect how we live? In what ways does the way we live affect Canada's environment?

Through a discussion with the class about these ideas and how they are connected to each other, we drew parallels between grades to consolidate the ideas into common class learning goals that would drive the unit.

For Science, we said: We need to respect and understand natural environments and ecosystems because human activities can affect them and all living things need them.

For Social Studies and Geography, we said: We will learn how all humans are connected to the earth and how the decisions we make affect us and the earth.

Move 2: Structured Hot Topics Knowledge Building with Accountable Talk Prompts

After establishing the Big Ideas and providing a space for students to begin the process of posing questions, I introduced Hot Topics as a way for students to build knowledge through authentic, current and relevant issues connected to the unit. I began sharing short articles and video clips, discussing a current situation related to the area of study. For example, in the fall of 2016, I shared a news story about Hurricane Matthew, a natural event that had devastating effects on communities and ecosystems on the Atlantic coast. I modelled how to create deep and meaningful questions about the topic, and guided the class through a Knowledge Building discussion where students answered the questions and generated more questions that would lead them to research hurricanes and monitor the aftermath of Hurricane Matthew.

Gradually, I released the responsibility of conducting Hot Topic inquiry discussions to the students. When given the opportunity to share ideas and issues relevant to them, and to lead a discussion around questions they have created, students feel their ideas matter and they become empowered to actuate their learning.

> **What was one of your deepest learnings?**
> My deepest learning was how facilitating student-driven learning sparks curiosity and leads students to develop confidence. I watched my students become self-motivated, confident learners who actively perused answers to their questions and enjoyed sharing what they had learned with others, rather than having to adjust their thinking to fit teacher-led activities.

Move 3: Hot Topics Facilitator Synthesis

As students became more comfortable with Knowledge Building, Hot Topics discussions and answering questions, building on other student's answers, and challenging ideas, the discussion organically evolved to the point where new, more complex knowledge emerged from synthesizing different ideas that had been shared by the class. In addition to their role of creating questions and leading a discussion, the facilitator was given the responsibility of consolidating the discussion by stating these new ideas through phrases such as, "This is what we have discovered…", or "From our discussion, I think we can all agree that…"

STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT

A key strategy I've learned for idea improvement is to utilize global current events whenever possible. As events are reported on, students can have Knowledge Building discussions to develop their understanding, draw connections and make predictions about how the event will unfold. As the learning takes place in real time over the course of the event, the process is authentic; everyone — including the teacher — learns together, and there is no option of looking ahead to see how the event plays out.

3.3 EXPLORING THE ARTS THROUGH KNOWLEDGE BUILDING

Written by Evonne Quintal, Grade 7/8 teacher, HCDSB

INTRODUCTION

Evonne Quintal is a grade 7/8 teacher at St. Anne Elementary school in Burlington. With a Specialist in Visual arts, she was interested in how Knowledge Building could be an effective strategy in approaching the Problem of Practice in her Intermediate Art Class. Before implementing key principles of Knowledge Building, Evonne found that her students had very little ownership of the creative process. When they were given tasks that required critical thinking skills, individual inventiveness, self-expression, and imagination, students often relied on copying or reproducing.

The following case study explores how Knowledge Building challenged students to discover meaning in the art work of others and to think critically about transforming ideas when creating their own art.

What was one of your deepest learnings?
Knowledge Building Principles have transformed how I approach everything in my classroom. The principles are an integrated part of my philosophy now, in all subject areas, and most importantly in building a positive culture of community. Learning used to be an individual process for my students, now learning focuses on knowledge that 'lives in the world' and requires all students in the classroom to extend what we all know. It is about community, and what the community can do to advance knowledge.

START WITH THE KB PRINCIPLES

Improvable Ideas — Students in Evonne's classroom work to understand that all ideas are treated as improvable and buildable. Evonne does a lot of work with students around the 'growth mindset,' which helps build a culture where students feel empowered to share their ideas. Students know that even though they may have misconceptions or ideas that need development, their ideas may spawn new thinking for others in the classroom.

Knowledge Building Discourse — Classroom discussion in the Knowledge Building Circles is not meant to be a presentation or by any means a sharing circle. In Evonne's classroom, students are working to transform and advance not only their own ideas and opinions, but that of others. Evonne provides students with sentence prompts where students can either: Sum Up, Refute, Bounce Off, or Question, their peers' thinking. In using these prompts students are provided with a scaffold to help them not only communicate but learn how to listen. In the Knowledge Building Circles students identify new problems; form new ideas; develop contrasting ideas; debate; and clarify each other's thinking.

KB PROVOCATION

It was important to Evonne that her students engage in authentic learning, where students can have their idea live in the world. In order to do this, students needed to have their curiosity provoked. The KB provocation consisted of establishing an "experience" for the students. The experience could be in the form of field trips, guest speakers, videos. In this case, a variety of art that could provoke engaging conversation was used as a method to pique the students' curiosity. Evonne shared her own knowledge and enthusiasm in order to further the discussion and create more interest.

STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT

Move 1: Formulating Questions and Selecting a Promising Question
Students work as a class community to develop questions and ideas that surround the Big Question: **How Do Artists Get Their Ideas?** This is a crucial part of the inquiry process because students are given agency to formulate a whole series of questions that they are responsible for answering, as opposed to the questions coming from the teacher. Students generate a variety of questions; it is the teacher's role as guide in this process to filter these questions. It is important to keep in mind that promising questions are ones that lead to deeper level thinking.

Once students had brainstormed questions, they worked together to group their questions into ideas or themes. These themes were recorded and posted around the room along with the questions that related to them. Students were now able to choose a theme that they were interested in or had a personal connection to. Using a RAN chart, students began their research, answering their own questions or the questions developed by their peers.

Move 2: Knowledge Building Research and Conferences
Students engaged in purposeful individual research, and collaborative conferences with the teacher. Students began their research by developing a theory/prediction as to how a particular artist was moved to create their art. From there, students tried to find supports for their theory by researching what they could about the artist's life and period. Following this work is conference time with the teacher. Conferencing is key to assessing the student's thinking, and to ensuring the student is heading in the right direction. It involves empathetic listening on the teacher's part in order to identify misconceptions or inaccuracies. Conferences took place during research periods, allowing the teacher to have profound conversations with students that helped to further guide their research.

Move 3: Knowledge Building Circles
In this stage, students engaged in a collective sharing of ideas much like it would look in the workplace. Students took on collective responsibility, in which responsibility for the success of the group is distributed across all the students in the classroom. Frontloading around Accountable talk and sentence prompts to guide discussion is key to ensuring effective communication and listening in the KB Circle. In this discussion students explored a variety of influences, both cultural and environmental. Students added onto, summed up, clarified, and refuted each other's ideas. During or after each discussion, students recorded their thoughts on stickies that were linked to others on a giant classroom mind map.

Sample Conference Questions:
- **That's an interesting idea, can you tell me more?**
- **What do you mean by_____?**
- **Could you give me an example? How do you know?**
- **Could you explain that further?**
- **Why do you say that?**
- **How could this art have been made?**
- **Why might this artist have made this here?**
- **Why did this artist choose this subject matter?**
- **What are we assuming? What is another way to look at it?**

Move 4: Evaluating Learning in a Knowledge Building Classroom

Conferencing: Conferencing is used as a primary assessment strategy. It is an ample opportunity for the teacher to quickly assess what students still need to know, as well identify any of their misconceptions or gaps in understanding. It is also a way to deepen ideas and guide students in the direction that they need to be headed.

Exit Tickets: Students reflect on what they know, and what they have learned. This reflection should include their greatest knowledge advances.

Self-Assessment: Students assess their individual listening and communication skills and develop goals for themselves based on this assessment.

Culminating Assignment: Students created their own art piece and Artist Statement. In developing an artist statement to accompany their art, students' thinking became evident.

Move 6: Create a Product that Could Live in the World

In this stage students came up with questions and ideas that the "real artists" are coming up with. Even better, they came up with a fresh new idea that no artist had before. Students used what they learned to inspire their own creations. Students were permitted to choose not only their own subject matter but also their own art materials. In this independent project, students were able to reflect on what inspires them. Student art work was presented at an art show at a local art gallery.

What surprised you?

One thing that surprised me was how natural it felt to release responsibility. I didn't think that I would be able to easily relinquish control in my classroom. But allowing students to participate in planning, evaluating, and identifying their gaps in understanding — in essence, doing the things that have only ever been the responsibility of the teacher — has dramatically changed what I think learning should look like.

3.4 SUPPORTING KNOWLEDGE BUILDING CIRCLES IN A GRADE 8 CLASSROOM

Written by Lindsay Butson and Nizam Hussain, Grade 8 teachers, TDSB

INTRODUCTION

At the beginning of the 2015-16 year, Grade 8 students participated in the WaterDocs@Schools project. Nizam Hussain and Lindsay Butson, both Grade 8 teachers, took a Knowledge Building approach to the project. The study students took part in required them to explore local water systems, learn about water conservation issues, and carry out action projects to affect change in the community. This case study highlights how Knowledge Building Circles were integrated at different stages in the inquiry, and the strategies that were used to support authentic Knowledge Building Discourse, Pervasive Knowledge Building and Embedded, Concurrent and Transformative Assessment. Students were able to problem solve and guide their learning according to their own needs, resulting in an increase in student confidence, perseverance, and deeper understanding.

KB PROVOCATION

The theme of Water Conservation is a Big Idea connecting all the strands of the Grade 8 Science and Technology curriculum. This Knowledge Building study began with a visit to the stream and surrounding forest

> Teachers worked collaboratively to deliver a cross-curricular Knowledge Building study, allowing students to access ideas and skills from multiple perspectives.

behind the school. Students spent time exploring the area, making observations, and recording questions about the land and water. Upon their return, the teacher held a Knowledge Building Circle with the guiding questions: "What did you observe?" and "What questions came to mind when we visited the stream?" Students generated questions that launched the main inquiry:

Move 1: Introducing Knowledge Building Circles

The teacher explicitly taught the procedures of a KBC to a small group of students to use in the following Fishbowl demonstration. At the beginning of the lesson the teacher posed the questions: "What is a Knowledge Building Circle and how does it work?" The teacher asked the students to keep these questions in mind while watching the fishbowl demonstration. The demonstration lasted 10 minutes, during which the teacher 'froze' the action several times to highlight important aspects of the KBC. Following the demonstration, the teacher invited students to share what they had observed and questions they had about KBCs. Students noticed the use of the hiking stick to indicate whose turn it was to speak and the deliberate use of sentence starters such as: "To build on what Mariam said…" and "Something else I tried was…" and "In my experience…" The teacher explained that those sentence starters (KB Scaffolds) can be used to help show respect for everyone's ideas, even when

> **What were some of your greatest challenges?**
> Teachers observed that small groups facilitated rich dialogue. The challenge they are grappling with now is how to get the ideas and discourse generated in the smaller groups back to the whole class.

you disagree with them. In other words, they can help you give and receive criticism in a positive way. The notes were compiled into an anchor chart and placed on the wall of the classroom for future reference.

Move 2: Community Building to Encourage Risk-Taking

TRIBES Community Circles and other community building activities were undertaken by the teachers in order to build a safe and inclusive classroom. Whole class discussion was integrated into other subject areas and students were given opportunities to engage in various discourses across the curriculum. In addition to ongoing community building in Drama and Physical Education, teachers organized a full day of outdoor Community Building activities (Figure 1).

What was your "Aha!" moment?

Students were making a lot of cross-curricular connections in the KBCs because they were engaged in really deep and meaningful conversations and were excited when they were able to make connections between their water inquiries and other concepts and ideas they were studying in other subjects.

Despite these activities, many students were not voluntarily speaking or participating in the KBC. This is one of the greatest challenges faced by teachers. Subsequent conferences revealed that some students did not feel comfortable asking questions or contributing anything that may reveal their lack of knowledge.

Figure 1: Community Building Activities

Simply speaking, they were afraid of being wrong. To increase participation, teachers used sticky notes to encourage students to contribute their thoughts, and questions. The teacher would use the sticky notes to facilitate discussions. This was a strategy used to promote participation and model that everyone's contributions are valued. Teachers continued with team building activities throughout the year and checked in with students regularly, to promote open and honest Knowledge Building discourse.

Pervasive Knowledge Building and Exposure to Diverse Ideas

A number of teachers in the intermediate division worked collaboratively to address the content and skills in Science, Math, Language, and Geography. Community building, development of teamwork, and growth mindsets that took place in Drama, Phys Ed., Music, and Visual Art were also critically important for evolving the KB discourse.

Move 3: Using Pre-Discussion Preparation to Increase Student Confidence During KBCs

During the first visit to the stream behind the school, the teacher asked the students to record observations, questions, and wonderings about the land and water with the expectation that this would be shared in a KBC upon their return. Students were given 20 minutes to explore, observe, and record findings and questions. Examples of notes taken:

- "Lots of different types of trees, some trees chopped down."

- "Not as much water in stream as last week."

Similar pre-discussion prompts were provided to students in all KBCs. Students were asked to sketch, or reflect in their journals before entering the circle. Other forms of accountable talk such as think-pair-share, inside-outside circle, and line-up were also used to give students the opportunity to practice talking about the topic before entering the KBC. Anchor charts and Word Walls helped students use subject specific vocabulary more often and more confidently in their discourse.
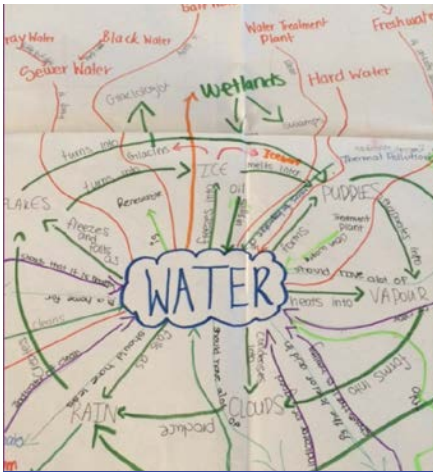

Figure 2: Students talking to the Water Brothers

Move 4: Making Constructive Use of Authoritative Sources to Provide Content for KBCs

Several weeks into the Knowledge Building study, students attended a Question and Answer webinar with the Water Brothers (Figure 2). Students were able to interact with the Water Brothers and have their questions answered about water conservation issues and documentary making. Following this webinar, students engaged in a KBC to review and document the new knowledge and understandings that were gained from the webinar. They added new terms to the word wall and concept maps. Students also made connections in other curriculum areas by exploring current events that related to national water issues, and exploring appropriate technologies and sustainability in developing nations.

To assist with the documentary filmmaking, students watched a variety of documentaries, paying special attention to filming, editing, and stylistic techniques. Students shared their observations in a KBC and discussed what made the films impactful, how they engaged their audience, and delivered their message effectively.

Move 5: Using KBCs as Embedded, Concurrent and Transformative Assessment

Students visited the stream several times over the course of the inquiry to count and identify populations of organisms, document changes following rainfall, and as the seasons changed, and to conduct a stream study. All activities were followed up with KBCs and the shared knowledge was documented through GAFEs, note taking, concept mapping (Figure 3) in the students' Science Journals.

Figure 3: This concept map was added to following several KBCs.

Students were provided with many opportunities to self and peer-assess their contributions to specific KBCs and in the overall project. The self-assessments were designed to have students reflect on their progress so far, and on their next steps. From this, teachers were able to determine what parts of the project the students needed further support with.

Well into the Knowledge Building Study, students had begun to amalgamate all of the information and data they had collected to create their documentaries. The students were given opportunities to participate in small groups KBCs to review their storyboards, problem solve gaps in their project and ask questions on what the next steps might be. The student documentaries were also deconstructed in small groups using the co-created success criteria. Students also did peer and self-evaluations to reflect on how the project was going and areas for improvement. The teacher took anecdotal notes during Knowledge Building Discourses to supplement other assessment data and to evaluate student thinking and unearth misconceptions that were addressed in future lessons.

What was one of your deepest learnings?
KBCs allowed the teacher to see evidence of students' differentiated learning. During the KBCs, students had the opportunity to showcase their diverse talents and skills to the discussion by sharing what they were working on (e.g., animated video of a water issue). This helped to boost students' confidence and improved the frequency and quality of their contributions to the KBC.

Knowledge Building Circle Self-Evaluation

Name: Date: Topic:

1. How did you contribute to today's discusssion? Add a comment beneath the choices you check off.

- [ ] I asked a question that related to a preceding idea.

- [ ] I made a comment that showed interest in what someone else said.

- [ ] I made a connection between two ideas.

- [ ] I used body language to support other speakers.

- [ ] I build on someone else's thoughts.

- [ ] I disagreed in a respectful way.

Sample of a self-evaluation form used after a KBC. Altered from Watt, J. *IQ: A Practical Guide to Inquiry-Based Learning, pg. 146*.

3.5 KNOWLEDGE BUILDING THROUGH INQUIRY IN THE INTERMEDIATE MATHEMATICS CLASSROOM

Written by Paula Molloy, Grade 7/8 teacher, TDSB

INTRODUCTION

My name is Paula Molloy and I am an Intermediate Mathematics teacher at John A. Leslie Public School in Scarborough. I have a background in Early Childhood Education, and have spent many years observing children and how they acquire knowledge. Culturally, we seem to understand that children learn from their environment and the stimuli that we provide for them. We freely and naturally provide young learners with tools with which to build, create and problem-solve. We prepare an educational environment that supports open-ended approaches to learning, encourages a variety of problem-solving strategies, and assesses and honours the process of learning.

I have adopted these same practices in my intermediate mathematics classroom. Not only has this process involved investigations such as building structures with embedded algebraic expressions, or creating picture books that tell a story about the birth of a mathematical concept and the mathematicians behind the concept, but we extend our sense of wonder into inquiry projects that make connections beyond the classroom and into the global community.

The following case study is a snapshot of the experience that my students participated in while they considered themselves Agents of Change. Mathematically, and thinking as mathematicians, through the strand of Data Management and the framework of Knowledge Building and Knowledge Forum, the Intermediate students explored relevant issues such as; Crime Rates in Toronto, Muslim Discrimination, Genetically Modified Organisms, Teens and Screens, Gender Inequality, Poverty in Toronto, and The Consequences of drinking bottled water on the Environment.

STARTING WITH THE KB PRINCIPLES:

Real Ideas, Authentic Problems

Epistemic Agency

Community Knowledge, Collective Responsibility

KB PROVOCATION

Move 1: Real Ideas, Authentic Problems

As students mature they continue to make sense of their world. The Intermediate student is a curious learner who is able to receive and synthesize information, and form and share their own perspectives. As a class, we discussed current events and global issues that impacted their lives. The provocation started with a discussion around the election process in the United States and Donald Trump's perspectives on Muslims and immigration. Conversations were filled with emotion and personal narratives, as connections were made and opinions shared.

Students were asked to select an issue that not only provoked emotion, but one that they were genuinely interested in learning more about, with the belief that they could better educate themselves to make more informed decisions or even create change for the future. They needed to think about how information was presented to them mathematically. Learning goals and success criteria were collectively constructed and the curriculum expectations were clearly identified.

Real ideas and authentic problems allowed students to acquire relevant knowledge, making sincere and meaningful connections. This not only informs the learning but may inspire and motivate, and give students the skills to challenge and change the world around them.

Move 2: Epistemic Agency

Students collectively or independently determined the issue that was of importance to them; similarly, they had autonomy in determining their work teams. In establishing a culture of Knowledge Building, it is imperative that teachers lay the foundation of what collaborative communication looks like and sounds like. For example, it was reinforced that we are all learners and that all efforts in moving forward are to be built and expanded on as a collective. Students were reminded that all team members had an equal role to play in establishing the inquiry question and participating in the Knowledge Building process. Further to this, team communications and responsibilities were to be documented in a Communications Book in every class. When conferencing with groups, I would refer to the Communications Book and reference individual contributions and their documented process of how the team was building and developing suggested ideas, as well as having a greater understanding of their next steps.

STRATEGIES TO SUSTAIN IDEA IMPROVEMENT

Move 3: Community Knowledge, Collective Responsibility

As students worked throughout the inquiry process, they needed to work through the challenge of what it looked like to research data independently and to share and learn from it collectively. For example, students were often referencing data that were presented on charts and graphs. Although graphs may have been collected by different team members, the analysis of information and the conclusions made were collectively accomplished. Team members may have developed their own survey questions but collectively they discussed the purpose and quality of those questions before establishing a final survey. Collectively, they made inferences on the results of primary and secondary data. Collectively, they made predictions, based on their data, about the future of their issue. Collectively, they discussed how their generation could play a role in shaping

the future of their issue. Students were heard discussing the need for governments to change standards and policies on issues such as increasing penalties for criminals, greater consumer education on genetically modified organisms, the consequences of drinking water from plastic water bottles on the environment, and other topics.

Students participated in a practice that required the contributions of all team members with the expectation that all ideas would be validated and collectively refined.

Move 4: Improvable Ideas

Within the culture of the learning environment and the learning itself, the process of learning is where the growth, development and building takes place. All ideas are valid and must receive recognition. If the team decides that an idea is productive to their overall goal, then the idea must be nurtured in order for it to develop and expand. Upon observation during the inquiry process, I could hear a team with a focus on gender inequality attempting to work through a problem with a comparison that they were making. One of the team members was quietly offering a suggestion that could move the thinking forward, allowing the group to narrow their comparison of data. The team, however, remained focused on their current train of thought and were unresponsive to the student's improvement plan. As an observer and a facilitator, I asked the team to explain their challenge and then I asked them to once again listen to the improvement plan of their peer. It was a learning opportunity that served to not only push their idea forward but also to reinforce that all team members must be heard when sharing ideas and improving upon them.

In terms of the mathematics, for example, groups often experienced difficulty with primary data collection. They were faced with the challenge of attempting to collect accurate and representative data within their own school. The growth was observable as teams worked through and improved their ideas, ensuring that they were asking bias-free questions that allowed the person being surveyed to answer honestly, and sometimes even anonymously, to ensure the most accurate results. Similar discourse took place when faced with the challenge of selecting appropriate graphs to represent particular data. Students improved upon their ideas through discussions that included the purpose of communication for each graph type.

The use of the Communication Book was also a valuable tool as it documented the process, development and improvement of their initial ideas, and allowed students to reflect on the rich journey that lead them to success.

Move 5: Embedded, Concurrent and Transformative Assessment

During our mathematics inquiry, the assessment was embedded within the process. The process is the learning. I had regular and ongoing communications with individuals and with teams. I anecdotally recorded observations that also included the support and direction that I gave to each team. Students continued to document their process within their Communications Book paired with occasional progress reports.

Providing feedback throughout the process was critical. It was my role to ensure that students were maintaining a clear focus, asking and researching rich questions, working equitably as a team and referring to the learning goals and success criteria that were collectively established. Throughout this process I was able to push the students' thinking forward. Students were asked to go beyond researching information on their issue and ensure that they were bringing their own informed perspectives to the project. For example, the team that was comparing gender inequality in Canada to Pakistan, speculated that it was likely that information regarding issues of inequality and abuse perhaps is not reported and that the actual data may indeed be more concerning than is mathematically documented.

The growth and achievements made throughout the process need to be assessed. The process is where the thinking, problem solving, and refinement take place. The product is a result of the process, therefore, the assessment, embedded within the process, and the finished product and presentation, are all necessary to assess.

Move 6: Conclusion

The conclusion of our inquiry included a reflection piece. Students must reflect on their journey and their process of learning. A reflection should highlight their challenges and discuss how challenges were overcome, their surprises, their successes, the knowledge that they built as well as the new curiosities that arose from their inquiry.

With this particular inquiry, a part of the concluding process was actually the birth of a new and thought provoking journey as students identified the possible future. Based on the actual data within their inquiry projects, students were to make informed predictions about what their issue would look like 10 or 20 years from now, with the realization that they are indeed the Agents of Change. We abstractly placed these supported predictions into a time capsule and acknowledged that the behaviours of their generation would shape, not only their own future, but the future of the next generation. As an educator, reflection is equally as important as we continuously strive to refine our own ideas, take risks, maintain an open-mind and provide best practice methods that will further the quality of learning for our students.

3.6 IMPROVABLE IDEAS IN A GRADE 8 KB CLASSROOM

Written by Jason Frenza, Grade 8 teacher, HCDSB

INTRODUCTION

This case study tells the story of how Jason Frenza, a Grade 8 teacher and his students at St. Anthony of Padua Catholic Elementary School in Milton created a Knowledge Building Community focused on collective idea improvement.

STARTING WITH THE KB PRINCIPLES

Jason had been practising Knowledge Building for two years in the junior division (Grade 5) before starting with intermediate students. During his year teaching Grade 8, Jason decided that he wanted to find ways to deepen his intermediate students' engagement with the KB Principle of Improvable Ideas. For Jason, improvable ideas means that there isn't a wrong answer or a wrong idea, but, given enough work and time, ideas can grow and develop meaningfully. Jason firmly believes that helping students feel as though they are valuable members of a Knowledge Building community is key to having this principle grow in the classroom.

Jason wanted to engage in this principle to help his students improve their ideas and deepen their thinking by doing more to connect scientific theories and concepts to their everyday world. So, he designed his "Improvable Ideas Board." This board was created to help give his students' ideas a public place to live and grow, and was something that he could use in his classroom as a tool to help students propose, build upon, and deepen their ideas as a community.

KB PROVOCATION

Jason co-created learning goals with his students around the Big Ideas in the curriculum at the beginning of each science strand. This process began by Jason taking the curriculum document and exploring it with his students. Together, they identified the Big Ideas in conjunction with the overall curriculum expectations. They then co-created the learning goals for the study of the unit that stemmed from the students' own interest and curiosity.

What was your greatest challenge?
Time is a challenge because of the amount it takes for student to build their theories through the inquiry process. But the extra time taken has always paid off in the end.

# STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT

Move 1:
Once the learning goals were created, students were then given a coloured sticky note where they were asked to create an initial theory that related to the particular learning goal they were most curious about.

For example, one of the community's learning goals was: We will use the particle theory of matter to investigate the various forms of solids, liquids, and gases.

Michael's initial theory related to this goal: My theory about fluids is that when fluids are combined with different properties, they will cause reactions, like explosions and lots of smoke. I think that, by doing this, they can also change their states of matter.

After they compose their theory, students then pasted their sticky notes up on the board so that they started to form the collective pool of ideas that they would strive to advance as the work went on.
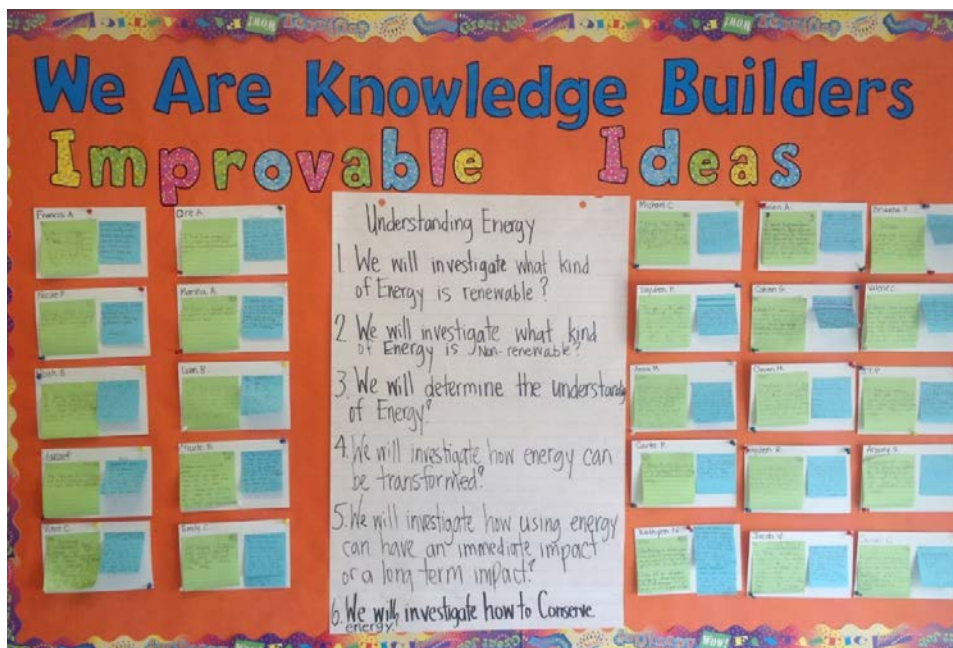
The improvable ideas board in Jason Frenza's Grade 8 classroom encourages his students to actively build off one another's ideas to grow community knowledge.

Move 2:
Over the course of the study, as the class explored the learning goals and their initial theories, students were provided an opportunity to reflect upon the ideas presented on the board. At mid-point in the unit, students were asked to select a particular theory posted on the board and take that idea and build onto it, based on the scientific concepts and ideas they have explored up until that point. For example, Adam decided to build on Michael's initial theory

about the properties of fluids by citing an example to support the theory that he found from his research: When you mix two different states of matter, example vinegar with baking soda, it causes a chemical reaction. They can change states of matter from a solid to a liquid to a gas. For example, when you mix vinegar, which is a liquid, with the solid baking soda, these two create a chemical reaction, and the vinegar turns into a gas.

Move 3:
At the end of the last learning goal, students were again asked to choose a different idea posted on the board, and again were provided another coloured sticky note. Students were then asked to try to improve the first two ideas posted on the card based on all the work and research they had done up until that point. They were asked to tie in and connect all the relevant concepts that they have learned throughout the study. In this way, they were actively and explicitly building off each other's knowledge and using the ideas of their peers as tools to help move their own learning forward. It is important to note that students were also continually reading and referencing everybody else's ideas as they did their KB work, which included conducting research, engaging in KB Circles, and doing experiments. Community ideas were always available for the whole community to access, and students found them a valuable shared resource. Here is an example of Zachary's refined idea:

Many materials change their states of matter due to the particle theory of matter. One of the laws of the Particle Theory of Matter is that particles move faster and spread farther apart when heated. Something that could also affect the particles could be how adhesive and viscous a material is. Adhesion is when the particles of one fluid (e.g., water) merge with the particles of something else (like a pipe).

Move 4:
Close to the end of the study, the original student (e.g., Micheal) who wrote the very first theory takes their original card once again. They consider all the ideas that classmates have provided (e.g., Adam and Zachary) and devise a final theory based on all of the theories presented to them on their card.

Michael's refined theory: My final theory about fluids is that they can provide energy as well as minimize side effects. While the example hydroelectricity is renewable it also can provide other strong uses for the environment such as prevention of major calamities like floods. Fluids are key factors to providing long lasting renewable energy. Fluids can help substitute non-renewable energy sources and help us live a clean life.

How does the Improvable Ideas Board relate to the other activities you do in class?
The Improvable Ideas Board helps to bring Knowledge Building Discourse to life. It also works very well with Knowledge Building circles. Through Knowledge Building Circles, students bring these improvable ideas to the circle where students can keep building upon them.

How does the Improvable Ideas Board help you create a KB community in your classroom?

The Improvable Ideas Board provides an opportunity for equitable and inclusive teaching practices where the learning styles and the learning needs of all students are met. Since all ideas are improvable, valued, and accepted, every student's idea becomes an important resource in the Knowledge Building community. Even when you start with an extremely simple idea, for instance, 'water is an example of a liquid,' over time, a student can see their ideas growing and flourishing. This helps them to develop critical thinking skills and helps them to expand their knowledge of scientific concepts. The Improvable Ideas Board significantly supports student engagement because the ideas presented on the Board are the students' ideas — ideas that come from their inquiry, interest, prior knowledge, and research, as well as new knowledge gained from each other.

What have you learned about yourself in the process?

Through this process, I have learned the importance of student voice and student engagement. I've learned that teachers need to set conditions in their classrooms where they are building a partnership with their students. Allowing students to be the drivers of their own learning is really critical in meeting the diverse learning needs of your students. What I learned about myself is that I can still create a classroom culture that fosters a love of learning while sometimes taking a step back from direct teaching. Now my students are given opportunities to take the lead.

The process of using the Improvable Ideas Board also helps students make connections between the scientific theories they are investigating and their everyday lives.

What do students think?

- "It helps us to look at questions we never would have thought of otherwise, thanks to our increased knowledge."

- "From the prior knowledge that we already have, we're able to expand on that topic and further research so that we can dig deeper."

- "I'd feel I am able to express my opinions in a way that I'm comfortable doing it."

- "Once I expand on my idea and gain more knowledge about that specific topic or question, I feel more comfortable discussing it with my peers."

- "I read Michael's initial theory about how baking soda was a solid. But then I asked myself, how is that possible, because baking soda takes the shape of its container and it doesn't flow? So, I thought about cohesion and how the particles within the materials bond with other particles, and so that helped me understand how baking soda was dissolved in a fluid, but didn't have to take the shape of its container. If I didn't read Michael's initial theory, I wouldn't have thought about this question, or made a real-life connection."

How does this work help you engage the KB Principles?

Earlier on in my KB journey, it was hard for me to recognize how KB principles connect to each other. However, I'm now beginning to see how the KB principles are tightly interconnecting. For example, while students are engaging in the inquiry process and having mini-KB circles, I see how Rise Above blossoms. Students are synthesizing each other's ideas, developing their understanding, and deepening their thinking skills. I can also see Pervasive Knowledge Building happening as students are making connections between their own lives and the concepts and ideas we're exploring in class. For example, the students were really interested in exploring how oil spills impact our natural environment and human life. So, they are making much broader connections to global issues as well as understanding more deeply how the concepts, problems, or ideas we're exploring together positively and negatively impact our society.

What was your "Aha!" moment?

When I realized that assessment and evaluation is everywhere in a Knowledge Building community, you just have to give yourself permission to take the risk!

SECTION 4:
SECONDARY (9–12)

4.1 CREATING A KNOWLEDGE BUILDING COMMUNITY AT WESTSIDE

Written by Marisa Kurtz, Landry Britton and Toshi Gunn, Canadian and World Studies Teachers, UGDSB

INTRODUCTION

How does a new teaching approach not only take root in a classroom, but then spread to modify the approach that an entire department takes when developing a unit of study? This case study tells the story of how Knowledge Building became common practice in the History department at Westside Secondary School in Orangeville, and how Marissa Kurtz, Landry Britton and Toshi Gunn have used Knowledge Building itself to challenge each other and their practice to create a classroom environment driven by student intrigue, interests and questions.

WHY KNOWLEDGE BUILDING? WHY HISTORY?

Covering the entire history of Canada becomes an insurmountable task if you start to list the major moments since its constitution. It is for this very reason that Knowledge Building is such an appealing and appropriate approach for Grade 10 History. Teaching history through Knowledge Building allows for the content of the course to reflect student interest. Marlene Scardamalia states that one of the key KB Principles is "students working with real ideas, authentic questions" (2002). The emotional attachment students have with a question they themselves have created is a major lure in a course that offers such a vast amount of content. If students are asking strong questions they are invested in answering and then building on each other's responses, the teacher is then free to focus on how the curriculum-identified essential historical skills can be integrated and fostered. The driving questions the teachers started out with were: How can we get students to ask strong questions that address curriculum identified content, how then can we get them to invest, respond to and build upon those ideas using key historical skills, and finally, how can we begin to assess the growth of students?

KB PROVOCATION

"It's a miracle that curiosity survives formal education" — Albert Einstein

Move 1: How can we get students to ask strong questions that address curriculum identified content?

Any parent knows that the volume of questions a child has is never ending, and yet so often when students reach school age, we dictate what students will invest in and learn about in a course. The first opportunity that Knowledge Building offered was the opportunity for students to delve into a question that genuinely interested them. With genuine interest comes an intrinsic value of wanting to unearth an answer; it was this emotional attachment that we hoped we could tap into by having students ask questions about history. However, it quickly became apparent that before students could be cut loose to ask questions, there would first have to be explicit direction surrounding the idea of question-creation and the difference between a good, open question

and a weak, closed question. To respond to this, a three-part process was developed that directly introduced and instructed the students on how to ask good questions.

Part 1: Understanding the benefit of questioning
In order for Knowledge Building to become a staple within the classroom, it is important for teachers to have honest and open conversations with the way their students have been taught in the past and the way society used to be expected to learn, and to allow the students to engage in a dialogue about why using questions to build knowledge is impactful to their understanding. For a history classroom, this conversation is extremely important, as it allows for the promotion of a shift away from a mindset based around facts, stats, dates and names, to a mindset that is structured around the impact, significance and meaning of an event.

For this mindset shift to occur, introducing the students to the concepts of Bloom's Taxonomy is integral for the them to see the differences in styles of learning. Breaking down the idea of understanding an historic event by moving away from the Knowledge-based bottom of the Bloom's triangle (recalling basic information) and allowing students to see the benefit to their understanding by approaching an event from the top tier of Synthesis and Evaluation is crucial. From this point, it is important for teachers to use the Bloom's Taxonomy mindset to begin to demonstrate to students how it can reshape the way we can question an historical event. Providing students with examples of Bloom's question stem sheets allows them to see the value of a challenging, non-Googleable question that promotes inquiry and critical thinking, and breaks away from simply recalling information. These stems can be used as a guide for discussions with students on why inquiry-based questioning and Knowledge Building allows them to be stronger critical thinkers, both in and out of school.

Classroom visual aid: Critical thinking skills chart

Part 2: Critical Thinking Skills and Infographics
One of the most successful methods that we have utilized in allowing students to use peer-based questioning to guide their Knowledge Building within our Canada and World Studies classroom is allowing them to not only see the value of open ended questions, but also to allow them the time to practise creating critical thinking questions without fear of mistakes and grade pressure.

After learning about the Bloom's style of questioning and looking at examples of critical thinking questions, students are given infographics as a tool to inspire and provoke questions. They use infographics on random topics unrelated to the course content to practise. They are able to use

the many ideas that are consolidated into an infographic to help spawn questions that they have based on the content given. They use their understanding of Bloom's critical questioning to develop as many open-ended questions as they can, based on the infographic they have been provided with.

Part 3: Peer Based Development and Collaboration

Typically, the process of question development is created in a small group situation. The groups spend their time creating as many critical questions they can think of based on the source(s) they have been provided with. As they begin to develop their questions, they can collaborate and give feedback to help decide if a question is open enough to allow for a deep understanding and building of knowledge to take place. They can work together to tweak and reshape their questions in order to focus in on particular aspects that they would like to investigate, thus helping to inspire more personal engagement with their learning. The teacher can use this time to work with each group to provide assistance and feedback to help further push the students to develop challenging questions. Their goal is to create questions that:

Infographics helped inspire student questioning

- Can allow for opinion or judgment to be made

- Can have multiple viewpoints

- Are not 'Googleable'

- Promote inquiry and critical thinking

- May have a defined answer that is illusive or non-existent

This activity works well by allowing the students to create their questions on chart paper that they can tweak, cross out, discuss, change, alter and develop in the direction that they want to investigate. They will then have more personal ownership of the question and this will allow them to be more engaged in the process of Knowledge Building around it.

Once groups have created their questions, it is important to display the questions to the whole class to allow for all students to be involved in providing feedback, opinions and critiques of each question (with teacher facilitation). This allows each student the ability to see what strong questions look

like, and how certain questions can be tweaked to become a more open, critical-based question. This process of learning the value of questioning, understanding the Bloom's mindset, practising question development, and whole classroom based feedback can run from 1–2 periods in length. At this point, students can apply their newly acquired skills of creating questions for historical understanding to an event, time period, etc., using primary source documents to invoke historical inquiry for the introduction of a topic or the summation of a unit.

STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT

Move 2: How then can we get them to invest, respond to and build upon those ideas using key historical skills?

After students have landed upon a strong, open question, the issue becomes: How, as educators, can we not only control the initial volley of personal investment, preconceptions, and emotional attachments students might have to a question, but also help provide them with the requisite historical skills and research skills needed to deconstruct and begin to respond to the question by building knowledge? To confront the issue, another three-part approach was essential.

Part 1: Research Skills

The initial hurdle for students faced in responding to their constructed question was dealing with how to locate and identify reliable sources that addressed it. It was decided that at the Grade 10 level, students would start off in a limited research environment where a teacher could safely assume that the information used was found both with relative ease, and was scholarly enough to be reliable. Gale Powersearch provided by UG2GO provides students with a closed research environment that is easily accessed and searched. After students had direct instruction regarding how to perform effective digital research, they were then afforded the opportunity to utilize any platform to find research.

Part 2: Historical Skills

The second hurdle for students to tackle was applying the historical thinking skill of primary source analysis to their researched materials. The active use of Knowledge Building in history inherently involves students actively analyzing primary sources of the time period linked to their question. To ensure students were familiar with these essential skills, the delivery of daily lessons was adjusted to focus around a three-part lesson plan that involved an action portion where students would deconstruct primary sources using various scaffolds and support structures. This ensured that students had successfully interacted daily with the requisite skills by the time the Knowledge Building unit required it.

Part 3: Knowledge Building Through Knowledge Forum

Having a class open and confident enough to share their ideas and findings publicly so actual Knowledge Building can occur is tough enough; however, the difficulty increases if there is no platform for students to effectively grow and track their thoughts. It was important that a safe collaborative classroom environment was the norm for this course. Both daily group deconstruction of sources and large group discussions were essential in the intentional creation of a collaborative classroom environment. For the platform that provided an effective online workspace for students,

the department turned initially to Knowledge Forum, which is the technology that supports Knowledge Building pedagogy. Knowledge Forum is basically an open, communal discussion space where students can contribute ideas and thoughts in the form of multimedia notes. Knowledge Form proved to be a fantastic tool as it was very visual and is built to directly support a classroom participating in Knowledge Building. After the department had more experience, other methods of tracking were effectively implemented. A physical corkboard version of Knowledge Forum was used with success in essential level classes, and Google Docs was also successfully used in many Applied and Open level classes.

Move 3: How can we begin to assess the growth of students?

Knowledge Forum provided a perfect platform to monitor and track students' thought processes, growth and participation. Initially, we wondered, how does the tangled web of thoughts and ideas get assessed, and how will a student receive a mark that evaluates not only their participation in the process but the growth of their understanding of the course and curriculum? In response to these concerns, ideas from Sandra Herbst surrounding the triangulation of data and a more direct application of historical thinking skills were applied.

Part 1: Triangulation of Data:

To create an environment that is conducive to collaboration and encourages Knowledge Building, we have made it a priority to co-construct our Assessment for Critical Thinking (ACT). ACT is used to ensure that students are engaged with historical content in a respectful and thoughtful manner. We have made it a priority to ensure that our students experience an environment that encourages and embraces growth mindset. ACT is a formal evaluation process that incorporates growing success and curriculum documents and allows for the triangulation of data in the observation and communication sectors. Its formal nature allows for continual feedback and reflection which students can use to improve their skill sets.

Part 2: Historical Skills Evaluations:

The assessment of Knowledge Building has varied between teachers and classes. The way in which we assess Knowledge Building depends on the individual class's needs and the teacher's comfort level. Some of the ways we have assessed our students include seminars, essays, interviews, infographics, debates, and long answer responses. We feel that it is important to choose assignments that fit the strengths of the students we are teaching. We use Knowledge Building as the basis to build the knowledge that students will need to understand the larger topic at hand and then we choose assignments that best showcase the understanding that the students have gained.

NEXT STEPS

Recently we have been looking at a way to re-engage students' interest levels and overall success in our Grade 9 Academic Geography program. We decided to sit down before the school year started and redesign our whole Grade 9 Geography course to be based around the ideas and principles of Knowledge Building. Our goal was to make the course question-based to allow

students to investigate major Canadian and Global geographic issues. Each week students would be introduced to a new geographic issue (water, fossil fuels, immigration, first nations populations, etc.)

The next step for the History department is to integrate Knowledge Building more seamlessly into our Grade 10 Applied History stream. Knowledge Building lends itself well to applied learners as it allows them to explore in greater depth topics and ideas that spark their interest. As for a school goal, we have made connections to the Math department and been working hand-in-hand to modify and adjust the progress we have made in the History department so that Knowledge Building can take root in Math based courses as well.

REFERENCES

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4.2 KNOWLEDGE BUILDING: A (FUN)DAMENTAL SHIFT!

Written by Pieter Toth – Head of the Business Studies Department, HWDSB

INTRODUCTION

This case study tells the story of how students at Dundas Valley Secondary School's Business department are using Knowledge Building principles to dig deeper into their own learning processes to create authentic, meaningful artifacts and demonstrations of understanding. Pieter Toth, the head of Business Studies at DVSS, has been experimenting and exploring with Knowledge Building since before he even knew it!

HOW IT ALL STARTED:

Pieter was talking to a teacher from another school about the inquiry-based learning that was taking place in his classes and she asked him how long he had been working with the Knowledge Building principles. He had no idea what she was talking about! So he asked uncle Google about KB principles and his journey began!

Once he read through some of the materials online and had a basic understanding of what KB was all about, he discovered that he had already been using a lot of the concepts informally. When he first read about the 12 KB principles, it was a bit overwhelming and he had no idea how to operationalize it in any meaningful way connected to the curriculum expectations. So, he did what he usually does when he gets stuck on something, he took it to the students. One thing he always does with students in all of his classes is break down the curriculum expectations and action verbs to co-create a common student-friendly understanding of what each one means. For KB, that meant doing the same thing for the 12 principles.

What was your greatest challenge?
My greatest challenge was time. Time to read and study the information, time to allow students to play with the concepts, time to extend the projects to support and honour the directions and development of the students and their groups, time for outside connections to respond, and time to reflect on the experience and evaluate the impact on the course, the students, and on me, as the teacher. The key was to see this as a fundamental shift in how learning was taking place, not just another add-on, but an actual change in how we all, as co-learners, expected learning to happen.

Move 1: Discussing the KB Principles

In his Grade 12 Business Leadership class the overall concepts of KB were discussed as a large group, then students were divided into six groups, each group randomly choosing two of the principles. Then each group began breaking down the language, the actual words within each principle, the concepts, and exploring the impact each principle might have on them as learners. Pieter moved from group to group listening in and being a part of each discussion without forcing or guiding the process. After 20 minutes each group presented their principles and discussion

points to the class. After each presentation, the class discussed the principles as a group and crafted a student-friendly version, or tagline, for each of the principles.

In a single 75-minute class the students went from having never seen the 12 Principles to having co-created their own versions and linking them directly to their learning processes.

Move 2: Linking the KB Principles to curriculum expectations

With his Grade 11 Marketing class, Pieter's students were working through the inquiry process and had just completed gathering background information on a specific set of curriculum expectations. Each group was preparing to share their information with the rest of the class. This can be done in many different ways, and in this particular instance, Pieter had a group of students who had reached the limit of their endurance for Power Point presentations. As a class, everyone agreed that they would spend 20 minutes discussing options and planning a single-period activity that would allow them to share all of the information gathered by the four teams in a way that would make sure that every student was exposed to all of the information and build in time for meaningful discussion.

The students quickly came up with the idea of using a jigsaw method (without knowing it was called jigsaw of course) and identified a logistical problem of making sure students were in different groups each time they shifted, so that every student would have the chance to share with every other student in the class. In no time at all, they came up with the idea of using coded nametags to tell students which groups they would form for each rotation through the cycle. They decided to use a combination of numbers from one to five, four colour versions for each number, four animal pictures, and five vegetables to represent four distinct grouping rounds through the cycle. They chose the pictures and vegetables and then left it up to Pieter to work out the logistics so that students would not be in the same groups more than once. He spent the rest of that class, all of his prep and lunch, and could not make it work out perfectly. So, once again, he took it to the students in his afternoon class and asked them for advice. They worked it out using mathematical permutation tables in less than five minutes! Pieter then fabricated the nametags using a colour printer and laminator.

The next day, the students in his marketing class used the nametags to determine their groups and shared the information they had gathered with every other student in the class, each student taking time to share their information, respond to questions, and then be part of a small group discussion. The class did three rounds of sharing in total. As an added element, each of the teams was given three of the KB Principles (along with the student-generated tag lines) in each round and were challenged to somehow include the principles in the discussion portion of the round. Once all of the rounds were completed, each student was asked to stand and share an "Aha! moment" with the entire class relating to the day's activity. The majority of students' comments were related to the KB Principles and how they connected to existing processes within the class.

Move 3: Incorporating the KB principles in project design (after the fact!)

In the 2014-2015 school year, Pieter's Grade 12 International Business class was tasked with creating an artifact around one of the curriculum expectations relating to global trends. Students conducted research with the constraint that all of their electronic sources had to be from outside of Canada. Working in small groups, then as a class, students shared their information and created a model depicting six major global trends impacting international business.

In the 2015-2016 school year, Pieter's International Business class had to begin with the artifact created in the previous year and design a project to build on and share that knowledge with other students within the school board. The project they designed focused on finding Canadian companies that operated internationally, making contact, interviewing them about the six trends, and then creating a blog within the HWDSB commons to share the trends and the results of the interviews. The class felt it would be more effective for each group to share their information in a variety of formats including text, photos, and a video, all to be posted in the blog. Once the entries were completed, each group invited the companies to visit the blog and provide comments. Pieter's task, as assigned by the students, was to contact business teachers in other schools and invite them to view the blog and provide comments. He took it a step further and shared the blog at a provincial business conference, inviting teachers from many different Ontario school boards to visit and comment on the blog.

For the final step of this project, Pieter presented the KB Principles to the class, they discussed each principle briefly as a class, and then the students had to write a reflection on how the principles could be related to the blog project. For the next school year, the plan is to have the International Business class review the blog and design a project to take it further — whatever that might look like!

Move 4: Incorporating the KB principles in project design (with intentionality)

Once the students in Pieter's International Business class had been exposed to KB in the blog project, they were challenged to design a project around three related curriculum expectations and incorporate all of the 12 KB Principles. The result was an inquiry project focusing on each group of students gathering background knowledge through secondary research, sharing that knowledge within their team, developing inquiry questions to dig deeper into the topics, and then making contact with one Canadian educational institution and one non-Canadian educational institution (students, teachers, or professors) to build on their knowledge through discussion of the inquiry questions as primary research. Students had to individually demonstrate their understanding of the curriculum expectations by creating a visual representation of the information they had gathered and a business report outlining the process, the research findings, the use of KB Principles, and a reflection on the experience. Students also sent a photo of the visual representation to the educational institutions contacted and requested feedback on the final product (see Figure 1).
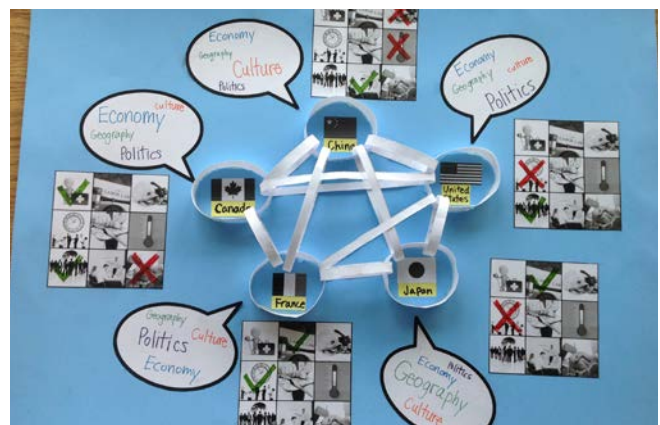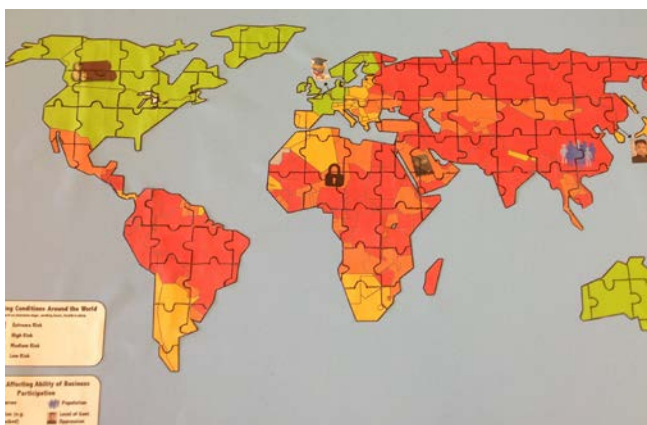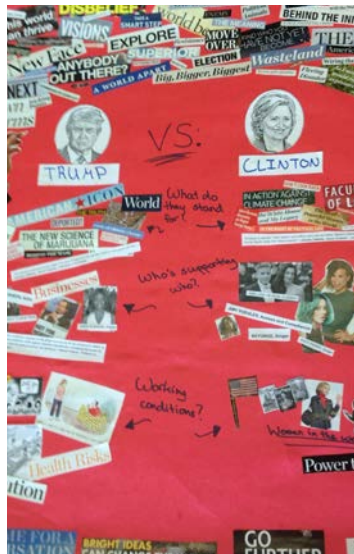
Figure 1: Examples of student demonstrations for Move 4

STRATEGIES FOR SUSTAINING THE USE OF KB PRINCIPLES

Over the past several years Pieter has been exploring a variety of cognitive thinking tools and initiatives in his classes as part of his own learning and development as an educator to increase the higher order thinking skills of his students. He has personally found the KB Principles useful in his own learning and is developing practical strategies for replicating that connection for his students. Pieter feels strongly that any strategy for sustainability must be linked to the curriculum expectations, be shared as widely as possible, seek feedback, and be as transparent as possible

for everyone involved. Several strategies include: creating visuals of the KB Principles and tag lines to be posted in the classroom, creating foam core boards outlining different processes related to each of the principles, using the HWDSB blog and other technology to share beyond the classroom, and inviting students to co-create resources as part of the project success criteria.

ASSESSMENT AND EVALUATION

Pieter believes that professional judgment is informed by three main areas of assessment and evaluation: observations, conversations, and demonstrations (products). In all of the courses that Pieter teaches he uses a combination of observation tracking forms, one-on-one and small group conferencing, class discussions, reflective exercises and assignments, and demonstrations of understanding (business reports, visual displays, class presentations, videos, blogs, etc.) to gather evidence and create a framework for frequent feedback. Pieter also spends a significant amount of time helping students build their reflection, critique, and self/peer feedback skills throughout each course.

NEXT STEPS

My next steps are to dig deeper into and explore the shared resources available for KB online through the Knowledge Forum. This is a tough step for me because I like to work with the students to co-create from the ground up so that we can all really and truly own the process. It makes me nervous to jump into something and encourage my students to jump with me, when I am not completely familiar with how it works.

TEACHER REFLECTIONS

What was your deepest learning, or, what was your aha! moment?
My deepest learning was about the interconnection between KB, the "Six C's" of deep learning, and the inquiry-based learning process. KB is both the umbrella and the end goal, the Six C's are the environment and catalyst, and Inquiry-Based Learning (IBL) is the process and vehicle to make it all come together. You can also add Integrative thinking as an important tool to deepen understanding of stance, models, and productive tensions within complex systems. It was incredible to experience, through the process of learning about and exploring KB, a model forming within my own mind about how these seemingly disparate concepts can actually all fit together and support each other within the framework of student achievement through the development of higher order thinking skills.

What did you learn about yourself in the process?
This process made me realize that I crave learning just as much as my students do, and that I am just as afraid to admit it to my peers.

4.3 KNOWLEDGE BUILDING IMPLEMENTATION: A GENERAL APPROACH OF THE CLASSROOM

Written by Glenn Wagner, Grade 12 Physics teacher, UGDSB

This section presents a five-stage approach for planning and implementing Knowledge Building in the classroom, engaging curriculum topics at both the elementary and high school levels. The timing for KB can last anywhere from several weeks to several months (or longer) depending upon the desired depth of the topic to be investigated. The teacher should ensure the key principles of Knowledge Building are understood and made transparent to students so that important principles, such as Idea Improvement and Community Knowledge, Collective Responsibility, will take place during Knowledge Building work.

STAGE 1: SELECTING A KNOWLEDGE BUILDING TOPIC

Examine your curriculum document for units of study that spark the imagination, create wonderment and hold relevance to students' lives. If possible, give students a choice of topic to explore within the chosen curriculum unit. This will heighten intrinsic motivation and result in a greater investment in time and energy learning about their topic.

STAGE 2: FOSTERING THE DEVELOPMENT OF QUESTIONS AND IDEAS

Step1. Once the curriculum topic has been selected, design a hook that works to promote interest and develops curiosity-based questions by students. The hook may consist of a news story, a thought-provoking question, guest speaker, field trip or high quality video. Using high quality, engaging video from the Web is likely the easiest and most convenient way to provide a hook.

Step 2. Using high quality video as a hook, students watch and develop responses to the following statements:

- "As I watch this video, I found the following ideas really interested me…"

- "Some questions I still have and/or things that I am still wondering about are…"

Do not ask students to summarize the video or to answer low-level questions about its content. Instead, foster curiosity and question-asking that will promote long-term interest in their topic.

Step 3. How questions are designed will impact students' level of thinking and collaboration. Introduce the difference between open-ended and closed-ended questions. Closed-ended questions are often fact-based questions that usually ask for simple information (e.g., How many stars are in our galaxy?). Open-ended questions lend themselves to explanation-based responses (e.g., Where did all the stars in our galaxy come from?). Although closed-ended questions develop important factual knowledge of concepts, open-ended questions develop knowledge about relationships between concepts that promote deeper, explanation-based thinking and learning.

STAGE 3: FORMING KNOWLEDGE BUILDING COMMUNITIES

Step 1. Once their questions have been developed, form students into a Knowledge Building Community (KBC). Ideally, each community size should range from four to six students to maximize effective collaboration between members. You can assign students into communities randomly, construct pre-assigned communities or have the students self-organize, based on their interests. The latter assignment is ideal and more deeply aligned with KB Principles, as it ensures each member of the community has the same heightened motivation toward the topic under investigation.

Step 2. Pass out chart paper or whiteboards and have each student in the KBC write down two or three questions that hold the most personal interest to them. Prompt students to identify whether their chosen questions are open-ended or closed-ended and encourage them to open any questions that may be closed.

Step 3. Ask students to work together to negotiate their numerous questions down to two or three that they believe are most foundational to begin their work. Foundational questions should promote learning and understanding of the broad ideas and key concepts outlined in curriculum expectations. To aid in the negotiations, share parts of the curriculum document with students. This may guide them to decide which questions will help them engage with the broad ideas and key concepts and to adjust their question accordingly. That being said, asking students to develop subsequent curiosity-based questions should be encouraged even if they divert somewhat from the curriculum expectations. This will encourage students to explore their interest in the topic that is student-directed and curiosity-driven. The remaining questions should be saved for later consideration as their foundational knowledge grows.

STAGE 4: BUILDING KNOWLEDGE TOGETHER

Step 1. Introduce the concept of Knowledge Building by sharing the 12 Principles of Knowledge Building. Focus on several of the principles, such as: **Collective Responsibility, Community Knowledge; Idea Improvement** and **Knowledge Building Discourse**. Demonstrate how pervasive Knowledge Building is in the world where objects (e.g., cell phones, automobiles) and ideas (e.g., art, language, scientific theories) undergo constant idea improvement often through collaborative engagement.

Step 2. A major outcome while working within a Knowledge Building community is the practice of collective responsibility through community discourse toward idea improvement. One simple way to convey the spirit of collective responsibility through community discourse is to have students practise that "to give knowledge is to get knowledge." Provide students access to authoritative sources where they 'get' knowledge from articles and relevant video on the Web, guest speakers, magazines, books and so on. Then provide students a public space where they 'give' their knowledge, where they post new knowledge, express their ideas and build upon the knowledge and ideas of others. This public space can be online using graphical based software, such as Knowledge Forum, which visually displays the growth of student discourse over time.

Offline spaces, such as classroom walls, can also provide a visual space for student discourse, especially for young learners (see pages 40–43 in the Knowledge Building Gallery, available via The Learning Exchange (http://thelearningexchange.ca/pdf/knowledge-building-gallery/).

Step 3. To facilitate idea improvement, encourage students to post curiosity-based questions for the community to consider that are relevant and likely to deepen the discussion. Asking students to "work a question, leave a question" provides students the opportunity to be curious but, at the same time, to understand their responsibility to their community to give knowledge and ideas in return. Where possible, share examples of collective responsibility and idea improvement from student work. Doing so provides students examples of what productive discourse and idea improvement looks like and the expectations when working as a Knowledge Building Community.

Step 4. After several days of Knowledge Building, students should meet face-to-face to process how their group is proceeding with their foundational questions. The basis of their discussion might centre around the following four questions: (i) Where were your knowledge advances and idea improvements the greatest and why? (ii) Where were they the least and why? (iii) How are you working together as a community? (iv) As a community, where do you collectively want to head next? The teacher may wish to post several key Knowledge Building Principles and have students refer to them explicitly during their discussions. Finally, the teacher provides a guiding role such as listening in on their discussions and providing feedback, designing subsequent opportunities to complete laboratory activities, conducting demonstrations and supplying just-in-time teaching as a result of community discussions.

STAGE 5: ASSESSING A KNOWLEDGE BUILDING ENVIRONMENT

Step 1. Towards the end of the Knowledge Building inquiry, students meet to assess and decide upon two or three strands within their topic they believe demonstrated significant collective responsibility toward idea improvement and knowledge development. Students are the 'experts' in this matter as they have the most familiarity with the content developed by their community.

Step 2. Once those strands are identified, the teacher can provide students with several presentation choices on how to demonstrate their understanding. Group presentations to the class that ensure individual accountability are an ideal method for evaluation. This stresses the importance that when working as a group they will be evaluated as a group. Alternatively, students can create individual portfolio summaries of one or more of the strands, highlighting not only content knowledge but also detailing how idea improvement developed through collaboration. The portfolio should directly reference the work of other members of the group, highlighting the collaborative nature of idea improvement in their work.

To see Glenn Wagner's students in action, and to hear more from him directly, visit The Learning Exchange (www.thelearningexchange.ca) and check out these video resources:

- Glenn Wagner, *A Secondary School Case Study*
  http://thelearningexchange.ca/projects/knowledge-building/?pcat=1102&sess=5

- Q&A with Glenn Wagner
  http://thelearningexchange.ca/projects/knowledge-building/?pcat=999&sess=3

SECTION 5: LEADERSHIP

5.1 KNOWLEDGE BUILDING: GROWING GOOD PEDAGOGY IN A CO-LEARNING AND LEADING STANCE

Written by Audrey Hensen, Student Achievement Officer (SAO), HWDSB

INTRODUCTION

Audrey Hensen is currently an Education Officer with the Ministry of Education on secondment from The Hamilton Wentworth District School Board, where she is an Administrator. This case study examines the leadership journey she traveled to initiate Knowledge Building in her K-8 schools, and support her teachers as they pursued in the implementation of new pedagogies to engage their students in deep learning.

KB PRINCIPLES – THE DRAW

The two principles that drew me to Knowledge Building were the concepts of **Democratizing Knowledge**, and **Idea Diversity** (Scardamalia, 2002). As a former Literacy Improvement Teacher I had worked extensively with teachers in their classrooms - and was determined to find ways to reach all students, to honor and unlock their thinking. Factors at play for me were student engagement and supporting underachieving/struggling students.

What is one of your deepest learnings?
Working with these two KB principles, requires taking a learning stance and understand that students always getting the 'right' answer is antithetical to nascent learning, inclusion, the exploration of ideas, student confidence, and students' perceptions of themselves as competent, valued learners.

Once students were engaged, how could we ensure that all felt valued for their thinking and their contributions to the collective wisdom of the group? As an administrator, I was looking at spread, depth and sustainability of this type of work in my school.

Democratizing Knowledge: All students are legitimate contributors to the shared goals of the classroom; all have a sense of ownership of knowledge advances achieved by the group. All are empowered to engage in knowledge innovation.

Idea Diversity: Different ideas create a dynamic environment in which contrasts, competition, and complementarity of ideas is evident, creating a rich environment for ideas to evolve into new and more refined forms.

KB PROVOCATION

Building upon current practice

Working with Denis Maika (Student Achievement Officer - Ministry of Education) led me to Knowledge Building. The foundational nature of the principles were universal and dovetailed quite naturally with pedagogies staff were working on, namely: Collaborative Inquiry, Gradual Release of Responsibility, and Rotman School Of Management's - Integrative and Design Thinking. Enhancing student's Critical Thinking skills was foremost in our minds and one of the school's and board's foci.

As a school leader, building teacher capacity and sense of efficacy was foremost in my mind – and Knowledge Building seemed to provide the right kind of entry point for a teacher seeking to deepen the learning of their students.

Equity and inclusion were also part of the plan. An invitational, natural way to reach our struggling or disenchanted students, instilling interest in learning and taking advantage of their natural curiosity was essential. Eliciting the thinking and voices of those who remained silent in classrooms was imperative. Getting teachers the right tools to do so was the starting point.

STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT

Move 1: Knowing Your Staff

I believe that to take care of the needs of the students in your building, you have to also take care of the needs of your staff. Teachers need to be respected for their professional judgment, and inspired to act upon their passion for teaching. The Knowledge Building Principles were focused, yet open enough to meet the varied approaches and strengths of the teachers at my school as we developed our community of co-learners.

Our Knowledge Building journey started with many conversations and questions. As a leader, I shared my wonderings informally, and sought out the views and understandings of staff members about how students learned. How might we more successfully include the voices of students? How could we unearth a variety of alternative viewpoints and perspectives, pushing our students to outside-of-the-box thinking? What could help us push Collaborative Inquiry into developing new thinking?

The school's Directions Team included divisional leaders, who had helped drive the school's vision with staff input from the primary, junior and intermediate levels. These leaders co-led the development of the School Improvement Plan.

Looking at Knowledge Building and how it might help facilitate our shared goals to develop critical thinking skills in our students gave us an entry point. We had many questions and began the journey by reading information and taking a 'field trip' to the Dr. Erik Jackman Institute of Child Study in Toronto.

Debriefing about what we had seen and what parts of Knowledge Building practice resonated with each staff member attending was critical. This information was shared with other staff members during divisional meetings.

The team we formed naturally began its own Collaborative Inquiry - and we were developing our own KB understanding together in order to explore practical applications of its principles.

To allow good work to blossom, I had to ensure that we had a Professional Development structure that was flexible and responsive to the needs of the teachers in the building. I also had to leave room for risk-taking, innovation and creativity- sharing success and clunker moments!

Move 2: Stepping In

Providing teachers with differentiated support, in response to whatever transpires in ongoing conversations and classrooms is important. Because teachers were doing the important work in their classrooms, they, in essence, were also leading my learning – turning theory into practice. Readiness to 'jump in' varied. Some teachers were merely curious, and others willing to read about the 12 Knowledge Building Principles. Each teacher with whom I worked saw themselves as addressing one or more of the principles in some form. Conversations and time were needed to allow the thinking to percolate and bubble up into practice. Innovation in practice emerged, as each teacher personalized their Knowledge Building practice. Each step in our co-learning was celebrated and shared within the team. I acted as a cheerleader and sounding board and added my own wonderings to the differing journeys. Common planning time and getting out of their way to allow teachers to take risks and try new ways of teaching was essential.

Move 3: Getting Traction/Scaling for Growth

For those teachers who dove more deeply into Knowledge Building, I aligned resources with their priorities, and worked to provide opportunities and resources needed to develop their practice. I looked for informal and formal ways to provide them with leadership opportunities to share and showcase their learning and the work of their students.

Developing a web of support for these teachers was important. The connections they made to a wider Knowledge Building community invigorated their practice. I facilitated their involvement in Knowledge Building webinars and Knowledge Forum training sessions with Dr. Monica Resendes and Ministry Student Achievement Officer Elaine Hine. Inviting school support staff, and like-minded teachers from other schools, as well as those who were just dipping their toes in, helped to begin to scale the growth of practice in the school. Investing in technology assisted with just-in-time classroom research and learning. Support and training from others legitimized our work. Staff told me that they felt invested in and valued. Assessing our students' growth became a topic of discussion, helping us to measure our success.

To encourage spread, I sought out ways to leverage the enthusiasm and leadership of these early adopters to build capacity within the school and paid attention to staffing and scheduling. Ultimately, these teachers moved their knowledge beyond their classrooms and gave workshops

to others on staff, staff workshops at the system level, and shared their work provincially. Their webs and leadership grew and spread!!

IMPACT ON CLASSROOM

I was awestruck by the power of the Knowledge Building practice. Students in these classrooms were energized. They spoke about their learnings and explorations in depth and with passion. Students were not just being fed a curriculum, they were uncovering and stretching curricula – and going deeper into the learning than they had previously. Teachers relayed stories about going beyond the curriculum while covering multiple expectations in authentic ways. Students' learning deepened as they invested in it through authentic inquiry. Questioning, research, sharing knowledge and seeking out new thinking became the norm.

What surprised you?

Students – rather than trying to get the 'right' answer – were asking questions. Not being in pursuit of 'getting it right' freed up real learning and provided a forum for more voices to be heard.

What was one "Aha!" moment?

The inclusive nature of Knowledge Building work created entry points for informed discussion. Each student could bring something to the table. Different ways of showing learning made for opportunities for differentiated assessment.

One very exciting outcome was the confidence it seemed to build in students as they became 'authorities' on new learnings. This work helped students engage and think more critically, and at times, transformed into a belief in self, and a greater sense of belonging in the classroom.

The transformative nature of the Knowledge Building work on the classroom dynamics served as a springboard to other conversations pertaining to Growth Mindset and Experiential Learning amongst the teachers.

REFLECTIONS

The greatest challenge in doing this type of co-learning, is 'not knowing' where it will end up in a society that is always looking for accountability. Trusting staff to take the ball and run with new learning signals to professionals that they are trusted and that their work matters. Learning through this process was an organic and energizing experience. It took place differently according to situations and inclinations of staff, as the KB principles were used in classrooms, to cover a variety of curriculum expectations.

Igniting enthusiasm in others for their work becomes possible when their work is seen as valuable – and that was true for both staff and their students. Investing in staff and then providing reflection time boosted collegiality provided a shared purpose and a sense of being respected. Co-developing a shared purpose – putting our kids at the center of all we do – can be a very powerful motivator for change at the school level.

What struck me the most was the added benefit of optimism and hope in the classrooms I saw digging into work using the Knowledge Building Principles. Knowledge Building has served as a wonderful launching pad for continuous teacher, student, and administrator growth.

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5.2 ACADEMIC PRESS AT
QUEEN ALEXANDRA MIDDLE SCHOOL

Written by Emma Nichols, Principal of Queen Alexandra Middle School, TDSB

INTRODUCTION

Queen Alexandra has been employing Academic Press as a teaching and learning strategy since they began Knowledge Building three years ago. As our understanding and experience with the KB strategies deepens, so too has the format and structure of our AP days at the school. Academic Press involves teachers across all subject areas, one grade at a time. In this case study, we will highlight how our Academic Press days are organized, and how we have the integrated the Knowledge Building Principles into the format for the day.

What is Academic Press?

Academic Press has traditionally been defined as all school members, including teachers, administrators and students, being motivated by achievement oriented goals, values and norms (Shouse, 1996). It is "the extent to which the school is driven by a quest for academic excellence," through its policies, practices, expectations, and norms" (Hoy, Sweetland & Smith, 2002, pg. 79; Lee, Smith, Perry, Smylie, 1999).

Through our Academic Press day at Queen Alexandra Middle School, we are able to develop a cultural system of shared norms, values and beliefs that emphasize and promote academic achievement. Academic Press has a focus on mastery learning.

Students from multiple Grade 7 and 8 classes gather together in the library on Academic Press Day.

KB PROVOCATION:
WHAT DOES ACADEMIC PRESS LOOK LIKE AT QUEEN A?

Academic Press occurs twice during each inquiry cycle — once at the mid-point, and once near the end of the cycle, just a few days before our Inquiry Showcase. Our AP days involve teachers, administrators, and students across an entire grade, coming together to take collective responsibility for the learning of the entire group.

The structure for the day involves everyone (teachers, students, and administrators) gathering together in the Learning Commons, setting common goals for the day, and engaging in KB Circles (some small, some large) as they share their ideas, plans, and learning journeys with each other. Staff members move between the groups, encouraging the students in their use of accountable talk strategies and the KB Principles.

What was your greatest challenge?
Some of our challenges have been:
Epistemic Agency — the gradual release of responsibility for setting goals and monitoring progress, from the teachers to the students.

Another challenge has been students failing to use Academic Press as an opportunity for feedback from teachers and other students, to advance their own knowledge. This is an active process, and many students struggle with it. Many students are used to taking a more passive role.

KB PRINCIPLES AT PLAY DURING ACADEMIC PRESS:

Epistemic Agency: During AP, the students are encouraged to set goals, engage in long-range planning, monitor progress, evaluate idea coherence, and support sustained knowledge advancement amongst all the students participating. The students are empowered to take charge at the highest levels.

Community Knowledge, Collective Responsibility: All participants in AP are considered to be legitimate contributors to community goals and need to take responsibility for advancing the community's knowledge, not just their individual learning.

Democratizing Knowledge: All participants are empowered as legitimate contributors to the shared goals; all take pride in the knowledge advances of the community. During the day, diversity of opinions are viewed as strengths rather than leading to separations along knowledge have and have-not lines.

Knowledge Building Discourse: The KB circles during Academic Press go beyond sharing ideas and opinions. They are intended to advance the knowledge of the group.

Symmetric Knowledge Advancement: Expertise is distributed within and between the learning communities and the various students from each class. "To give knowledge is to get knowledge."

STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT

- Build classroom culture

- Foster a Growth Mindset

- Start with student interests — know your students

- Reinforce strategies across all classrooms, all teachers

What surprised you?

"I was surprised at how useful it is to come together to unite in a common purpose"

"I was surprised by how much the students enjoy these days."

"I was surprised that you could get over 100 students together in one room, and they would be able to share technology, resources, and ideas and to stay on task."

What were some of your deepest learnings?

"The classroom culture, along with strong individual personalities, can derail the KB process in more unstructured settings."

"Activating an individual student's growth mindset is critical to the success of KB. It is when our students come to us with a strong fixed mindset, that we struggle the most."

"Class size and teacher-pupil-ratio has had a huge impact on the success of KB at Queen Alexandra."

Students and teachers sit in a Knowledge Building Circle.

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5.3 USING KNOWLEDGE BUILDING WITH TEACHER CANDIDATES

Written by Barbara Van Hatten, Contract Lecturer at Lakehead University, Faculty of Education

INTRODUCTION

Barbara Van Hatten is a Contract Lecturer at Thunder Bay's Lakehead University's Faculty of Education, with responsibility for the Junior Intermediate Professional Program On Site Delivery (PPOD) model. Students in this program spend a full day with an instructor in a local elementary school, where they receive instruction in Language Arts, Balanced Literacy, Teaching Literacy, Planning, Evaluation and Classroom Management. They also have the opportunity to work with classroom teachers and students. Barbara is also a CPCO (Catholic Principals' Council of Ontario) District Facilitator with the Leading Student Achievement: Networks for Learning project (LSA).

STARTING WITH THE KB PRINCIPLES

Today's teachers reach beyond classroom walls to participate in collaborative discourse and build knowledge in order to grow as professionals who can incorporate 21st century learning into their practice. Could having teacher candidates (TCs) participate in Knowledge Building Discourse help them become active participants in their own learning? Could this give them the skills they need to create the conditions for children to wonder, explore, inquire and build knowledge comfortably? By working for the LSA project, I have first-hand knowledge of the power of KB in classrooms across the province, and I wondered if KB principles could be applied to the work of the PPOD. With that in mind, I chose to focus on the following Knowledge Building Principles (Scardamalia, 2002):

Democratizing Knowledge: The creation of knowledge is not confined to a few. Instead, all are empowered to create and are recognized as valid contributors to advance community knowledge.

Knowledge Building Discourse: The power is in the discourse — in collaborative interchanges that lead to better solutions, better explanations and better ways forward.

Community Knowledge, Collective Responsibility: Team members produce ideas of value to others and share responsibility for the overall advancement of knowledge in the community.

Constructive Use of Authoritative Sources: To know a discipline is to be in touch with the present state and growing edge of knowledge in the field. This requires respect and understanding of authoritative sources, combined with a critical stance toward them.

What was your greatest challenge?

My greatest challenge was that university students who already have a degree have developed strategies and preconceived ideas of what they need to do to get their work done, survive and be successful. They arrived with a deeply ingrained mindset and were expecting to use the same practices in the PPOD program. Building everyone's knowledge, explaining their thinking openly, using discourse instead of argument, identifying areas they needed to understand more deeply, and supporting statements during discourse with evidence, seemed a challenge for some. Many had spent a great number of years looking for "filler" to complete assignments instead of building knowledge. What I was asking them to do was contrary to how they had functioned for much of their educational career. To counter the tendency to revert to these practices, I provided opportunities during class to practice this new approach.

KB PROVOCATION

KB is based on exploring "promising" questions; those questions that engage and excite the learner. Out of all the courses, the one that often worries teacher candidates the most is Classroom Management. I theorized that Knowledge Building would help students move their thinking beyond basic classroom management moves and routines toward a more holistic examination of what constitutes a truly transformative learning environment. We spent a morning examining aspects of a language/literacy program by discussing the criteria for assessing thinking, based on the work of Garfield Gini-Newman. We used a variety of teaching strategies designed to encourage discourse (Turn 'n Talk, Inside Outside Circle, Jig Saw) and candidates participated in small group problem solving. Following these experiences, TCs were asked to meet with a "Go To Group" of three to discuss the question: What is 21st Century Learning? Each student was given a note card and following the discussion was asked to use the KB Scaffold, "My theory is…" to record their individual ideas. These theories were then posted on a Knowledge Building wall.
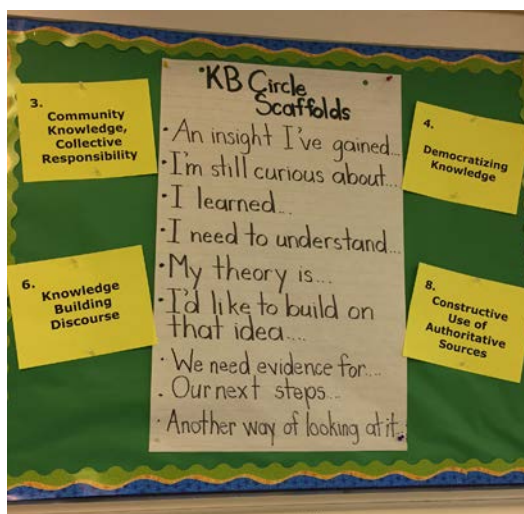
Criteria for assessing thinking
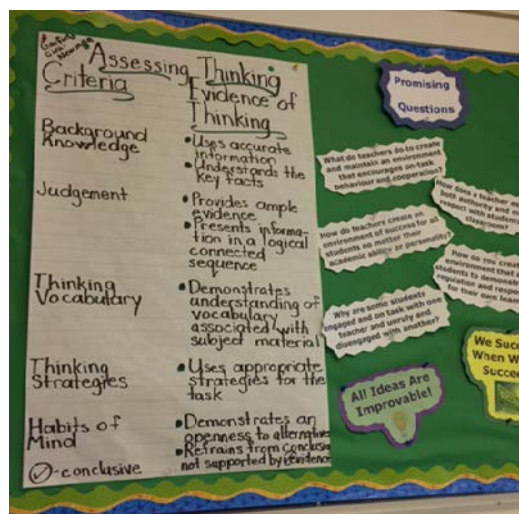
KB Scaffolds posted on the classroom wall.

STRATEGIES FOR SUSTAINING IDEA IMPROVEMENT

Move 1: Build Capacity and Use a Process for Discourse

Students were assigned two readings from their course texts, one on classroom management, and the other on 21st century learning. The classroom management reading outlined the characteristics of various management orientations; the most effective being an approach that created an environment that produced self-directed students who had internal motivation, collective responsibility, self-efficacy and a community view of the class. This complemented the reading on 21st century learning that talked about student engagement through intellectual engagement, ways of knowing, making meaning by working with others, constructing knowledge through community interactions and determining what we want students to know, do and be.

Teacher Candidates were introduced to a Knowledge Building Circle by watching a video from the LearnTeachLead site (http://learnteachlead.ca/projects/knowledge-building/).

The video featured a Grade 5 class effectively using a KB Circle to share and build knowledge through discourse. The focus for viewing this video was: Identify the characteristics of a KB Circle. Scaffolds used in the video were posted and candidates then participated in a KB Circle to discuss: What is classroom management? What does it involve? The discourse was videoed and promising questions asked were extrapolated and posted beside our Criteria for Thinking rubric.
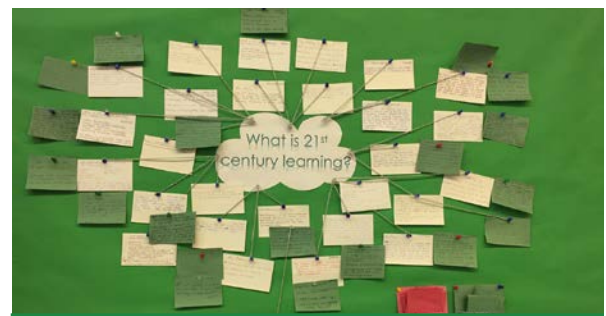
KB Wall focusing on the big question: What is 21st Century Learning?

What surprised you?

I was surprised by how quickly the comfort level in the room changed once PPOD members got to know one another better. A freer exchange of ideas began and students were actively using KB Circle scaffolds when discussing topics throughout the day. Some of the students used the KB Circle in lessons during practicum assignments, and I saw scaffold charts they had posted in some of the classrooms I visited. A few Associate Teachers, unfamiliar with Knowledge Building, indicated they were going to continue to use the scaffolds and Knowledge Building Circles once the teacher candidates left. I can also confirm what KB teachers have said — students do go beyond curriculum expectations as they explore and investigate their questions.

Move 2: Use KB Discourse Supported by Authoritative Sources to Democratize Knowledge

The following week, after additional reading, candidates used mini Knowledge Building Circles to describe their current thinking regarding transformative classroom environments, using the following provocations: What would you see students doing? What would you see the teacher doing? What would you hear the students saying? What would you hear the teacher saying? What would you see in the classroom? Participants in each mini circle then shared their most important thinking with the large group and provided evidence from their readings to support it.

Candidates were given time and access to contribute to our "KB Wall" on 21st century learning. They were encouraged to add "Evidence to Support" their theories (using green cards) or "Evidence to Discount" their theories (using red cards). They could build-on their original theory or someone else's theory.

The rationale for sharing knowledge in this way was discussed in relation to what we currently understood about 21st century learning. The principles of Knowledge Building noted above were introduced as integral to creating a 21st century environment. Candidates identified examples of how these principles had been incorporated in the course up to this point.

Move 3: Motivate and Recognize the Importance of Collective Responsibility, Community Knowledge and; Pose Promising Questions

Students reviewed the Classroom Management eReflection assignment due at the end of Term 1. The assignment asks Teacher Candidates to select an area of interest from a list of promising questions that they have created. Candidates are asked to share their learning in Knowledge Building Circles as well as on Knowledge Forum (KF) and independently use the community's knowledge to address the question in an eReflection.

After reviewing the assignment, candidates were introduced to promising questions using a concept attainment model of examples and non-examples. The questions posted from the KB Circles were used to support the concept.

Using their readings, as well as their experiences during Literacy Coaching sessions where they worked with teachers and students during literacy blocks, TCs recorded their wonders regarding classroom management on individual Post-it notes. In groups of four, they classified the questions as promising (explanation-seeking) or fact-seeking. They then participated in a Gallery Walk and provided feedback to other groups about the classifications or wording of the questions. The questions were revised by the authors based on descriptive feedback and were posted around the room. TCs wrote their names on 3 Post-it notes and identified their preferences by numbering each as 1, 2, and 3. Each Post-it was placed beside the three questions they wanted to explore. The Instructor used these expressions of interest to create Knowledge Building Communities of 4–6 students. Although they were not all able to get their first choice, the Instructor ensured that each of them was able to explore one of his/her identified questions.

Move 4: Use Knowledge Forum to Support Collective Responsibility, Community Knowledge and Democratizing Knowledge

Students were introduced to Knowledge Forum (KF) — the technology that supports KB pedagogy — during class, and were given time to explore the online tutorials (#1, 2, 6, 7 and 8) independently in order to learn the basics of the program. Essentially, a KF community is made up of different discussion spaces, called "views." Students contribute multimedia notes onto views, which serve as the community's collective knowledge space. KF views give student ideas a place to live and grow over time, and help make the community's thinking visible. For this class, a Welcome Page with the question, "What is 21st Century Learning?" was created for students to experiment with KF. At the end of class, a comparison was made between the KB Wall we had used and KF.

The instructor then created five more KF views using the promising questions students had created in Move 3 (five questions in total). Students were asked to make two contributions into the dialogue spaces in Knowledge Forum to help build their community's knowledge prior to the next class.

During the last three classes of the term, students were given class time to meet face-to-face to discuss promising ideas/avenues that needed further exploration, get help with any issues they might be having when posting, conduct research and post additional contributions. The quotes, "All Ideas Are Improvable" and "We Succeed When We All Succeed," were used to support ideas associated with 21st century learning. Before leaving for practicum, students posted their individual responses to the community's question on our D2L (Desire2Learn) site. TCs needed to include and cite notes from the community view that influenced their thinking and explain the note's importance in shaping their current response to their question.

What did I learn about myself?

I learned that I didn't have to be in control of everything. I just had to take a deep breath, jump in the deep end and try Knowledge Building, even though it was messy and a little scary at first. The learning is definitely in the doing and each time I plan activities designed to help my candidates understand it, I deepen my own learning, become more comfortable and even more committed.
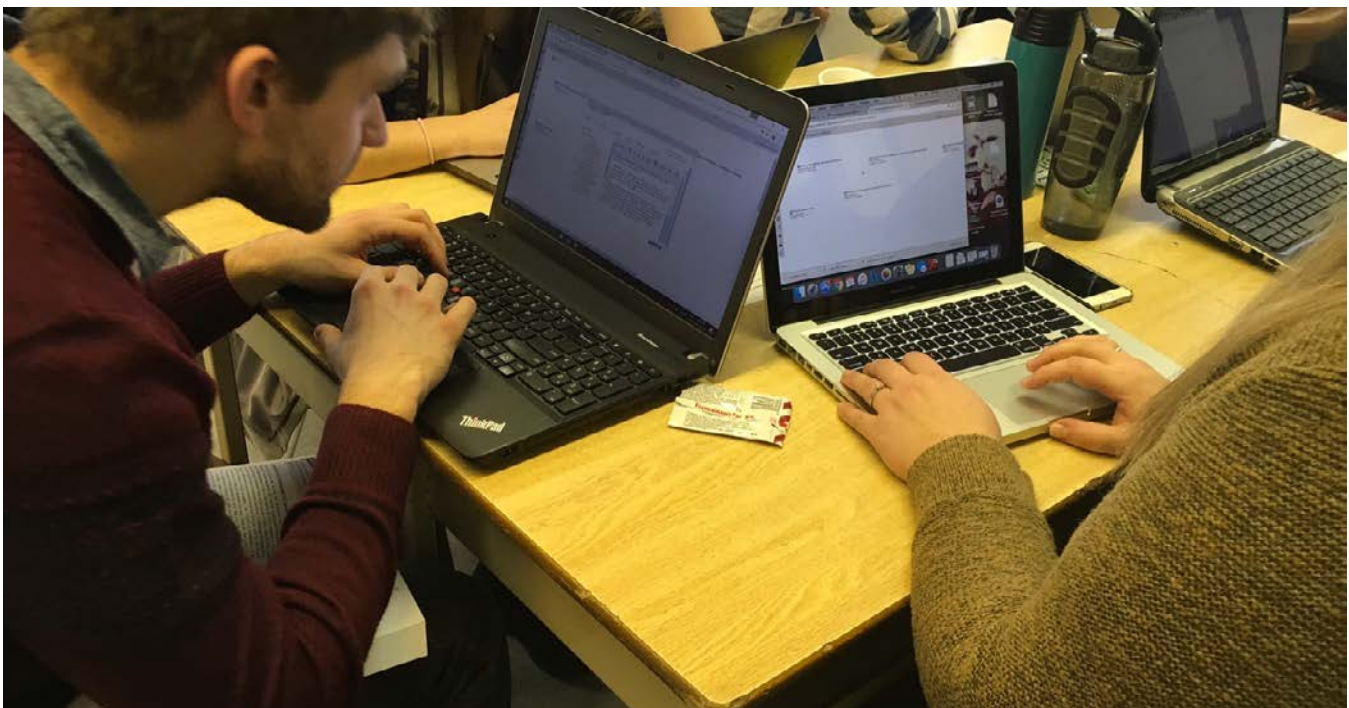
Students working on Knowledge Forum

> **What was your deepest learning?**
>
> I had a big Aha! moment from my experiences with KB in the PPOD. Classrooms, whether populated by elementary students or adults, need to feel safe, have a "We Succeed When We All Succeed" atmosphere and encourage risk-taking in order for thinking to move forward.
>
> Many Teacher Candidates found it difficult to participate in KB Discourse at first. They were uncomfortable voicing that they needed to understand something better and were hesitant to put forward a theory. A few admitted privately that they feared judgment.
>
> I had to take a step back in order to address these needs. It was necessary to build trust and establish positive community relationships among the PPOD members. I incorporated many opportunities for candidates to work with a wide variety of individuals during the day, often using random groups in an effort to build a collaborative culture. Each class contained community-building activities to help create the dynamics necessary for this kind of work. Lessons were designed so that random partners and small groups were working with ideas, and much of this work was supported by written and oral descriptive feedback rather than marks. Accountability was built in using Cooperative Learning strategies to encourage candidates to take responsibility for one another's learning.

NEXT STEPS

I will continue to design activities that demonstrate the remaining KB Principles so that candidates understand what needs to be in place in a KB classroom. We will also explore the concept of "Talking and Thinking Like an Expert" using the scaffolds identified in the Knowledge Building Gallery (http://thelearningexchange.ca/pdf/knowledge-building-gallery).

This should help teacher candidates develop a deeper understanding of how to incorporate a wider variety of scaffolds into different subject areas. I am also "tweaking" many of my assessment tools to more accurately reflect and assess Knowledge Building, using ideas I've found in the Gallery resource. My hope is that the work we've done will help teacher candidates incorporate a Knowledge Building culture in their own classrooms and provide them with a framework to move their future students more deeply into Knowledge Building Discourse.

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5.4 THE COURAGE TO BUILD: GETTING STARTED WITH KNOWLEDGE BUILDING AS WHOLE-SCHOOL EFFORT

Written by Karen Dobbie, Student Achievement Officer (SAO), HWDSB

INTRODUCTION

Karen Dobbie is presently a Student Achievement Officer with the Ministry of Education, on secondment from the Halton Catholic District School Board where she was an elementary school principal for 13 years. This case study explores the leadership journey she took with her teachers in order to explore the possibilities that Knowledge Building had to offer their school community.

STARTING WITH THE KB PRINCIPLES

Student engagement and a true sense of a love of learning within a supportive community is what I wanted to see most for all my students. These aspirations led me to focus on how we could engage students in the following Knowledge Building Principles:

Epistemic Agency: Students are given a voice and choice in their learning and allowed to engage in learning about what truly matters to them.

Community Knowledge, Collective Responsibility: A strong sense of community is established in order to value, support, and build on to one another's knowledge.

> **What was one of your greatest challenges?**
> In the beginning, this journey seemed quite a daunting task that might never gain traction. It seemed like an uphill battle. However, the productive struggles led us to our greatest accomplishment: student engagement. Student voice was honoured and we had truly shifted directions and allowed students to drive their learning. Epistemic Agency has taken root and was beginning to grow.

KB PROVOCATION: WHAT SPARKED OUR JOURNEY IN KNOWLEDGE BUILDING?

After being introduced to the pedagogy of Knowledge Building and Knowledge Creation and the practical application of the Knowledge Forum software at the 2013 Fall LSA Symposium, I found myself asking: How do I get my school to move in this direction? How does this relate to both my school improvement plan and my Board's improvement plan? It became very clear that Knowledge Building and the use of Knowledge Forum software supported and aligned beautifully with our goals at both school and board level around 21st century teaching and learning. We want to be able to equip all of our students with the ability to:

- work collaboratively and learn with and from one another

- share and think critically

- have a voice in their learning

- be creative and innovative

- be problem solvers

These are the skills that will enable our students to be successful in the world today.

As the LSA Lead for my board at the time, the challenge that quickly became apparent to me was how do we layer and unfold the pieces of Knowledge Building in order to spread this work, not just at my own school, but also among our principals and vice principals through our Principal Learning Teams, and eventually throughout the district. At the time this seemed like quite a daunting task!

Knowledge Building sounds great and I believe this is inherently good for all our students, but the challenge really lies in convincing others to share in this belief.

Move 1: Teacher Champion

At the school level, it is imperative that as an administrator you find a teacher who is willing to take on new challenges, someone who has a growth mindset, who won't give up when things get difficult and who, in the end, will be the champion of Knowledge Building. For me, that teacher was my Grade 5 Teacher, Jason Frenza, who was the school program team leader for the junior division.

Taking on the pedagogy of Knowledge Building is difficult and challenging for some of our most creative and innovative teachers. My teachers who were engaged with Knowledge Building had no difficulties telling me that it was one of the hardest things they had ever done in their teaching career. We know that when we engage our students in Knowledge Building, ultimately, we are letting our students take charge of their learning. For some teachers and — let's be honest — for some administrators, this is a very frightening situation.

However, once you overcome this initial fear and witness the learning and engagement taking place in the classroom, the teachers and administrators will tell you that you won't turn back. You will stick with Knowledge Building despite all the trials and tribulations.

Choosing your champion is crucial to the success of the spread throughout your school. Obviously, you want the champion to be a teacher whom other teachers respect; someone whom others will be open to learning from and with. Despite the challenges teachers have faced and are still facing today, what is always unanimous is that the learning taking place in their classrooms is much more meaningful, and the thinking and learning is going much deeper than what the classroom teacher would have accomplished with their students if they had followed a typical teacher directed unit of study.

Move 2: Co-Learning Stance

Having a teacher champion is one thing, but teachers need to know that you, as the administrator, are learning alongside them and that you are supporting them. One of the biggest challenges teachers struggle with is time. There never seems to be enough hours in the day. When you as the administrator are involved and learning with your teachers, you know what they are struggling with and you can give them permission to be flexible on the journey. One of my teachers was concerned with how long this process of Knowledge Building was taking. However, what kept this teacher motivated was that she saw firsthand that the students were engaged in their learning and learning from others; they were going deeper with their thinking and were asking rich questions and making meaningful connections to their everyday life. So, in the end, the extra time spent on the learning taking place in this teacher's classroom was well worth it, despite all the stress and worry.

What surprised us?

Parent engagement flourished as students went home excited to share their latest theories, questions, and wonderings around the dinner table. Through the use of the Knowledge Forum, parents were able to experience firsthand how their child was embracing this new way of thinking and learning!

Move 3: Scaling Up with Knowledge Building Capacity Building Sessions

At the school level, teachers explored and shared their innovative Knowledge Building practices at lunch-and-learn sessions and monthly divisional meetings. The honest sharing between colleagues allowed teachers to learn from one another and provided supports for those who were starting to play with Knowledge Building in their classrooms. Teachers were able to build their self-efficacy and see the value in this new way of teaching.

With the support of our Superintendents, we invited administrators and teachers to come as a team to three capacity building sessions on Knowledge Building that allowed both the teacher and administrator to engage in the learning together and formulate a plan to take their learning back to their home schools and spread the work at the school level.

Our three capacity building sessions took place over a course of 15 weeks. After each session, each school team went back to their schools charged with ideas and Knowledge Building practices to explore with their students. At each subsequent session, opportunities to each school team were given to share both their success and their productive struggles with their Knowledge Building journey.

Aha! Moment

Student and teacher efficacy increased as student thinking became visible in the classroom. The fears that took hold originally quickly began to dissipate as students immersed themselves in Knowledge Building and were excited to continue this new way of learning.

We explored together through each capacity building session the following questions:

- **Session One:** What does Knowledge Building look like in the classroom?

- **Session Two:** How does the Knowledge Forum provide a space where student ideas can live, grow, and develop organically?

- **Session Three**: How do we create Knowledge Building communities?

When we work together and share knowledge and engage in learning from one another, everyone achieves more. The professional learning networks for teachers, administrators, and superintendents are essential if you want to provide support and assist with scaling up.

To schools and districts embarking on this journey, my advice to you is to explore the possibilities that Knowledge Building has to offer. Take a risk and see where your questions, theories, and wonderings take you! The possibilities are endless.

> **Deepest Learning**
>
> Once you create supports and a culture built on trust and honesty, the 12 Principles of Knowledge Building will take root and flourish in your KB Community.
>
> Collective responsibility for idea improvement will become an everyday practice that will always lead to rich and meaningful learning for your entire community.