

2010 - IKIT SUMMER INSTITUTE PROPOSAL
ABSTRACT SUMMARY FOR MULTIMEDIA PRESENTATION
INSTITUTE OF CHILD STUDY LABORATORY SCHOOL

- **PLEASE NOTE:** Richard Messina will be out of the country until August 4th. May we please present our session on August 5th or 6th?
- Title:
Planting the Seeds for Growth in Knowledge Building and Teacher Transformation for Math and Science in Ontario Public Schools
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- Statement of the issue/problem:

Teachers often feel that Math and Science are content heavy disciplines which involve rote memorization of procedures, and official terminology.

How can teachers embrace and see the value in a more child-centred, idea-based approach for teaching in these subject areas?

With respect to Science / Environmental Education:

In 2007, Dr. Roberta Bondar and her Working Group submitted a compelling report to the Ministry of Education that would provide insight into the manner in which Environmental Education should occur in Ontario schools. This Report, entitled *Shaping our Schools, Shaping our Future* contained 32 recommendations, all of which were accepted by the Ministry and represented in the official Policy Framework for Environmental Education, *Acting Today, Shaping Tomorrow* (2009). One of the Policy recommendations contained therein carries the potential to clear the way for Knowledge Building to take its long awaited place in the public education system in Ontario:

“Environmental education will draw on effective learning strategies - including inquiry, problem solving, critical thinking, and assessing alternatives - that engage students personally in their own learning, connect them to the world they live in, and give them the systems thinking and futures thinking they will need to become discerning, active citizens.”

This recommendation not only makes learning about our natural world mandatory in the province of Ontario, but it also names Inquiry-based learning as a required pedagogical approach through which children should learn about the environment. Nevertheless, despite the institution of the abovementioned Ministry Documents, important questions still remain for teachers in the province of Ontario: **“How will they know what Inquiry-based learning looks like in practice?”** **“What core principles will guide their practice?”** and **“Can Knowledge Building happen in environments that do not have KF technology?”** and **“How can teachers incorporate Knowledge Building principles to their understanding of Inquiry and avoid**

the risk of adopting what Ann Brown refers to as “Lethal Mutations” of Knowledge Building? (Brown & Campione, 1996)

With Respect to Math:

Within the diverse urban student population of the Toronto District School Board (TDSB), approximately 40% of marginalized students (those traditionally underserved by the educational system, many of whom are students of colour and students living in poverty) are not meeting grade-level expectations in school mathematics, compared to 25% of their non-marginalized peers (TDSB, 2006). Mathematics is often used as a “gatekeeper” subject, regulating acceptance into sought-after university programmes and professions. Doing well in math may therefore be seen as holding “a passport to gain entry into practices that enjoy a different status in the wider society” (De Abreau & Cline, 2007), while doing poorly serves as a form of exclusion from further involvement in mathematics at university and beyond. Math achievement in school clearly becomes an equity issue that divides those who gain access to higher education and better-paying jobs from those who do not. Equitable access to math learning for all students is therefore critical.

This disparity in achievement between marginalized and non-marginalized students highlights the need for systemic change in the way we think about mathematics teaching and learning. Both traditional and reform methods of teaching mathematics need to be revisited, reconstructed and reinvented. The Toronto District School Board recently released its *Urban Diversity Strategy* (TDSB, 2008) which calls for the development of an inclusive curriculum (with a focus on big ideas) to respond to the gap in achievement. An inquiry-based model of teaching supports this call. In order to transform teacher practice, change needs to occur within schools and within teacher education programs in order to prepare teachers to meet the needs of the diverse student population. But what does equity in mathematics mean, and what would an inquiry-based mathematics program look like when equity is the focus?

- [How does your Initiative address the issue/problem:](#)

With respect to Science / Environmental Education:

The parallel guidelines between what the Ministry is asking of teachers in the public education system and the Knowledge Building principles that define the teaching and learning in ICS Lab School classrooms presented an exciting opportunity for the Lab School to share its work with the broader educational community. After all, one of ICS’ distinct characteristics as Laboratory School is its commitment to explore what is possible in education through research and classroom practice, and to disseminate those possibilities to the public education system.

The excitement for learning at ICS, which is the result of putting children’s questions at the centre in order to collaboratively improve both their individual and collective ideas, attracted a benefactor who was keen to see this learning replicated in classrooms across Ontario.

ICS has embarked on a two-year Environmental Education Initiative in 2009 to disseminate the Knowledge Building approach to Environmental Education with elementary school teachers in Ontario. Through this Initiative, ICS has forged links with four GTA elementary public schools. Since September 2009, we have been discovering together how the Knowledge Building practices that define Inquiry-based learning at ICS fit into different public education settings, all of which will inform a “How-to” Handbook for pre-service and in-service elementary school teachers in Ontario. Teachers from participating schools have attended Lesson Study at ICS, Professional Developments Days at ICS where they have observed and debriefed Knowledge Building Talks in ICS Classrooms, and they have received ongoing personalized support in their own public school classrooms.

Through a multi-media presentation, we would like to tell the stories of how teachers in these public school environments have begun to transform their teaching this year by representing core Knowledge Building principles to guide their practice of Environmental Education such as:

- Real ideas & Authentic problems
 - *“Knowledge problems arise from efforts to understand the world. Ideas produced or appropriated are as real as things touched and felt. Problems are ones that learners really care about—usually very different from textbook problems and puzzle”* (http://www.ikit.org/mvt/kb_principles.htm)
- Improvable Ideas
 - *“All ideas are treated as improvable. Participants work continuously to improve the quality, coherence, and utility of ideas. For such work to prosper, the culture must be one of psychological safety, so that people feel safe in taking risks—revealing ignorance, voicing half-baked notions, giving and receiving criticism”* (http://www.ikit.org/mvt/kb_principles.htm)
- Pervasive Knowledge Building
 - *Knowledge building is not confined to particular occasions or subjects but pervades mental life—in and out of school.* (http://www.ikit.org/mvt/kb_principles.htm)
- Constructive Uses 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.”* (http://www.ikit.org/mvt/kb_principles.htm)
- Knowledge Building Discourse
 - *“The discourse of knowledge building communities results in more than the sharing of knowledge; the knowledge itself is refined and transformed through the discursive practices of the community—practices that have the advancement of knowledge as their explicit goal.”* (http://www.ikit.org/mvt/kb_principles.htm)

Our presentation will include examples of “Environmental Knowledge Building” from public School classrooms as well as videos of teacher commentary of their experience along this journey of “transformation”.

With Respect to Math:

In an effort to explore how to best re-engage marginalized students and to meet the needs of early learners in mathematics, this initiative is an attempt to support teachers in inquiry-based mathematics teaching with an equity focus. The project involves professional development with classroom teachers who are part of a participatory action research group working towards promoting equity in an inner city school located in one of the city’s high needs neighbourhoods. Participatory action research (PAR) is a form of knowledge building with a social justice focus. PAR grew from action research and participatory research but is different from both and has its roots in social justice and brings “inquiry, learning, critical consciousness, community building and social change” (Rutman *et al*, 2005, p.155).

The school’s PAR project focused its inquiry on recess in a collaborative effort involving students, in-service and pre-service teachers, parents, community members and school administration.

Through a multimedia presentation, participants in this presentation will be able to see how an inquiry-based, student-centred approach guides curriculum and raises levels of student engagement and teacher transformation.

- [What you have learned/progress to-date:](#)

With respect to Science / Environmental Education:

The Professional Development that we have been providing teachers in four partner schools across the 2009-2010 school year has shown that Knowledge Building principles are possible in public school settings.

- Teachers seemed to benefit from validation from another teacher in order to trust that the pursuit of children's **Real Ideas, Questions, and Authentic Problems** would lead to valuable, integrated learning experiences that would also connect to Ministry curriculum expectations. Many teachers were pleasantly surprised to discover that children's questions or "authentic problems of understanding" more often than not connect to different strands and areas of the curriculum. This was an important revelation because meeting curriculum expectations is a common concern among public school teachers for implementing and Inquiry-Based, Knowledge-Building approach to practice. Once teachers realized this, they were more willing to use children's ideas to drive the learning in the classroom.
- Teachers noticed a difference in the manner in which students discussed and expressed their thinking toward the end of the year. Children became more familiar with the notion of **Improvable Ideas**, and less concerned with only putting for the "right answer". They were more willing to put forth "half-baked" ideas.
- KB Language began to **pervade** school and home life for students. Teachers reported a mother describing surprise at the "theorizing" that her kindergarten daughter was positing at the dinner table. Knowledge Building language such as "I wonder" or "My theory" began to permeate children's spontaneous conversations and observations of the natural world after several months of engagement in this process.
- In the consultation of **authoritative sources**, a Grade 4 class researching their theories have begun to look at information more critically than before. For instance, one student group researching climate change found two different authoritative texts containing conflicting stance on the existence of climate change, yet both texts also contained supporting evidence in favour of their respective arguments. The students had to reconcile the differing authoritative sources with their own ideas. The school principal also reported: "Our most recent CASI results (Comprehension Attitude Strategies Interests) show that the children in the grade 4 class have made gains in their depth of understanding. They are thinking much deeper and more critically about the text that they read since being involved in this project."
- **Knowledge Building Discourse**, where children discuss, negotiate, and build on each others ideas, represents in important forum in a public education setting, for children to contribute and make public their knowledge to the collective group in the absence of KF technology. Teachers scribe students' comments on chart paper for display in order to archive and create a reference point for students' further knowledge advancement work. One teacher created a wiki on which students contributed to their own view, as well as those of other groups.

Other Points:

- Students enjoyed this manner of learning: "*I like learning this way...talking about questions and sharing theories. It's really fun!*"
- Teachers were especially inspired by observing a seasoned teacher facilitate Knowledge Building talks with his or her students.
- A common concern for teachers was the time it takes to facilitate Knowledge Building based learning

With Respect to Math:

- Teachers reported an increase in student engagement in mathematics, especially from students who often did not contribute to classroom discussions.
- Teachers reported a feeling of renewed vitality in their teaching that came from seeing the students' levels of engagement with an inquiry-based, knowledge building process.
- Students were able to use mathematical ideas to represent data and to communicate what changes were necessary to make the playground a safer and more inclusive environment.
- Students reported feeling that mathematics could empower them to take action on issues that affected their lives.
- School-wide changes were made based on the results of the students' work around mapping recess and identifying issues in the playground and creating equitable solutions.
- The school principal reported more parental engagement in the school due to the students sharing their work at home, in the school halls, in presentations to the parents' council, to the school administration, etc.

Major project goals: What do you hope to achieve/accomplish?

With respect to Science / Environmental Education:

The main objective is to develop and disseminate a comprehensive "how to" handbook, to be available on the ICS website in 2011 for pre-service and in-service elementary school teachers in Ontario.

The Handbook, entitled ***Unearthing Natural Curiosities: Digging Deeper with Children to Uncover Big Ideas***, will include examples of "Environmental Inquiries" that have unfolded in both ICS classrooms and its public school partners to show how elementary school teachers can make the shift to student-centred, and Idea-centred learning, while connecting to Ministry Expectations.

With Respect to Math:

The project will have an impact on the way elementary students perceive mathematics and how pre-service and in-service teachers think about designing inquiry-based learning environments in mathematics that are inclusive and accessible. Through videotaped examples of students and teachers doing inquiry and reflecting on the process, teachers will be able to view the power of moving toward a student-centred, inquiry-based, participatory action research model of teaching and learning.

Bibliography

Bereiter, C., & Scardamalia, M. (accessed, June 17, 2010) Knowledge Building Principles.
http://www.ikit.org/mvt/kb_principles.htm.

Brown, A.L., & Campione, J.C. (1996). Psychological theory and the design of innovative learning environments: On procedures, principles, and systems. In L. Schauble & R. Glaser (Eds.), *Innovations in learning: New environments for education* (pp. 289-325). Mahwah, NJ: Erlbaum.

De Abreau, G., & Cline, T. (2007). Social valorization of mathematical practices: the implications for learners in multicultural schools. In Nasir, N.S. & Cobb, P. (2007). *Improving access to mathematics: diversity and equity in the classroom* (pp.118-131). New York: Teachers College Press.

Rutman, D., Hubberstey, C., Barlow, A., & Brown, E. (2005). Supporting young people's transitions from care: reflections on doing participatory action research with youth from care. In L. Brown, & S. Strega (Eds.), *Research as resistance* (pp. 153-179). Toronto: Canadian Scholars' Press.

Toronto District School Board (2006). The TDSB Grade 9 Cohort Study: A Five-Year Analysis, 2000-2005. Toronto, ON: Author.

Toronto District School Board. (2008) Urban Diversity Strategy. Toronto, ON: Author.