Natural Curiosity 2nd Edition

A Resource for Educators

The Importance of Indigenous Perspectives in Children's Environmental Inquiry

Doug Anderson, Julie Comay, and Lorraine Chiarotto

Land Acknowledgement

We would like to acknowledge this sacred land on which the University of Toronto operates. It has been a site of human activity for 15,000 years. This land is the territory of the Wendat and Petun First Nations, the Seneca, and most recently, the Mississaugas of the Credit River. The territory was the subject of the Dish with One Spoon Wampum Belt Covenant, an agreement between the Haudenosaunee Confederacy and Confederacy of the Anishinaabe and allied nations to peaceably share and care for the resources around the Great Lakes. Today, the meeting place of Toronto is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work in the community, on this territory.

Revised by the Elders Circle (Council of Aboriginal Initiatives, First Nations House, University of Toronto) on November 6, 2014.

A Note on the Cover Design

Turtles are significant to many cultures across the world. In the Anishinaabe Creation Story, The Great Flood, the turtle, a symbol of wisdom and kindness, has the responsibility for carrying the Earth on his back (Conroy, Wheatley, & Johnson, 2010, p. 47). Turtle Island is the land upon the turtle's back, also known as North America.

Waynaboozhoo put the piece of Earth on the turtle's back. All of a sudden the noo-di-noon (winds) began to blow. The wind blew from each of the Four Directions. The tiny piece of Earth on the turtle's back began to grow. Larger and larger it became, until it formed a mini-si (island) in the water. Still the Earth grew but still the turtle bore its weight on his back. (Benton-Banai, 1988, as cited in Bell, Wheatley, & Johnson, 2012, p. 47)

The placement of *Natural Curiosity* on the turtle's back makes explicit the relationship between Indigenous perspectives and children's environmental inquiry.

Praise for *Natural Curiosity 2nd Edition*

Natural Curiosity 2nd Edition is an excellent resource for educators seeking to act as co-inquirers with their students and share the learning spirit while fostering relationship with our natural kin and relations. With a newly expanded lens on Indigenous perspectives and worldviews, this resource encourages teachers with philosophies, rationales, tools and activities to help them grow ecological and social justice citizens. A timely resource and highly recommended.

— **Jean-Paul Restoule**, Ph.D., Professor and Chair,
Department of Indigenous Education, University of Victoria

Natural Curiosity is a great gift not only to North American educators, but to people around the world. As this good book makes clear, the often-Eurocentric deconstruction of reality does not represent reality. The point of natural curiosity is not to study a *thing*, but to inquire into the connections and relationships of all things and spirit, seen and unseen. This book is an inspiration, a doorway into a web of life and truth.

— **Richard Louv**, Author of "Last Child in the Woods" and
"The Nature Principle"

Perhaps the greatest strength of this edition is the care taken to ensure that Indigenous peoples, along with their knowledges and pedagogies, are understood as contemporary, and that they have important contributions to make to environmental education … This text is remarkable in that it takes theory, including Indigenous knowledge, and applies it through storytelling from both an educator's and child's perspective ... *Natural Curiosity* takes the important step of highlighting broader societal obligations such as those laid out by the Truth and Reconciliation Commission … The pedagogy employed offers a sensitive and respectful way to present challenging topics. I much enjoyed the stories by educators and children alike and how art and creative expressions were used to convey profound teachings.

— **Deborah McGregor**, Associate Professor, Osgoode Hall Law, School
& Faculty of Environmental Studies, Canada Research Chair, Indigenous
Environmental Justice, York University

In *Natural Curiosity 2nd Edition*, Western ways of relating to nature intermingle with Indigenous ways. The book respects the integrity of both coexisting cultural perspectives. By understanding both, readers and their students will gain greater curiosity and deeper insights to make sense of the world around them or to solve problems.

— **Dr. Glen S. Aikenhead**, Emeritus Professor, Aboriginal Education
Research Centre, College of Education, University of Saskatchewan

I must admit to having a case of Canadian envy, and the second edition of *Natural Curiosity* is a good example of why I feel this way. There aren't any education resources like *Natural Curiosity* in the United States. The wedding of theory and practice, the case studies of real live classroom curriculum, the vibrancy of childrens' and teachers' voices about their environmental work--it's compelling and exciting. And the integration of Indigenous perspectives as part of the warp of the fabric of environmental inquiry makes the whole endeavor deeply equitable and just. If I teach my Place-based Education course again, this book will play a leading role.

— **David Sobel**, Senior Faculty, Education Department,
Antioch University New England

The second edition of *Natural Curiosity* from Indigenous perspectives gives educators practices and pedagogies for helping learners develop a much needed deeper sense of place. We are at a significant moment in time where we need more sustainable and ecologically just ways of being in this world. This resource provides rich possibilities for all of us to achieve shared commitments to reconciling our relationships with land, people, and place.

— **Dr. Jan Hare**, Associate Dean for Indigenous Education,
University of British Columbia, Unceded Musqueam Territory

My students and I found the first edition of this text book to be very engaging and accessible … With the incorporation of Indigenous perspectives, the 2nd edition is an even better fit! The text is an excellent balance of theoretical perspectives illustrated with practical examples from a range of classrooms. I particularly enjoyed drawing on the actual transcripts from teachers and students as they engaged in knowledge building discourse and explored students' questions. The content also complements education transformation that is occurring in British Columbia right now.

— **Rachel Moll**, PhD, Chair, Graduate Programs and Professor,
Faculty of Education, Vancouver Island University, BC

The second edition of *Natural Curiosity* is an excellent resource for educators wanting to include Indigenous perspectives in their environmental inquiry with learners of all ages. More than a "how to guide", this text engages educators in learning from Indigenous thought.

— **Susan D. Dion**, PhD, Associate Professor, Indigenous Education,
Faculty of Education, York University

This book should be held close to the heart of all educators in Ontario. It synthesizes the breadth of current theory and provides a wide variety of critical perspectives. The 2nd Edition of *Natural Curiosity* acts as a beacon, lighting the path along which we should and must selectively and collectively evolve. It should be embraced by all and will, no doubt, stand as a substantial part of the foundation upon which the future of education in Canada can be built.

— **Matt Brundle**, Assistant Coordinator/Site Supervisor,
Toronto Urban Studies Centre, TDSB

Natural Curiosity 2nd Edition is a resource that should be used in every classroom across Canada … Stories that include the importance of reciprocity, spirituality and place-based learning will support exemplary educators with a land-based teaching practice further connect with their students to the natural world. Through living in harmony, mutual sustainability and heightened environmental consciousness, it is what many Indigenous people and Indigenous nations around the world have already believed and practiced on a daily basis through prayer, meditation and thanksgiving since time immemorial. Quite simply, it is called "all my relations."

— **Stephanie Roy**, M.A., OCT, Executive Director,
Kenjgewin Teg Educational Institute

This timely and useful resource supports the increasing recognition of the importance of embodied learning in nature. Challenging Euro-Western child-centered pedagogies common in nature and environmental programs, it acknowledges and honours Indigenous ways of knowing and being and the pedagogical significance of connectedness and relations with place, materials, plants, animals, land, water and weather.

— **Louise Zimanyi**, Professor, School of Health Sciences, Early Childhood Education, Humber College

This second edition of *Natural Curiosity* feels like an invitation and a gift. The text invites me to respect the relationships and ways of knowing that Indigenous peoples have had with this land since time immemorial. It is also an invitation to deeply understand that as a guest on Turtle Island, my role is to listen and learn. The gift is that of responsibility – now that this knowledge has been shared with me, how will I take it up with my students? From its first pages, this resource invites non-Indigenous teachers to welcome these understandings into our teaching with humility. Thank you to Doug and the entire team for this important work.

— **Angela Nardozi**, PhD, OCT, Author Listen & Learn newsletter, Sessional Lecturer, Ontario Institute for Studies in Education

At ALCDSB we have been on the integrated environmental inquiry journey since 2011 when the first *Natural Curiosity* resource came out. Since that time we have embraced more deeply student voice in the learning process and have benefited greatly as a result. The second edition of *Natural Curiosity* comes at an important time for us as it nurtures another voice, the voice of the land through an Indigenous perspective. It is through this perspective that we become more fully aware that as human beings we are "of the land" not separate from it. When we educators begin working with our students in this way a much different learning journey begins, one that reinforces our collective call to care for the sacred gift of creation.

— **Mike Bibby**, Outdoor and Environmental Education, Special Assignment Teacher, Algonquin & Lakeshore Catholic DSB

Natural Curiosity (First Edition) opened a door and inspired many educators, including myself, to engage in and shift to an environmental inquiry stance – outside! The professional development and conversations I was involved with repeatedly left educators wanting MORE. After the anticipation of this second edition, I am confident it has met its objective to go deeper. This is not a resource that will sit on a shelf, rather it will be weathered and folded from being used to align what was always meant to be connected: environmental inquiry and Indigenous ways of knowing. Congratulations on yet another outstanding resource that will set the stage for future caring environmental citizens.

— **Tanya Murray**, OCT, Ontario Environmental Educator, York Region Nature Collaborative, Child and Nature Alliance of Canada

Natural Curiosity 2nd Edition is a welcome, practical and vital evolution of the original edition of this resource that first appeared in 2011 with such promise. Where the first version was successful in promoting meaningful inquiry in outdoor natural space, the second edition will do that and more. For education, the practice of recognizing and applying indigenous ways of learning will inspire educators in rich new ways of teaching, and students in deep personal learning. For society, delivering on our collective commitment to reconcile Indigenous and non-Indigenous cultures to move into a future with greater hope, understanding and partnership is crucial. In short, the sacred educational ground of this important new resource needs to be an honoured path on which all educators tread.

— **Bill Kilburn**, Program Manager, Back To Nature Network

The Laboratory School
Dr. Eric Jackman Institute of Child Study
UNIVERSITY OF TORONTO

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www.naturalcuriosity.ca

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SECOND EDITION

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In 2014, members of the Laboratory School's Environmental Education Initiative team realized, through conversations with educators from Johnny Therriault School on Aroland First Nation, how much there still was to learn about situating Indigenous perspectives into Canadian curricula. Thank you to the Elders and educators of Johnny Therriault School for starting us on this journey, and for motivating us to find support for the second edition.

Our sincerest thanks to our donors; without you it would not have been possible to write this resource. The second edition of *Natural Curiosity* was produced with funding from TD Friends of the Environment, The Norman and Marian Robertson Foundation, and private donors.

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Finally, we owe our deepest thanks to all the children in the classrooms represented here for joining us on this journey. Without their willingness to follow their curiosity, try things out, and wholeheartedly embrace their teachers' experimentations with environmental inquiry, there would be no resource.

The Dr. Eric Jackman Institute of Child Study Lab School is grateful to the writers and contributors to this resource. Julie Comay so beautifully revised and enriched our first edition, after extensive research, reading, and carefully interviewing Lab School teachers, to express our pedagogy as we currently understand it. Lorraine Chiarotto created the visionary first edition of this resource, upon which this revised edition is built. Ed Burtynsky has shown unwavering support and encouragement. Andrea Russell has been dedicated to growing Natural Curiosity into a transformative professional learning program and laying the groundwork to make this edition possible. Haley Higdon's passionate commitment to environmental sustainability and nature-based learning has been an inspiration as she masterminded the creation and production of this resource. Finally we thank Doug Anderson for his powerful, thought-provoking prose which unfolded from two years of heartfelt discussion and reflection. His writing is an immense gift to us all.

Richard Messina, Principal
Chriss Bogert, Vice Principal

Introduction to the Second Edition

When the first edition of *Natural Curiosity* came out in 2011, its goal was to introduce an inquiry-based approach to environmental education. This approach was situated within a longstanding tradition of progressive schooling that places children at the centre of their learning, responds to their lead as they construct meaning through engagement with the world, and supports the emergence of a community of learners.

In 2009, a key document issued by the Ontario Ministry of Education (*Acting Today, Shaping Tomorrow*) called upon educators to mobilize their teaching around issues of environmental education. In response, the first edition of *Natural Curiosity* set out to demonstrate how an inquiry-based approach could enable educators to meet Ministry expectations as students absorbed themselves in learning shaped by their own questions and ideas. *Natural Curiosity* offered educators a four-branched framework that included Inquiry-based Learning, Experiential Learning, Integrated Learning, and Environmental Stewardship. The second part of the resource brought these theoretical orientations vividly to life as teachers described how they embraced the possibilities offered by this approach and, with their students, found new ways to meaningfully and joyfully engage with the natural world.

About the Dr. Eric Jackman Institute of Child Study Laboratory School

Natural Curiosity was developed by the Laboratory School at the Dr. Eric Jackman Institute of Child Study, which is part of the Ontario Institute for Studies in Education (OISE) at the University of Toronto. Established under the leadership of Dr. William Blatz in 1925, the Laboratory School is a Nursery to Grade 6 elementary school dedicated to exploring what is possible in education, operating in conjunction with an MA in Child Study and Education teacher certification program and the Dr. R.G.N. Laidlaw Centre for multidisciplinary research in child development. The Lab School philosophy emerged from three foundations: an understanding of the unique development of children; Dr. Blatz's theories about the critical role of security in children's education; and John Dewey's ideas for child-centred inquiry. Today at the Lab School, these beliefs remain central to our program, while we continue to expand our understanding of what these guiding principles might mean for school communities in this century.

Impact of the First Edition

Since its initial launch, *Natural Curiosity* has gained widespread implementation in schools, school boards, and ministries of education across the country and internationally. As environmental education becomes a priority for schools everywhere, the resource continues to be in high demand. *Natural Curiosity*'s message has been disseminated through partnerships with schools, communities, and faculties of education, professional development workshops, and by word of mouth among enthused practitioners. In addition to high rates of electronic downloads of both French and English versions, more than 20,000 paper copies of the book have been printed and sold to date.

Since teachers first began to incorporate environmental inquiry into their practice, the word "inquiry" has become commonplace in educational settings. At the Lab School, addressing teachers' questions and encountering myriad interpretations of the concept in action have forced us to reflect upon what inquiry-based learning does and does not mean to us. One important feature that characterizes our approach to learning is the use of community knowledge building practices. We also find ourselves frequently returning to Dr. Blatz's prescient ideas about the importance of children's security or emotional well-being to their learning. This foundational concept continues to inform our understanding of inquiry and *Natural Curiosity*'s other three branches through all their permutations.

Rationale for a Second Edition

The driving motivation for a second edition was the burning need, in the wake of strong and unequivocal recommendations by the Truth and Reconciliation Commission (2015), to bring Indigenous perspectives into the heart of Canadian educational settings and curricula, most notably in connection with environmental issues. Momentum gathered as points of convergence (as well as discontinuities) between *Natural Curiosity*'s approach and certain Indigenous perspectives were identified. Doug Anderson, who has thought long and deeply about such matters, agreed to articulate these perspectives in this edition; other experts offered their insights, and a project was launched. Looking back at the first edition, Lab School educators realized that it was not enough to simply layer an Indigenous perspective on our own fixed way of doing things. We began to see our values and practices through other eyes, and this triggered a process of rethinking or refining what was most important about our philosophy and practice. We had never intended to freeze our approach; our beliefs and practices remain living, breathing, dynamic processes that are inevitably and repeatedly revised, as our school, like all schools, builds relationships with changing communities in changing times.

Organization of the Second Edition

We have preserved the structure of the first edition, in which a theoretical section is followed by teachers' voices. The four branches continue to provide the framework for our approach, with intriguing and substantive links to the views expressed so eloquently through the Indigenous lens. This lens illuminates both marked continuities and evident disjunctions with *Natural Curiosity*'s approach to environmental inquiry. One beautiful connection lies in the high value placed on what Indigenous cultures regard as "learning from the heart" and what we think of as "curiosity-driven learning"; despite telling differences in terminology, at their core, both descriptions see worthwhile learning as coming from what matters most deeply to the child.

While they provide a useful analytic scheme, the four branches outlined in *Natural Curiosity* are deeply entangled. We see interweaving threads in each branch – with an emphasis on agency in inquiry-based learning, on place and real-world experience in experiential learning, on the holism and interconnectedness of integrated learning. Though both editions begin with a chapter on inquiry – for one must start somewhere – any branch could have equally well served as a starting point. Each circles back to the others. Especially because we are aspiring to education with implications for living in an increasingly unsustainable world, the Indigenous lens offers an invaluable counterpoint to the more "evidence-based" practices of mainstream Euro-Canadian schooling, and recalls David Orr's caution that "the skills, aptitudes, and attitudes necessary to industrialize the earth are not necessarily the same as those that will be needed to heal the earth or to build durable economies and good communities" (2004, p. 27).

Part 1: The Branches

The resource consists of two parts. Part 1 describes the four branches of environmental inquiry. These branches appear under chapter headings that have been slightly amended from the first edition to reflect our current shifts in emphasis: Inquiry and Engagement, Experiential Learning, Integrated Learning, and Moving Toward Sustainability. Each chapter presents a theoretical background followed by ideas for putting the theory into practice. Each branch is considered first from a Lab School perspective, then through an Indigenous lens.

Part 2: Educators' Stories

Part 2 describes the experiences of educators who have integrated environmental inquiry into their practice. Whereas all of the classroom stories in the first edition were written by the author of the resource (Lorraine Chiarotto) after interviewing teachers, the current stories have been written by the teachers themselves. What may have been lost in uniformity of presentation is wonderfully replaced by the multiplicity of voices we encounter. From diverse backgrounds and teaching situations, some new to this approach and some highly experienced, the educators represent the variegated social and

educational landscape of Ontario. They write from schools in rural northwestern Ontario, in downtown Toronto, in Caledon, Kingston and Ottawa. They teach at alternative schools, inner-city public schools, a First Nation school, and our university lab school. Taken together, the educators' stories powerfully illustrate some of the unique ways that environmental inquiry comes to life in classrooms.

As we think about strengthening environmental inquiry with Indigenous perspectives, these stories from teachers reflect the beginning of a journey rather than a destination. It is hoped that they will motivate meaningful dialogue about the links between environmental education and Indigenous thinking as we move forward on this path together.

While only a few of the educators explicitly address Indigenous perspectives or content, aspects of the perspectives highlighted in the Indigenous lens surface through all the stories. As teachers everywhere begin to build Indigenous content and perspectives into learning experiences for their students – an emerging and challenging area for many – stories such as these provide a starting point for a continuing conversation.

Changing Terminology in the Second Edition

The words we use sometimes have unintended connotations. For that reason, we have revised our use of two common terms in this edition.

Teachers or educators?
There are many who support the learning of others, including classroom teachers, early childhood educators, Indigenous Elders, community educators, school administrators, professors, camp counsellors, parents, and caregivers. Though many of the voices in this book reflect the experiences of elementary school teachers, we hope that the relevance of this resource will extend beyond the school context. We have therefore used the broader term "educator" in the title, and referred to "educators" and "teachers" interchangeably throughout the resource.

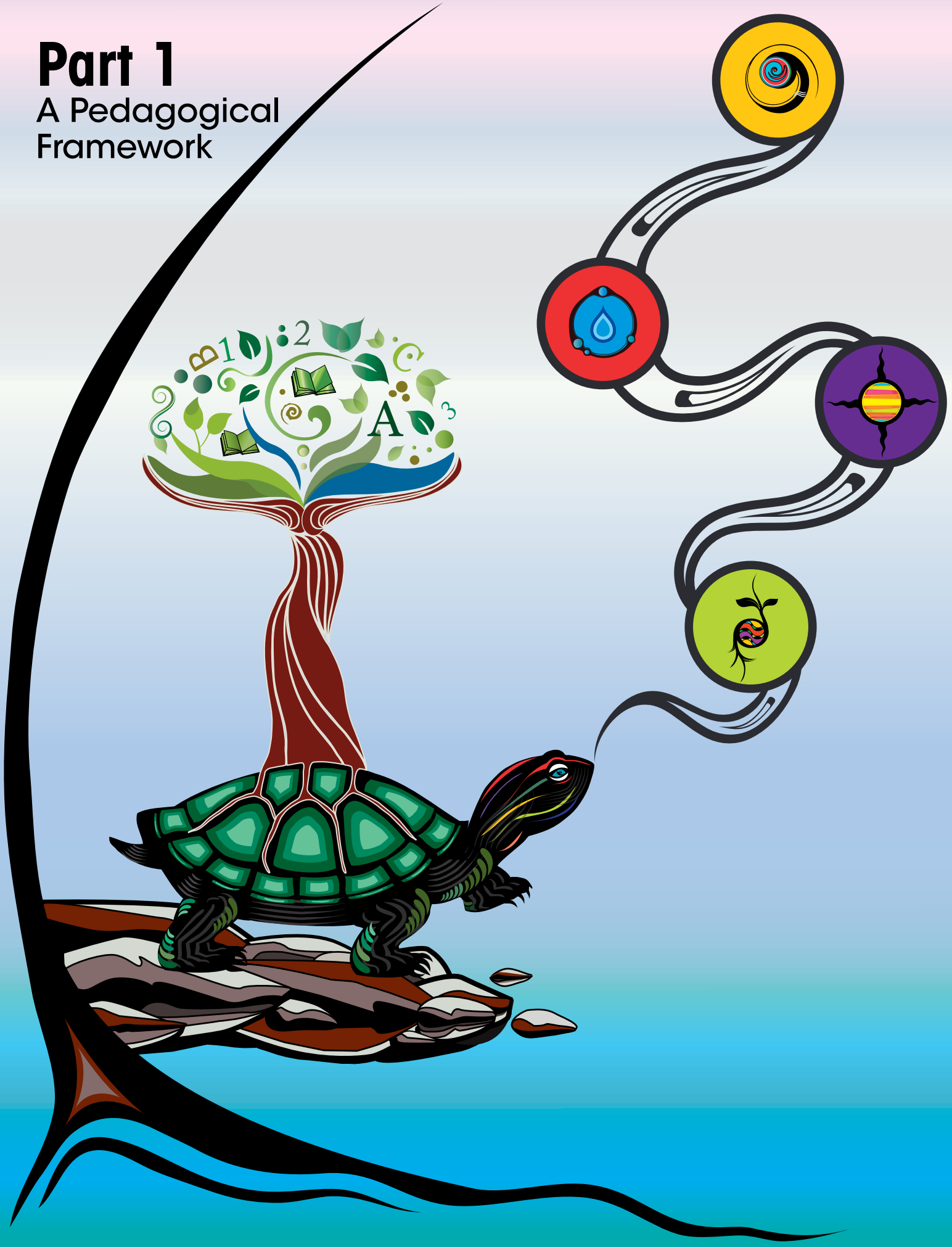
Stewardship or sustainability?
Thinking about the ultimate purposes of environmental education, we use the term "sustainability" to represent a broader and more meaningful goal than "stewardship", while continuing to acknowledge a place for concepts of stewardship or caretaking in children's environmental learning. Details of this thinking can be found in the introduction to Branch IV.

Looking Ahead

Natural Curiosity was never intended as a "how-to" manual for teachers. It offers an approach and framework that encourages educators to find their own ways to connect their students with the natural world. Nor is it the intent of the second edition to provide a step-by-step method for implementing Indigenous pedagogy in classrooms. At this early stage of our learning, that would be presumptuous. What we offer instead is an encounter with Indigenous perspectives on some of our own ideas about children and their learning. The Indigenous lens opens our eyes to transformative possibilities for practice. Working with Doug Anderson and his colleagues has brought the Lab School into a conversation that has initiated us into acting in reconciliatory ways.

This edition represents only one leg of an unfinished journey. We are grateful to Doug Anderson for offering, within an Indigenous framework, this thoughtful response to some of our ideas and practices in environmental inquiry. The next step is up to all of us, creators and readers of this second edition, as we work out ways to respond to the challenges revealed by that lens and actively bring Indigenous perspectives into our classrooms. Sharing our stories is essential to this process.

Part 1
A Pedagogical Framework



Preface to the Second Edition:

An Indigenous Lens on Natural Curiosity

The approach to environmental inquiry in both editions of the *Natural Curiosity* resource finds common ground with Indigenous values in some important ways, and reflects an emerging sense of respect for Indigenous knowledge among educators. One Anishinaabe Elder and retired elementary teacher said of the first edition, "I cried when I read it. I said to myself, they're finally starting to get it!"[1]

The second edition of *Natural Curiosity* supports a stronger basic awareness of Indigenous perspectives and their importance to environmental education. Over time such awareness can support better understanding of Indigenous knowledge through relationships with Indigenous people. This awareness and understanding can serve, in turn, as the basis for the application of Indigenous perspectives in modern learning contexts.

Indigenous perspectives cannot be deeply reflected in a written document or outside of their cultural contexts. All that can be provided here are some indications of how such perspectives can inform environmental inquiry. The living and moving spirits of students, educators, and communities are needed for transforming awareness over time into understanding, knowledge and, eventually, wisdom.

The Indigenous lens in this edition represents a cross-cultural encounter supporting what can become an ongoing dialogue and evolution of practice in environmental inquiry. Some important questions are raised that challenge us to think in very different ways about things as fundamental as the meaning of knowledge. We hope this lens inspires educators to explore learning in relation to these challenging questions.

If we begin to understand and appreciate Indigenous wisdom traditions, and work ethically with Indigenous people to bring those traditions to bear on how we learn, we can improve any education system. This edition provides some examples of how Indigenous perspectives confirm and deepen principles and practices laid out in both editions of *Natural Curiosity*. We begin to ask: How do Indigenous perspectives relate to environmental education? How might they enhance educators' understanding over time as they explore environmental inquiry? What Indigenous perspectives and principles apply to all of us, and can these be supported ethically in any learning environment?

These questions need to be approached with humility and a recognition that exploring them will take time and involve the development of meaningful relationships with Indigenous people. The Indigenous lens in this edition provides a glimpse of what such a process and relationship might mean. Exploring these perspectives, in partnership with Indigenous communities and educators, should be the work of all educators.

We have consulted with Indigenous teachers and academics in both Indigenous and mainstream learning contexts, as well as non-Indigenous educators and scholars.[2] We hope this edition advances discussion on how learning takes place in the classroom, around the school, and in relation to the places we live.

Why an Indigenous Lens?

Canadian education systems have begun to acknowledge the importance of building Indigenous perspectives into curricula to support learning *about* Indigenous histories and cultures. The need for reconciliation is also pressing and, as we move through the 21st century, making it a priority is long overdue. This adds to the urgency of addressing Indigenous issues and content, but these are not the most compelling reasons for exploring Indigenous perspectives in education. The greatest opportunities lie beyond cross-cultural awareness of issues and content, and involve profound challenges to *how we learn*, and *how we live*.

[1] From a conversation in 2013 with Wahgeh Giizhigo Migizi Kwe (Eileen "Sam" Conroy). The Anishinaabek (plural of Anishinaabe) include the peoples of the Three Fires Confederacy (Odawa, Potawatomi, and Ojibwe) surrounding the Great Lakes region, and the term is also applied to closely related peoples, such as the Algonquin in eastern Ontario and Quebec, or the Saulteaux in the west, for example.

[2] Contributors to this edition are listed in the acknowledgements section.

Indigenous knowledge and processes related to learning and life in general, and to environmental education in particular, are useful everywhere – for anyone.

For example, one Indigenous principle we would all do well to consider is the idea of thinking seven generations into the future. Another would be the idea that a living Spirit resides in everything, and that for this reason, everything around us, whether seen or unseen, deserves respect. Such ideas have enormous implications for how children learn to think about and relate to the world. Indigenous wisdom traditions challenge us all, regardless of our background, to directly address the most difficult and pressing questions about learning, being, knowledge, love, death, and our purpose and survival in Mother Earth.[3]

The World Commission on Environment and Development, the United Nations Declaration on the Rights of Indigenous Peoples, and the Convention on Biological Diversity all recognize the significance of Indigenous knowledge to all peoples (McGregor, 2014). Indigenous ways of thinking involve "an understanding that has *endured* for a *reason*" (Meyer, 2013, p. 98). Indigenous people have not struggled, against all odds, to maintain their cultural traditions simply because it is their right to do so. These cultural traditions have survival value in themselves. They express a deeply felt *responsibility*. Indigenous cultures point out important factors in our very survival, factors that are generally neglected today.

While distinct in many ways from popular conceptions of the world in recent history, Indigenous perspectives belong in *all times*, and are contemporary in ways that extend far beyond "cultural content" for schools. There are not just *Indigenous perspectives on science*, for example; there is *Indigenous science*, offering clear remedies to the narrowness and blind spots of what most people consider science in the 21st century (Cajete, 2000).

[3] Saskatchewan Cree and Dene Elders believe the common expression "on Mother Earth" continues the subtle colonization they experience from Anglophones. The expression "in Mother Earth" is closer to their Indigenous meaning. Similarly, the phrase "on the land" becomes "in the land."

Indigenous perspectives also inform good teaching practice, are applicable to all educators and students, and are increasingly relevant to mainstream education systems as we struggle with 21st century realities (Aikenhead & Michell, 2011; Metallic & Seiler, 2009).

This edition of *Natural Curiosity* is not about improving outcomes for Indigenous learners, or adding Indigenous content in classrooms, although it can and should connect with these critical aims. This edition is about beginning to consider how an Indigenous lens *informs learning, in ways that address our present and future, by improving our relationship with the world around us*. This is where the approaches taken in both editions of *Natural Curiosity* begin to intersect with Indigenous perspectives. It is a humble beginning that holds great promise for all people.

What Are "Indigenous Perspectives?"

There are many Indigenous perspectives, rooted in complex, dynamic knowledge systems, and grounded in the long-standing cultural worldviews of Indigenous peoples. These perspectives reflect Indigenous processes, principles, and wisdom that are alive today. This edition of *Natural Curiosity* draws on Indigenous perspectives of the Americas, whose cultures (while never static) have existed for millennia and continue to have profound implications for the present and the future. Because the Dr. Eric Jackman Institute of Child Study Laboratory School is in Toronto, this edition mostly considers Indigenous sources in Ontario and the surrounding provinces and states (although sources as far as Saskatchewan, British Columbia, and Hawai'i are also considered).

Not all genetically Indigenous people should be stereotyped as holding Indigenous cultural perspectives, which have been under assault for generations. This genocidal assault has included widespread, systematic attempts at the intellectual colonization of Indigenous peoples and the eradication of Indigenous cultures. As a result, many Indigenous people have an extremely disrupted experience of their own cultures.

Reducing Indigenous perspectives to simplistic terms is problematic; even leading Indigenous Elders, scholars, and knowledge keepers cannot be expected to always agree on particulars. However, with this in mind, commonly agreed on qualities of

most, if not all, Indigenous perspectives include:

- a strong sense of spirituality
- a deeply rooted sense of place
- a recognition that everything is related
- an emphasis on reciprocity

These qualities, and the genius and importance of Indigenous perspectives, are grounded in what are sometimes referred to as "Original Instructions," or various levels of "law" – from Sacred laws to natural laws – which, in turn, define (or should define) customary human laws.[4] These "Original Instructions" apply to all nations, but have become increasingly forsaken around the world in modern times.

The four qualities listed above are not a comprehensive summary of Indigenous perspectives. However, they do correspond in important ways with the four branches of the *Natural Curiosity* approach, and help frame the Indigenous lens to the second edition. They are explained and explored further on in this edition, in relation to those branches.

How Do Indigenous Perspectives Relate to the Four Branches?

It is impossible here to give comprehensive examples of the implications of Indigenous perspectives for environmental education. However, aspects of Indigenous perspectives certainly correspond with best practices promoted in the *Natural Curiosity* resources, and can deepen our understanding and practice of environmental education as it evolves.

Ideas that relate to the cultural principles, practices, and communication styles found in diverse Indigenous cultures are found in many parts of the *Natural Curiosity* resource. An Indigenous lens placed on any page would enlighten and add value, but this edition cannot contain and analyze all the places we might apply an Indigenous lens; to do so would be to write another, much larger book. Rather, each of the qualities of Indigenous perspectives outlined above is placed in relation to *Natural Curiosity* as a reflection at the end of each branch in this edition:

[4] These English terms are inadequate to convey the full meaning of the ideas. For example, some connotations of the English word "law" conflict with certain Indigenous values.

Table 1: Relating Indigenous Perspectives to Natural Curiosity

Indigenous Perspective	Natural Curiosity
Strong sense of spirituality	**Branch I** – Inquiry and Engagement
Deeply rooted in place	**Branch II** – Experiential Learning
Recognition that everything is related	**Branch III** – Integrated Learning
Emphasis on reciprocity	**Branch IV** – Moving Toward Sustainability

These Indigenous perspectives often, but do not always, correspond with the perspectives that have informed much of the *Natural Curiosity* resource. This correspondence is not rigid, and any of the qualities of Indigenous perspectives may relate to any of the branches.

"But I'm Not Aboriginal!"

Many educators want to address and build Indigenous perspectives into their classrooms, but feel hesitant about how to do so. This is actually a good sign. Teachers in earlier decades often presented highly misinformed views on Indigenous people and cultures as fact. While greater understanding generally exists today, the stereotypes and misconceptions[5] held by that earlier generation of teachers still exist and will take time to more fully address.

The inevitable persistence of misconceptions should not stop us from trying to provide learning environments informed by Indigenous perspectives. Many Indigenous Elders are happy with educators trying their best and learning from their mistakes. It is better to innovate with Indigenous perspectives in steps that fit actual learning contexts, than to try to implement many aspects of the ideas being shared here all at once.

This second edition of *Natural Curiosity* does not assume significant knowledge of Indigenous cultures and peoples beyond the general knowledge most Canadian teachers are already likely to hold. For educators with this basic awareness, the suggestions below can be helpful in trying to build Indigenous perspectives into learning.

[5] Stereotypes can be positive and negative; idealizing or romanticizing Indigenous people and cultures in general can be as misleading as casting them as savages.

Table 2: Suggestions for Building Indigenous Perspectives into Learning

Work wherever possible with Indigenous resource people
Be up front about what we do and don't know
Be clear that Indigenous people, cultures, and knowledge are contemporary
Respect Indigenous knowledge as a precious heritage
Be aware of the complexities of real Indigenous people

Work wherever possible with Indigenous resource people

Many educators may not have access to or awareness of keepers of Indigenous cultural knowledge. Elders with a lot of cultural knowledge are generally busy and hard to reach. However, local Friendship Centres (urban Indigenous community centres) or nearby reserves may be able to help educators find appropriate resource people. While Elders may not be available, a younger generation of Indigenous people is working to ethically bring Indigenous perspectives into learning environments.

Be up front about what we do and don't know

As we explore Indigenous issues, knowledge, and practices as important ways to inform environmental inquiry, we must recognize that we are doing so not as experts, but as a community of educators and learners who are involved in our own lifelong learning process.

Be clear that Indigenous people, cultures, and knowledge are contemporary

It is insulting to many Indigenous people when they are considered only in the context of "how they used to live." Exploring the history of Indigenous life and cultures is important, but it is critical for learners to understand that Indigenous people and their worldviews are both traditional and contemporary. They exist and survive today.

Respect Indigenous knowledge as a precious heritage

Many keepers of Indigenous cultural knowledge have legitimate concerns about protecting their knowledge from misuse, misappropriation, or exploitation. Indigenous peoples wish to maintain ownership over their knowledge, even when they choose to share it with others. This is best achieved through collaboration (McGregor, 2014).

Be aware of the complexities of real Indigenous people

Maintain a distinction between traditional ideals of Indigenous cultural values and wisdom and the present-day realities of individual Indigenous people. Avoid romanticizing Indigenous people, who are as diverse and complex as any other broad category of people. Canadian cultural genocide has had the effect of dislocating many Indigenous people from land, culture, and language. Before inviting Indigenous students to share information about their culture, it is important to establish a relationship with them, and to gain a sense of their nature as individuals, as well as their comfort level with sharing such information.

Challenging Dominant Worldviews

For centuries, increasingly dominant modern Eurocentric modes of knowing have too often been assumed to be the final intellectual framework, and the only road to the truth. In reality, there are a variety of worldviews supporting diverse paths to the truth, and Indigenous worldviews represent important and essential aspects of the human intellectual tapestry. Indigenous ways of knowing are in many ways inherently better adapted for the future than modern Eurocentric intellectual frameworks which, for all their strengths, appear to have some fatal flaws.

The Indigenous lens in this edition of *Natural Curiosity* challenges us to shift from a Eurocentric perspective (which usually considers Indigenous cultures only at the level of a topic to be studied), and to rethink some of the assumptions of modern Eurocentric thought. Of course, the degree to which we meet this challenge is left to individuals. Perhaps the most important thing to remember is that knowledge and perspective are not stagnant, and never have been, and that some of the assumptions many of us now have and consider unassailable may well come to be seen as dead ends by future generations.

At the same time, Indigenous and Eurocentric ways of knowing are not simply opposed or incompatible. The two can be complementary *and* incompatible. While there are areas where divergences are wide, the Indigenous lens in this book is an attempt to see how Indigenous perspectives can inform and relate in good ways with non-Indigenous learning contexts and systems.

Our Common Ground

The contribution of Indigenous perspectives and approaches is about much more than cultural diversity, much more than learning some unique cultural knowledge about animals or plants, or about how to have a "talking circle." These kinds of opportunities may happen in a good way in certain contexts. More than this, however, Indigenous cultural ways enrich what it means to be human in relation to the world around us. We are challenged to ask not just what we need to learn, but what kind of people we need to *become*.

How do we effectively set the broadest possible parameters for our children's learning? How can the process become more holistic, seamless, meaningful, and less institutionalized? How can we involve families and communities; connect outside of school with parents or play, *in the land, as part of it*; link with our food and our future; think and feel deeply about our ancestors and our great, great, great grandchildren? How are the solutions for survival in the 21st and 22nd centuries social and spiritual and not merely technocratic? Are we raising nations of people who can work together and define how technology and resources are applied for common and deeply ethical purposes? Or, are we preparing our children to become increasingly atomistic, isolated, and defined by technology, anxiety, and money?

While these challenging questions are deeply informed by Indigenous cultural values and wisdom, they are not for Indigenous peoples alone. They are the most pressing issues of our time.

Reconciliation

We cannot make this journey without reconciling with Indigenous people, without a transformation of Canada's encounter with Indigenous peoples. A respectful conversation can and must emerge that meets all our needs, and educators are critical helpers in facilitating that conversation, not working alone as educational experts, but also as reflective practitioners who hopefully have the safety to grow and learn and feel joy with their students in the process.

None of this should be considered in isolation, without a sense of history. Nor should the hard facts of colonization – a colonization which is both historical and also expresses itself today – be avoided. Perhaps what is needed is a "reconciliation pedagogy," a recovery of relationship, an encounter that brings us all together as co-creators of our children's survival. After all, reconciliation with Indigenous people cannot really take place in a vacuum, apart from the big questions of mutual concern, a point that has been emphasized in the Truth and Reconciliation Commission's final report (2015).

> Reconciliation between Aboriginal and non-Aboriginal Canadians, from an Aboriginal perspective, also requires reconciliation with the natural world. If human beings resolve problems between themselves but continue to destroy the natural world, then reconciliation remains incomplete. This is a perspective that we as Commissioners have repeatedly heard: that reconciliation will never occur unless we are also reconciled with the Earth. Mi'kmaq and other Indigenous laws stress that humans must journey through life in conversation and negotiation with all creation. Reciprocity and mutual respect help sustain our survival. It is this kind of healing and survival that is needed in moving forward from the residential school experience.
>
> *– Honouring the Truth, Reconciling for the Future: Summary of the Final Report of the Truth and Reconciliation Commission of Canada*

The most vital reason for educators to understand Indigenous perspectives is this: it already is – and increasingly will be – Indigenous peoples around the world who are the first and most effective in standing up to prevent our current wholesale destruction of life in Mother Earth. The perspectives driving this broad trend need to be understood and supported by our children and youth. And we have to move fast.

We all need to work together towards Mino-Bimaadiziwin ("living in a good way" in Anishinaabemowin) – a vision that we hope can come about over seven generations as our children and grandchildren succeed us. This is something we must plan for and act on urgently. It is the job of educators today to process the reflections provided through Indigenous perspectives, and to act, deepening a mutual encounter with Indigenous people and perspectives in our work.

> Respect is more than tolerance and inclusion. It requires dialogue and collaboration.
>
> *– 8 Ways: Aboriginal Pedagogy from Western New South Wales*

Branch I: Inquiry and Engagement

Nurturing a Sense of Wonder

> I should ask that a gift to each child in the world be a sense of wonder so indestructible that it would last throughout life, as an unfailing antidote against the boredom and disenchantments of later years, the sterile preoccupation with things that are artificial, the alienation from the sources of our strength … If a child is to keep alive his inborn sense of wonder, he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement, and mystery of the world we live in.
>
> – Rachel Carson, *The Sense of Wonder* (1998)

Theoretical Underpinnings

Curiosity Is Natural

Humans are curious beings. From birth, they behave in ways that demonstrate a drive to figure things out, a natural capacity and desire to learn about their world (Worth, 2001). Babies rely upon their senses as they explore the concrete, observable aspects of their immediate surroundings. Their world is full of wonder and newness. They gaze at faces, put objects into their mouths, respond to voices and sounds – all to gain more experience and information (Thornton, 2003, as cited in Ogu & Schmidt, 2009).

As children acquire language, they build upon this foundation of sensory exploration. They begin reflecting on and asking questions about the many things they notice in their environment, both material and social. Their curiosity seems insatiable, the process of learning self-propelled and unstoppable. One analysis of four young children's questions over a four-year period (starting at 14 months) revealed a total of 24,741 questions in 229 hours of conversation, averaging to about 107 questions *per hour* (Chouinard, 2007, as cited in Engel, 2015).

As children grow and develop, the nature and expression of their curiosity changes. To the very young child, not fully aware of regularities in their world, many events are surprising and evoke the drive to make sense of them (Kagan, 2002). As experiences become more familiar, this kind of all-encompassing curiosity often shifts into a narrower, more targeted mode linked to specific interests; what is lost in breadth gains depth and focus. This kind of curiosity provides a perfect starting point for school learning.

However, as Rachel Carson notes, a child's sense of wonder can be lost or diminished, and with it, the desire to learn (1998). Through an inquiry-based learning approach, educators have the opportunity to build upon students' natural curiosity and nurture their ability to be fully engaged learners throughout their lives.

Sustaining and Cultivating Curiosity

> Inquiry does not bubble up just because the child is intrinsically curious. Nor does it simply erupt when something in the environment is particularly intriguing. Whether the child has the impulse, day in and day out, to find out more, ebbs and flows as a result of the adults who surround her.
>
> – Susan Engel, *The Hungry Mind* (2015)

It has often been noted that curious children learn more easily, and teaching students how to harness and pursue their curiosity provides them with a powerful learning tool. Yet an oft-cited study of children's conversations by Tizard and Hughes (1984) showed a marked decline in the number of "why" questions posed by children as they moved from home to school. Developmental psychologist Susan Engel (2015) similarly observed little evidence of curiosity in the classrooms she visited. She noted that even in rich learning environments it tended to be actively discouraged through statements such as "I'll give you time to experiment at recess. This is time for science" (p. 162).

Engel (2015) suggests some simple ways to sustain and nurture children's curiosity at school. First, refrain from oversimplifying: children are attracted to complexity and ambiguity,

intrigued by the possibility of the unexpected. A rethinking or defamiliarization of the everyday can also trigger the desire to find out more. Rather than aiming for the perfect clarity of a textbook, information requiring interpretive work tends to be more interesting; one study showed children's comprehension of complex writing to be significantly higher than their understanding of more straightforward and transparent texts (Garner, Brown, Sanders and Menke,1992, as cited in Engel, 2015). Beyond textual information, the natural world right outside our doors is probably the most perfect example of a highly complex environment.

Second, educators need to follow their own curiosity, to welcome not-knowing as an opportunity to learn more. Ideally, an educator's curiosity will encompass questions about curriculum or content, about children, and about pedagogy. Admitting ignorance as a starting point for an investigation can offer to students one of the best possible models of curiosity and its satisfaction. Setting up a learning program that leaves room for the unexpected will also make classroom life infinitely more interesting for both educators and students.

Finally, make the cultivation of curiosity a priority – perhaps *the* priority – throughout your teaching day. Start to notice where your students show curiosity, and how they show it, verbally or nonverbally. What happens after they ask a question or demonstrate an interest? And where is curiosity not happening? As you focus on it, it will start to happen more. Refrain from rushing to completion in any subject; encourage students to decide if they are satisfied with an answer. And remember – it is the promise of a satisfying answer to a pressing question that drives real learning. While an educator may be most interested in the *process* by which students approach a question, it is the burning desire to find something out that motivates students to wholeheartedly pursue their curiosity.

In all, this focus on curiosity will form a solid ground for launching inquiry-based learning in children's lives.

What Is Inquiry-based Learning?

Inquiry-based learning is a dynamic and emergent process that builds on students' natural curiosity about the world in which they live. It places their questions and ideas at the centre of the learning experience. While the educator may offer the big idea that becomes the focus, it is the students' own responsive questions and ideas that drive the learning forward. Educators using an inquiry-based approach encourage students to pursue their own questions about the world. They support student learning by providing tools, resources, instruction, and experiences that enable learners to rigorously investigate, reflect upon, and discuss potential solutions to their own questions about a shared topic of study.

Inquiry gains richness from its situation within an interrelated and reciprocal learning community of questioners, hypothesizers, and observers, all with different kinds of expertise, perspectives, interests, and priorities. Both the educator and the students work together as learners and thinkers within this community. The sense of community is both what makes classroom inquiry possible in the first place and what emerges out of the multiplicity of voices that come together to move an inquiry forward.

Jerome Bruner once famously remarked, "You can no more teacher-proof a curriculum than you can parent-proof a family" (1996, p. 84). An inquiry-based approach is not a rigid methodology or set of procedures that, blindly followed, will yield consistent results. Rather, it entails an overall orientation that pervades classroom life to foster a culture of collaborative learning and idea improvement. Within this classroom culture, educators encourage students to contribute their ideas and engage in critical problem-solving processes in a variety of contexts, both curricular and social.

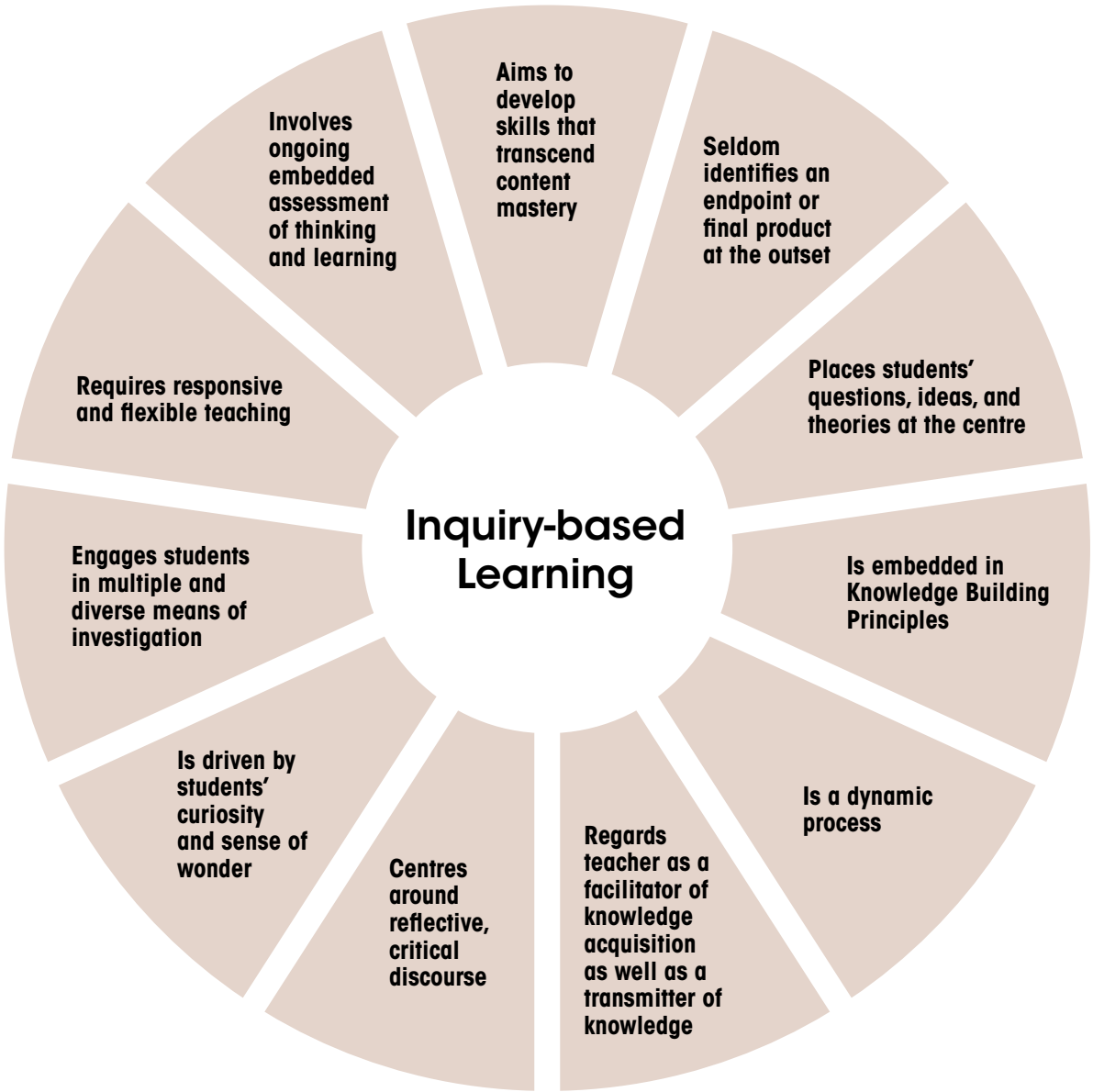
For the educator, the focus tends to be more on the process of student learning than on curriculum coverage for its own sake. By actively engaging in their own learning, students deepen their understanding of content knowledge in a manner relevant to their interests and stage of development. To this end, an educator might respond to a child's question with an open-ended question of their own: "What a great question. How can we find that out?" Knowing the value of struggle in coming to truly own an idea, the

educator will also allow students time to grapple with problems, and may suggest, "Why don't you tell us more about this after you have had some time to think about it?"

Over the course of a single inquiry, a class will move back and forth along a continuum of structure and openness, depending on the balance of student-driven and teacher-directed learning. Both openness and structure have important places in inquiry-based pedagogy, depending upon many aspects of the learning context (including the topic of study, the social dynamics, and the specific learning goals). Indeed, an implicit structure inheres in even the most open-ended learning situation, with clear expectations for learning and engagement that have been explicitly taught to and internalized by the students. These may include developmentally appropriate expectations of focus, of industry, of kindness, of intellectual rigour, of persistence, of respectful contribution to group knowledge. Though curiosity may be natural, inquiry in a school setting is neither natural nor easy; it must be learned and worked at.

Many educators invest effort in helping children to independently navigate more open-ended forms of inquiry. Making the decision to do this may require what some have described as a "leap of faith," a trust that this way of thinking and acting in the pursuit of meaningful questions will enhance learning for their students.

Figure 1: Defining Characteristics of Inquiry-based Learning at The Laboratory School



Why Take the Leap? The Benefits of Inquiry-based Learning

Whether they have been teaching through inquiry for several years or several months, most educators agree that inquiry-based learning offers far-reaching benefits for students. Some of the major benefits include the following:

1. Honouring interests and questions related to a common focus or big idea leads to higher levels of engagement, improved understanding, and a love of learning. Genuine questions from students both provide their teacher with information about what they want to know and reveal their understanding. A student's degree of interest profoundly affects their attentional and retrieval processes, acquisition of knowledge, and expenditure of effort. When students engage deeply with the content because it interests them, their learning is deeper and more complex; they use more elaboration strategies, seek more information, and reflect more on the material (Hidi, 1990).

2. Inquiry stimulates and focuses students' curiosity, leading to progressively deeper questions and a habit of critical thinking. By fostering a culture of inquiry, educators help students become more discerning observers, deeper thinkers, and more innovative problem-solvers. Curiosity is cultivated and preserved – and for good reason. As David Orr (2004) cautions, "the sense of wonder is fragile; once crushed, it rarely blossoms again" (p. 24). The consequences can be dire. Students eventually stop noticing and asking questions about their world, at least at school. They may instead opt to disengage completely from classroom learning, or else resort to the 'game' of education, figuring out what the teacher wants to hear or what will be on the test.

3. Inquiry builds lifelong learning skills that go beyond content mastery. We live in an age of information overload and rapidly changing technologies. Access to content knowledge is literally at our fingertips. However, information accumulation in itself should not be the primary objective of education. Students in the 21st century need to build skills for dealing with complexity, interpreting and connecting information as they assess its utility in the light of their current learning goals.

4. Engaging in inquiry encourages perspective-taking, collaborative problem solving, and communal knowledge building. In learning to relate their own hypotheses and knowledge to the knowledge of others, students begin to see themselves as integral members of a learning community.

Through practicing inquiry, students wholeheartedly bring many aspects of their lived experience into the learning environment. They develop and apply skills across content areas and grade levels. As they reflect on the purpose, meaning, and process of their information gathering, they interpret information in relation to their own beliefs and experiences. Working with others to build understanding, they learn the need to articulate ideas clearly, pose focused questions to clarify a point of view, and respect the diverse contributions of individuals within a collaborative community ("Partnership for 21st Century Learning," n.d.). A powerful culture of communal knowledge construction both emerges from this process and provides a framework that supports and furthers student learning, engagement, and agency.

Inquiry and Knowledge Building

> The goal of Knowledge Building is not simply to create life long learners, but rather, life long contributors.
>
> – Carl Bereiter, Co-founder, Institute of Knowledge Innovation and Technology, University of Toronto

Inquiry provides an opportunity for rich knowledge building talk to flourish within a learning community. Knowledge building pedagogy is a unique approach to teaching and learning that aims to improve the ideas of the entire learning community beyond those of individual learners. It emphasizes collaborative exchanges in which students publicly negotiate ideas with each other. In placing ideas, rather than activities, skills, or facts, at the centre of student learning, a knowledge building approach prioritizes the widening perspective and deepening understanding that develops as children

question, argue with, and begin to incorporate each other's divergent views into their own thinking. Knowledge building is an essentially metacognitive process; for students, the knowledge that they co-construct through ongoing mutual discussion becomes the most significant artifact of their thinking.

For more than 20 years, Marlene Scardamalia and Carl Bereiter at the Ontario Institute for Studies in Education (OISE/UT) have worked in consultation with teachers to refine principles and procedures that will most effectively guide and support students as they engage in knowledge building. Central to this process is the conscious use of knowledge building discourse within the classroom community. Encompassing quite specific ways of communicating and reflecting upon understanding, knowledge building discourse is a specialized form of idea exchange which can uniquely support inquiry in the classroom. The following section spells out (in limited detail) a few of its most basic features.

What Is Knowledge Building (KB) Discourse?

Through oral and written knowledge building exchanges, learners come together to pose questions and posit theories. They revisit, negotiate, and refine their thinking with the shared goal of idea improvement. Knowledge building discourse "serves to identify shared problems and gaps in understanding and to advance the understanding beyond the level of the most knowledgeable individual" (Scardamalia, 2002, p. 12). While the content of these exchanges remains very open, educators in knowledge building classrooms often offer particular linguistic forms to scaffold student exchanges and highlight the processes by which collective knowledge is constructed.

Knowledge building discourse focuses on deepening understanding through encounters with the diverse perspectives and ideas of classmates. These conversations occur both informally and within more structured "Knowledge Building Circles (KBCs)" that are designed specifically to facilitate the group exploration of emergent questions and ideas. The resulting questions and theories then serve as entry points for further investigations and discussions.

Knowledge building discourse differs from other forms of class discussion in several important ways as outlined in Table 3.

Table 3: The Unique Role of Knowledge Building Discourse in Inquiry-based Learning

Student discourse shapes the learning. Students are encouraged to frame their contributions with metacognitive phrases that support mutual respect and foster awareness of how ideas interrelate. Examples are: • I want to build on to Nigel's idea ... • I think ... because • I think something different ... because • Something I still don't understand is ... • I wonder if ... • My theory is ... • I need to know ...
The teacher is unlikely to know in advance all of the questions and ideas that will emerge from student discussion.
The teacher nurtures student engagement through open-ended questions such as: "Did anyone notice/read/find out something that might help us better understand our question?"
Students work to reconcile their own theories and ideas with new pieces of information. Teachers support them in this process by asking questions: • How does that information support your theory? • Have you changed or added to your theory? • How has your thinking changed since we started learning about this? • Is there a theory that can make sense of both Anna's and Sophia's ideas?
The teacher models and prompts multi-directional dialogue to help students internalize and practice using it themselves. "Would anyone like to build on to Fatima's idea?"

There are many possible ways to support knowledge building discourse, depending on factors ranging from the available physical space to the developmental readiness of the children. Within this variation, there are certain protocols for KB discussions which help to support idea-centred discourse and reinforce the guiding values of a knowledge building culture. Especially with students who are new to this discussion format, an educator will take time to introduce and model some behavioural and linguistic protocols for ensuring mutual respect.

Most educators find that taking the time to teach explicit procedures for engaging in knowledge building discourse is a worthwhile investment of effort. Overall, they have learned that when students become accustomed to the process, and are engaged in dialogue about a topic that is important to them, classroom management issues tend to diminish.

With younger students, the circle configuration is often used for KB discussions for some of the following reasons:

- Sitting in a circle with classmates builds children's sense of themselves as part of a community.
- Circles support attentive communication and face-to-face dialogue. Attentive body language – a physical sign of respect and active listening – is more visibly apparent. An educator will often help to build children's awareness of the tacit meaning of the verbal and nonverbal signals they observe and transmit.
- Circles are non-hierarchical. Both students and educators enjoy equal places in a circle; no one takes precedence and teachers position themselves as co-learners within the circle. As members of an egalitarian knowledge building community, all members learn from each other's understanding. Students build self-regulation as they wait for their turn to speak.
- Learning how to communicate respectfully with others is a critical aspect of children's social development. It is also integral to developing respect for all living things. Respect and care for close members of one's community become the basis for building a respectful, caring relationship with the world at large.

Within the general KB format, there are many effective structures for promoting discussions. In classes new to knowledge building, the educator may help to manage the conversation by selecting who will speak next (ensuring that all willing students have a chance to participate). As children grow older and more experienced, they may sometimes take responsibility for selecting the next person who wishes to speak once they

have had their turn. As these procedures become automatic, an educator may encourage students to try conversing without raised hands, as they learn to interpret a speaker's cues and jump into the discussion without interrupting. However, the educator is always watching closely to make sure that the process remains democratic and that sufficient focus is maintained for the learning to move forward. Sometimes, a child's body language may suggest they have something to contribute, even in the absence of an overt signal that they would like to speak; noticing this, an attentive educator will offer the possibility of participation.

In KB discussions, students learn to take a step back from their immediate thoughts and impulses as they develop a public voice. They listen respectfully to others and build on to their ideas in a way that takes seriously the enterprise of building knowledge together. They learn that others cannot read their mind, that they need to convey their meaning precisely to be fully understood. They become aware of the need to recognize the perspectives of other participants in order to voice ideas that are relevant and available to everyone. None of this learning happens overnight, and the educator plays a key role in facilitating its development.

Of course, the circle is not the only grouping format an educator will use. In most classrooms, there are likely to be times – such as picture book read-alouds – in which students clump together to focus on the book rather than on each other. And there will likely be other times during which everyone finds a private space in which to comfortably focus on individual projects. But to sustain democratic and egalitarian discussions, especially among children just learning how to engage in this kind of talk, there is value in a format that reinforces their ongoing awareness of one another.

As literacy develops, knowledge building discourse need not be limited to oral discussions and conversations. Sorting and connecting movable sticky notes on a board is one concrete way to represent and keep track of the shifting interconnections that emerge in group knowledge building. At a more sophisticated level, there are a number of web-based databases that lend themselves well to dynamic representations of individual and group thinking, deepening understanding even as they provide a means for archiving and returning to it. An example of computer-based knowledge building on a networked database called "Knowledge Forum" appears in "Mike's Story" (Part 2, p. 251). For more information, see "In the Ground Beneath the Trees" on p. 20.

Key Principles of Knowledge Building

A knowledge building approach to environmental inquiry follows a number of key guiding principles, summarized in Table 4.

Table 4: Some Principles of Knowledge Building within an Environmental Inquiry (from Scardamalia, 2002)

Students work with authentic problems and real ideas
All ideas are improvable
A diversity of ideas is valued
Students exercise epistemic agency
All members assume collective responsibility for community knowledge

Students work with authentic problems and real ideas

Genuine knowledge problems arise from a learner's authentic efforts to better understand the world and their place within it. Problems that students genuinely care about drive their learning very differently than the decontextualized problems posed by many textbooks. Further, the ideas that students create or develop are as real and important as any other artifacts of their learning. Ideas can be expressed in many ways, not only in explicit verbal or concept-heavy communication, but also in action and more concrete manifestations. It is the educator's job to notice and interpret the many ways in which a child's ideas begin to emerge.

All ideas are improvable

The history of science provides convincing evidence for the improvability of ideas. Even the most sophisticated theory expresses a partial or provisional understanding with the potential to deepen and change through reflection, negotiation, and empirical testing. Participants in a knowledge building community work together to improve the coherence, complexity, and utility of their ideas. Such a culture relies on a safe setting that encourages risk-taking, the possible pursuit of blind alleys, and the acceptance of ignorance or error as integral to idea improvement. High value is placed on rethinking a belief in the light of new evidence. Only through voicing and working through misconceptions is it possible to eventually move beyond them to a more nuanced or accurate view.

A diversity of ideas is valued

Idea diversity is essential to knowledge advancement. To fully understand an idea requires a grasp of how it relates to ideas that surround it, both related or supporting ideas and those that stand in contrast. As learners encounter and struggle to accommodate other perspectives, their own perspective broadens and their original beliefs gain complexity, coherence, and objectivity. An environment that welcomes diverse perspectives enables new and more refined ideas to emerge.

Students exercise epistemic agency

Students who develop epistemic agency take control of the process of creating and working with knowledge. As they negotiate their ideas about meaningful questions in the light of other views they encounter, they take responsibility for important aspects of their own learning, including goal-setting, prioritizing, assessment, and planning. This sense of agency can empower children to go far beyond typical grade expectations as they, along with peers, take ownership of their learning process. The resulting sense of autonomy has strong implications for the development of environmental concern and action.

All members share collective responsibility for community knowledge

As learners trade ideas of value on an ongoing basis, they share the responsibility for furthering the knowledge of the entire learning community. Each student understands that they are responsible for the overall advancement of the community's knowledge in addition to advancing their own knowledge. Though students may exercise different roles in the knowledge building process, every student understands their obligation to play a part in contributing to communal learning.

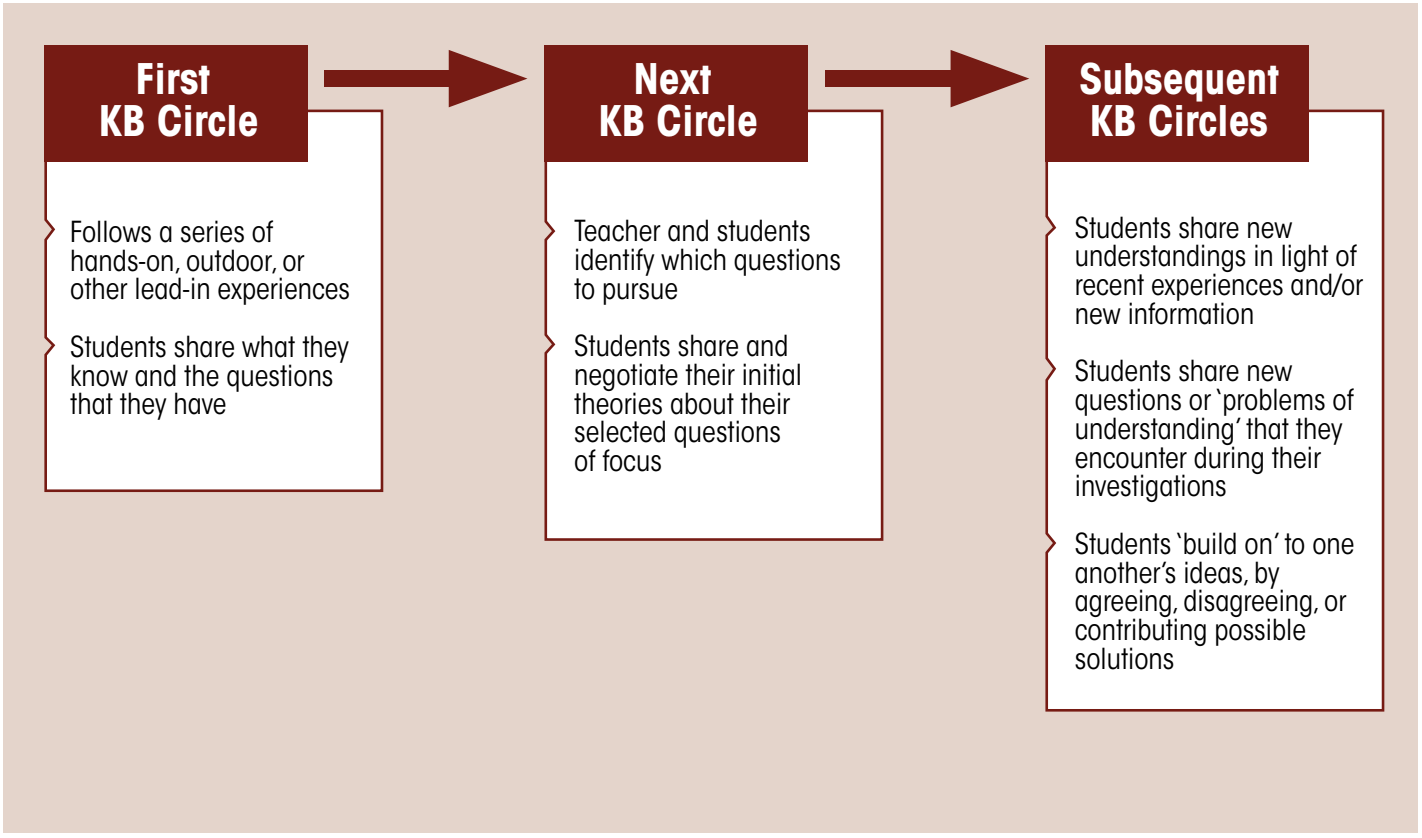
Other knowledge building principles

Grounded in discourse practices that promote the exchange and refinement of ideas, knowledge building is a continuous process that pervades all aspects of classroom life. Beyond the five principles detailed above, it embodies a number of other guiding values, including the understanding that within knowledge building communities there is a clear role for more authoritative sources of knowledge – such as books or expert testimony – which are received and interpreted critically and reflectively. The community makes ongoing efforts to synthesize or "rise above" individual or conflicting ideas to see the bigger picture. Within such a knowledge building community, assessment is embedded, concurrent and transformative.

How Does Knowledge Building Progress?

During the course of an inquiry, a mix of hands-on exploration and KB discourse will begin to permeate the classroom. Through discussion and argumentation, students learn to become critically mindful of their investigations, guarding against making cursory observations, drawing hasty conclusions, or reading information perfunctorily. As students become accustomed to reporting back and thinking through ideas with the group, they develop a sense of responsibility for their learning and a desire to make meaningful contributions to the collective community. In the process, critical thinking and self-reflection become habitual modes of inquiry. Figure 2 shows one possible example of a knowledge building progression.

Figure 2: Example of How Knowledge Building Discourse Unfolds



Knowledge Forum:

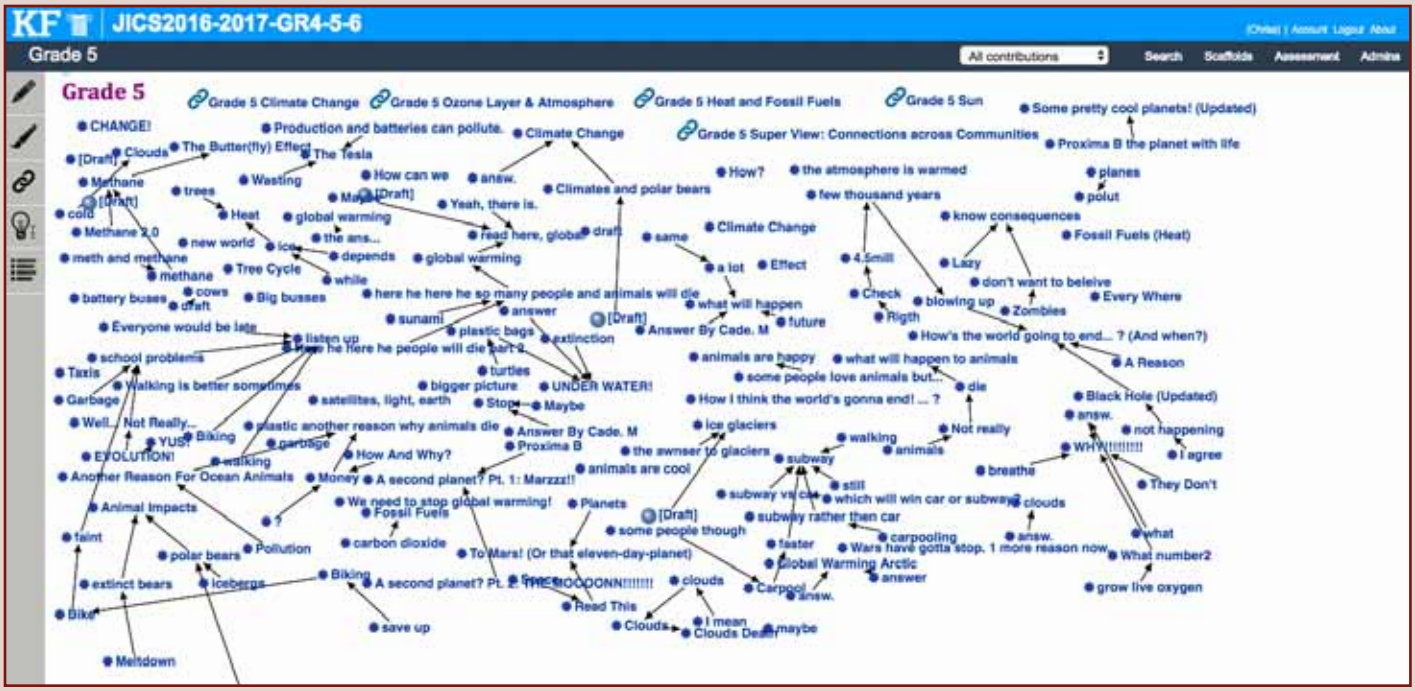
In the Ground Beneath the Trees

By Richard Reeve

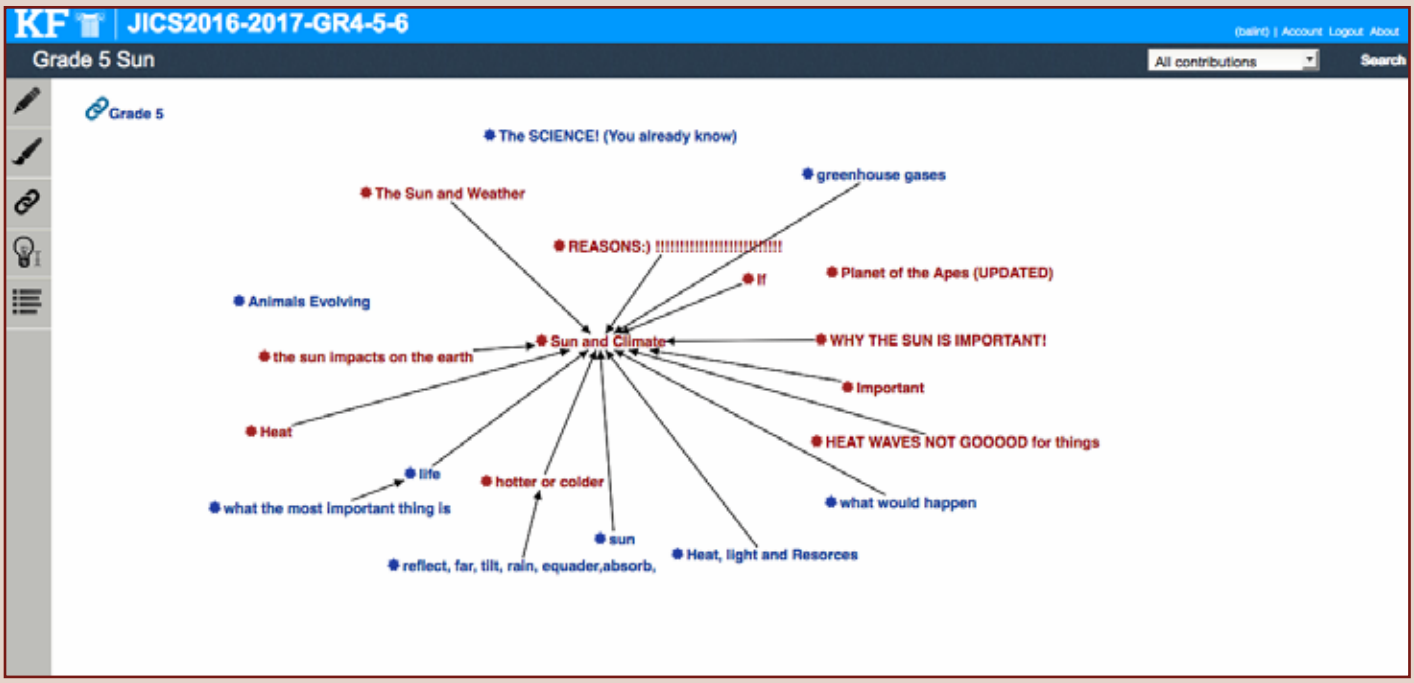
Knowledge building is an approach to education that places knowledge creation at the centre of student activity in classrooms. Throughout the history of its development, including a 20-year partnership between educators at the Dr. Eric Jackman Institute of Child Study Lab School and researchers from the Institute for Knowledge Innovation and Technology (IKIT) at the Ontario Institute for Studies in Education, University of Toronto, knowledge building has involved the construction of student-generated online databases. My goal in this short section is to describe the technology that has been most closely associated with knowledge building and to show how this technology coordinates with environmental inquiry.

Carl Bereiter and Marlene Scardamalia initiated the development of knowledge building through research into expert writing and collaborative writing tools. Subsequently, they focused on theory development in various disciplines (Bereiter & Scardamalia, 2012). Since the Lab School adopted a knowledge building approach in 1995, at the dawn of the use of the internet in schools, the software designed to support knowledge building has been an online database called Knowledge Forum (KF). Community participants use this software to collaboratively build knowledge.

Knowledge Forum View Showing All Student Contributions (Original Grammar Maintained)

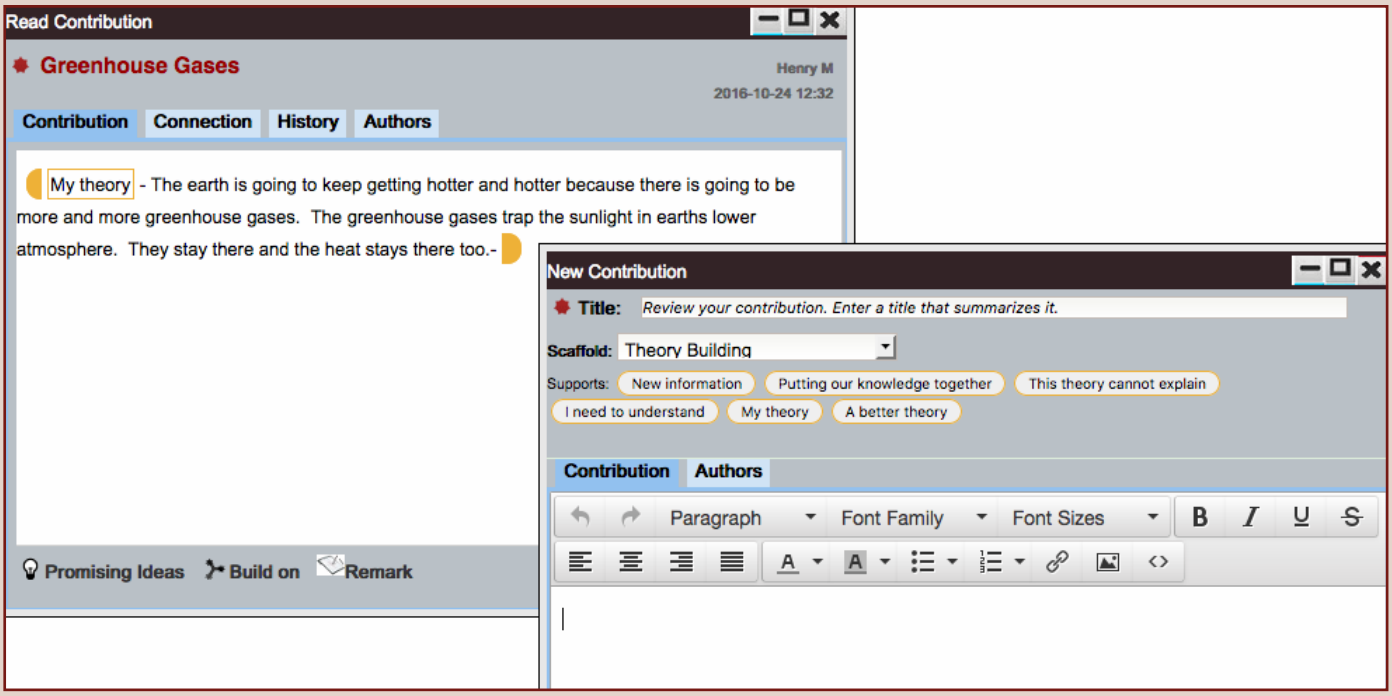


Example of View Showing Selected Student Contributions (Original Grammar Maintained)

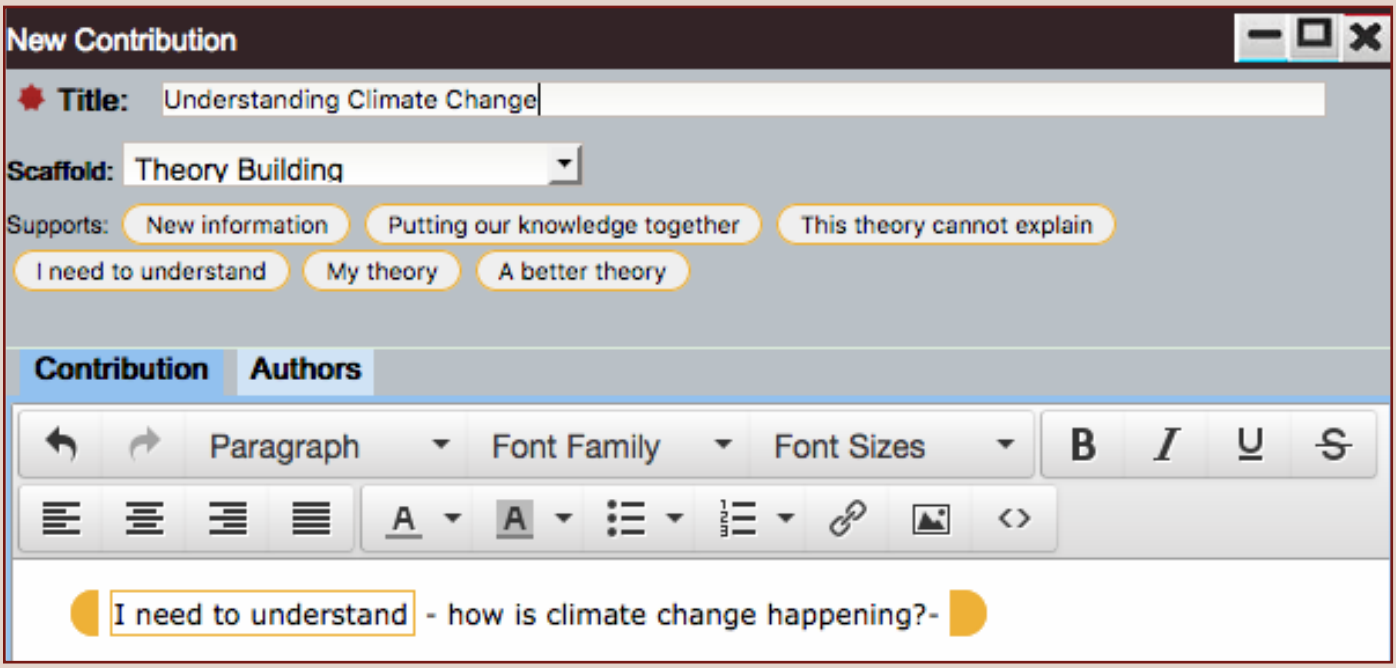


KF functions as an infinitely malleable space where students can work collaboratively on ideas of interest. Basic functions include the ability to contribute notes, draw pictures, attach resources, read the notes of others, build onto the notes of others, and arrange notes within and across views related to the knowledge being developed. Scaffolds in the form of sentence starters are provided to support student writing and sharing of ideas and knowledge. A "super note" and its supporting scaffolds allow students to document their journey of thinking and synthesize understanding in order to share with other KB communities, while a "rise-above" note helps a community of learners to take their knowledge to the next level together. The overall intention of KF is to support the community as it builds knowledge within and between domains.

Example of Student A's Theory of Greenhouse Gases (Original Grammar Maintained)



Example of Student B's Response to Student A's Theory (Original Grammar Maintained)



Readers may recognize the basic functions of KF as resembling a number of social networking tools that have become part of our daily digital lives. However, a key difference between KF and other environments intended to support the social sharing of knowledge (e.g., learning management systems or social media platforms) is that KF was specifically designed to support a knowledge building approach. There are 12 principles associated with KB, but two pairings (four principles) that I feel the KF environment is particularly well-suited to support are highlighted here:

- **Embedded Transformative Assessment and Knowledge Building Discourse**
  Through contributing, reading, and building onto KF notes, students begin to make judgements about the knowledge being developed. Discourse in the KF database often overlaps with what is put forward in the KB Circles with one key difference – the KF work is available for repeated review and continuous revision. Assessments of the ideas in the notes are ongoing and this form of KB discourse lends itself to idea refinement.

- **Improvable Ideas and Rise-Above**
  The KF system provides spaces for similar ideas to be worked on, in the form of views of notes, but a key KB principle and KF feature that is often overlooked is the concept of "rise-above". The database offers the option of creating a "rise-above" note that students can use to figuratively pull together their thinking and literally pull together their notes. An effective rise-above note does justice to the ideas it subsumes and also creates a new plateau from which to continue the work.

Examples of Super Notes Which Illustrate Development in Thinking (Original Grammar Maintained)

Read Contribution

Supernote: Why are glaciers melting a critical problem?

Nicola P
2016-11-10 14:02

Contribution | Connection | History | Authors

We used to think that the only affects of glaciers melting was polar bears dying and some places being flooded. Yes, those are effects that it has, but they may not be the worst ones.

Most of the freshwater in the world is locked up in glaciers, and we can't drink saline (salt) water, also glaciers can completely stop the flow of the gulf of Mexico and if the arctic goes above 0˚ then it can really change the world for the worse. Also, polar bears need the glaciers for homes and food and the world may get flooded. Finally glaciers reflect so much heat away from the surface of the earth so if they melt the world will get hotter. More water means more heat is stored away.

We want to research everything to do with this topic.

Promising Ideas | Build on | Remark

Read Contribution

climate vs weather effects

Lauren K
2016-11-10 14:00

Contribution | Connection | History | Authors

Topic: The difference between climate change and weather

We used to think: that climate and weather were the same thing. we also didn't know much about climate and climate change.

What we know now: We know now that there is a pretty big difference between them both. Climate its a long term weather effect. And weather is a short term effect of weather. Like summer is a climate, and one weather effect to another.

We have to research more about: Learning a bit more about climate change and what causes it

to happen. we also need to know how can weather change so quickly like from hot to cold.

Promising Ideas | Build on | Remark | Edit

An ecological metaphor may help here. After being asked to contribute to this edition, and seeing the tree image on the cover, I did some research into trees and forests. My basic question was, how does the KB/KF aspect fit with this image? This search led me to the popular 2016 book by Peter Wohlleben – *The Hidden Life of Trees* – and then to groundbreaking work by Canadian researcher Suzanne Simard. Simard, a forest ecologist, along with colleagues at the University of British Columbia, published a paper in the international science journal, *Nature*, about their discovery of carbon transfer between tree species through a shared (ectomycorrhizal) fungi network (Simard et al., 1997). Coined the "wood wide web" by writers at the journal, Simard recently described her discovery:

In pulling back the forest floor … I discovered that the vast belowground mycelial network was a bustling community of mycorrhizal fungi species ... [that] connect the trees with the soil in a market exchange of carbon and nutrients and link the roots of paper birches and Douglas firs in a busy, cooperative Internet (Simard, 2016, p. 248).

Research into these underground networks has continued, with findings clearly demonstrating that trees cooperate and "share their sugar" when nearby neighbours are in need (Wohlleben, 2016). As Wohlleben states, "these fungi operate like fibre-optic Internet cables. Over centuries a single fungus can cover many square miles and network an entire forest … helping to exchange news about insects, drought and other dangers" (2016, p. 10). In short, trees communicate in an attempt to help support the survival of their forest community.

In many ways the metaphor of a fungus network, a sharing system designed to support community development and survival, represents well the way in which students in a KB community use KF. They share their knowledge with each other in a bid to strengthen the community's understanding of the topic at hand. The applicability of the fungus metaphor falls short only in that production of these valuable community resources, for trees, appears to be developed outside this communication system, while KF can function as a place where community knowledge is developed. The KF "sugar-sharing" network is one effective way, amongst many, for teachers and students to share their knowledge in an effort to strengthen their inquiry communities.

Please refer to the *Natural Curiosity* website, in the Resources section, for more information on knowledge building and Knowledge Forum.

Children's Preconceptions

> The theories children build, whether they are right or wrong, are not capricious. They are often logical and rational, and firmly based in evidence and experience.
>
> – Karen Worth, "The Power of Children's Thinking" in *Inquiry: Thoughts, Views, and Strategies for the K-5 Classroom* (2001)

Children do not come to school as blank slates waiting to receive instruction. With strong instincts for making meaning out of experience, they come full of knowledge and ideas about the world that they have either heard, figured out, or intuited through observation. While some of these preconceptions will easily support the learning they encounter in the classroom, others may be fundamentally incompatible with some of the knowledge they encounter in school, impeding their ability to assimilate certain concepts. Teachers must therefore make it a priority to find out what prior knowledge their students are bringing into the classroom (Gelman & Lucariello, 2002).

Joan Lucariello and David Naff distinguish between "anchoring conceptions" that are consistent with curricular concepts and conceptions that tend to work against them (n.d.). Straightforward misconceptions based in lack of information are relatively easy to address, and exposure to the correct facts usually suffices to rectify the false belief. However, some misconceptions take the form of strongly entrenched intuitive or common-sense theories which have served the child reasonably well in their day-to-day efforts to make sense of their world. Held tenaciously by both children and adults, these theories can be extraordinarily difficult to counter. They are often unarticulated and unconscious, yet observations are made and new information interpreted within the framework of the misconception just as it would be through any theoretical lens. Since modifying these intuitive theories can require radical cognitive reorganization, just telling the child otherwise is unlikely to have much effect.

Everyone who lives or works with children encounters dozens of such misconceptions. A kindergarten teacher gives the example of the child who refused to put on a coat on the coldest day of winter because the sun was out and the day must therefore be hot. Many children of that age also insist that height is totally dependent on age, people get visibly taller on their birthday, everything in the ground, including a rock, grows, or that bigger things fall faster.

Sometimes, as theories become more entrenched, children seem to lose the common sense of an earlier age. A telling example is provided by Pine, Messer, and St. John (2001), who showed that most six- and seven-year-olds were unable to balance a weighted rod on a fulcrum, claiming that for something to balance it needed to be placed on its midpoint (despite the proprioceptive feedback that told them otherwise). The four-year-olds, on the other hand, had no problem with the task, because they hadn't yet built a generalizing theory that got in the way. As the authors of that study ask, "if the child ignores information from his or her own senses, will he or she find it difficult to assimilate evidence that is counter to the center theory from a teacher?" (Pine et al., 2001, p. 81)

Children also work hard to find ways of incorporating new information into a preexisting naïve theory. For example, they may struggle to reconcile their physical sense that the Earth is flat with the received information that it is spherical, developing a variety of compromise theories, such as the idea of a flattened sphere, or the belief that the flat world in which we live is located inside a larger spherical Earth. Unless we know that the child is thinking this way, we are talking at cross-purposes when they and we both agree that the Earth is spherical. Similarly, we cannot assume that a child means the same thing that we do when they parrot the common wisdom that humans are animals.

Inquiry and knowledge building processes encourage students to explore the ramifications of all their preconceptions. Sometimes, a well-timed and aptly designed experiment will provide counter-evidence that sows the first seeds of doubt. Sometimes, encountering other viewpoints in books or KB discussions begins, bit by bit, to turn thinking in another direction or at least widen its scope. It has also been found that greater pedagogic diversity – in teaching strategies, in available perspectives, in modes of expression – encourages the uncovering and working through of deep-seated student beliefs (Hayes, Goodhew,

Heit, & Gillan, 2003). However, this process can be long and drawn out, with a strong tendency to revert to old beliefs in times of uncertainty. Along these lines, Mike describes what he calls "sticky misconceptions" in his fifth graders (p. 254).

It is therefore unrealistic to expect that every student will fully grasp abstract or counterintuitive concepts by the end of an inquiry. Bringing an implicit theory to awareness and watching it begin to shift may be considered a strong measure of success for many students. This process can take weeks, months, or even years.

In his work *The Unschooled Mind* (1991), Howard Gardner writes: "For the most part, early science education need not directly address the students' misconceptions. Such a confrontation … should await the time when the child has been thoroughly immersed in the phenomena ... and has taken her intuitive theories as far as they can go" (p. 213).

It is also important to distinguish between children's misconceptions, often developmental, which reveal some kind of error in their thinking, from other kinds of beliefs they may hold. This includes other cultural or spiritual ways of parsing the world. These are not something to overcome but have the potential, in their distinctly different purposes, to broaden or transform understanding. In these instances, the aim is not for children to reorganize existing conceptual structures. Rather, we can help them to become aware of the varied purposes different knowledge structures can serve and to consider the contexts in which different kinds of theories might be useful.

Putting It into Practice

Space and Time: What Might an Inquiry-based Classroom Look Like?

> For educators it may be important to realize that classrooms and the things in them are cultural things, things that not only reflect cultural assumptions but may also have effects on how students see themselves in relation to school, communities, and nature itself. This observation represents both a challenge and an opportunity.
>
> – Megan Bang and Douglas Medin, "Culture in the Classroom" in *Phi Delta Kappan* (2013)

In designing a classroom that will support inquiry, there are a multitude of possibilities. While physical classroom design alone cannot guarantee high-level learning, inquiry-oriented educators take seriously the idea of the physical learning environment as a "third teacher" (as described by Reggio Emilio educators), forming the "bones of the curriculum" (Curtis & Carter, 2008, p. 54). Most decisions that educators make, from the wall displays to the layout of workspaces to the selection and organization of materials, will reflect the value they place on fundamental principles of inquiry and knowledge building. Educators, therefore, work to balance practicality with the following considerations:

- Is this classroom conducive to learning in which students' ideas and thinking are at the centre?
- How can I provide long periods of time for students to delve deeply into a topic?
- What values about learning does the physical classroom convey? For example, does the displayed work show a range of skills and levels of thinking, including errors and beginning ideas?
- Can all students find themselves represented in the materials and learning tools of this classroom?
- Have I ensured that each student's thinking is visible in some way?
- Does the classroom set-up encourage students to connect their ideas with those that have gone before (e.g., through archived discussions

or the choice of books)?
- Are materials presented in an undistracting, inviting, and aesthetically pleasing way that awakens curiosity?
- Are materials organized so as to encourage agency, independence, and resourcefulness in students?
- (in an environmental inquiry) How can we bring "the outdoors in," maintaining strong connections between classroom practices and the natural environment that is our focus?

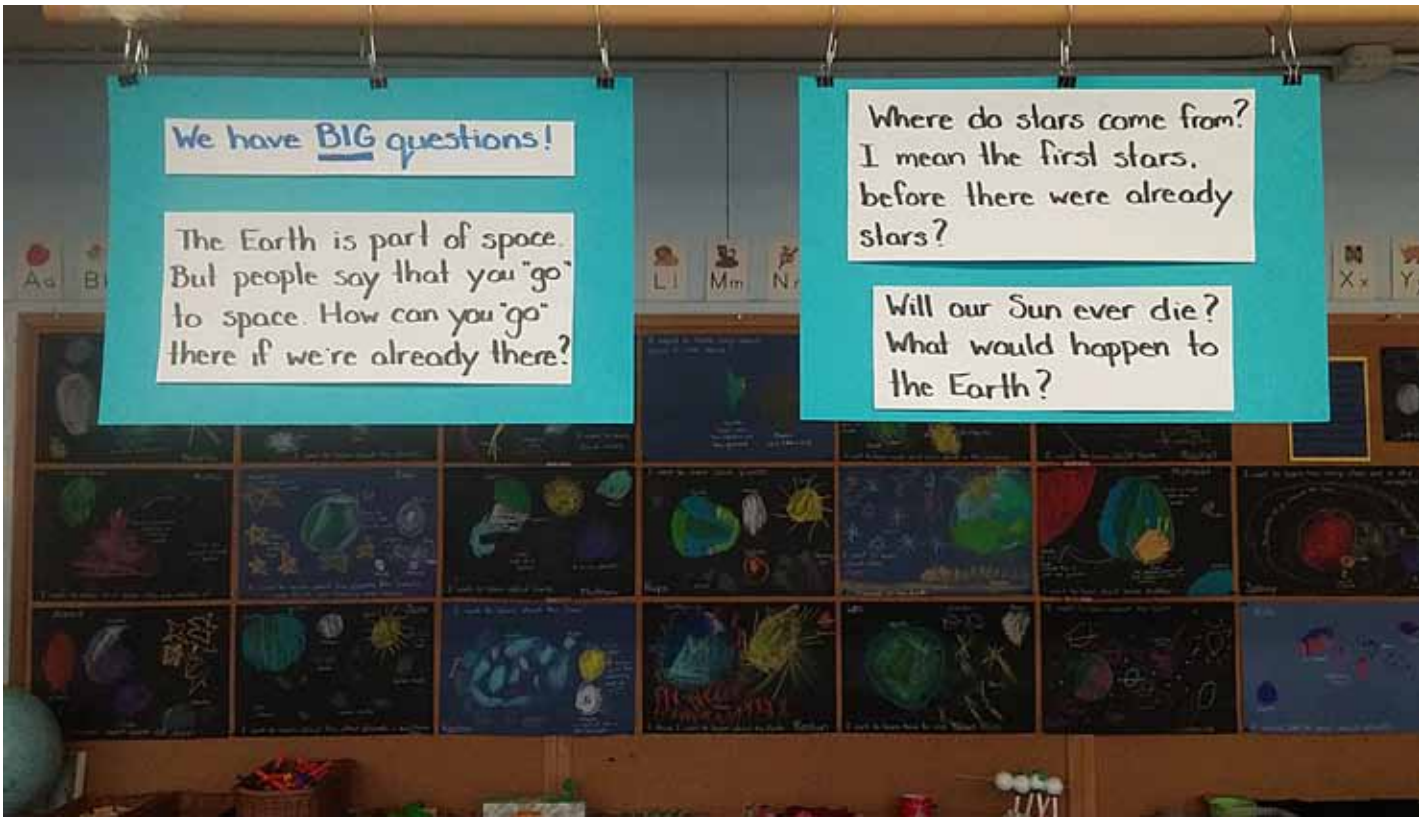
The physical classroom

At the start of the school year, the walls of an inquiry-based classroom will often be quite bare. Few, if any, pre-purchased teaching visuals are on display. Educators want their students to understand that the classroom belongs to everyone. The walls serve as blank canvases to be filled with students' questions, ideas, and expressions of understanding.

As the year proceeds, diverse representations of student learning – in art, writing, building, action photographs, curated collections, and so on – are displayed throughout the classroom. When useful, an area may highlight the questions, ideas, and theories that have emerged from knowledge building discussions. The purpose of these displays is not to highlight the most accomplished work, but to archive ideas – including the less accurate or developed – as they emerge and play off each other. This approach makes explicit the growth of understanding over time.

Such egalitarianism reinforces respect for different ideas, and creates a culture of psychological safety which is essential for genuine learning. Students are more likely to "feel safe taking risks, asking questions, revealing ignorance, voicing half-baked notions, and giving and receiving criticism" (Scardamalia, 2002, p. 9). They come to understand the value of questioning, thinking critically, and testing ideas. They learn that a correct answer or nice-looking end product is not the full measure of learning success. By extension, they come to appreciate their own value as learners.

In this kind of classroom, students often return to use their archived questions or theories as reference points for rethinking existing ideas and triggering new questions. The visible documentation of learning naturally invites conversation with people from outside the classroom, such as family members or other students. As new people are drawn into the learning community, fresh perspectives inevitably emerge.



Given the importance of these physical markers of thinking in the ongoing inquiry process, they need to be made readily accessible to all the students. For example, in classrooms with young children, educators ensure that student work is placed at a child's eye level, not high up where only adults can see it.

When there is room, evidence of student questions and theories may remain on display even after the class has moved on to another topic. This encourages students to build connections among topics and reinforces the notion that individual learning about a particular subject can continue even if the overall focus has shifted to another curriculum area.

Configuration of workspaces

In an inquiry-based classroom, desks or tables are often arranged so that students can interact face-to-face as they work. This encourages students to exchange ideas, learn from one another, and solve problems of understanding together. In contrast, desks arranged in rows and facing the teacher's desk at the front of the room create a narrow path of communication that hinders knowledge building and signals to students that learning occurs solely through the teacher.

At the same time, a program that recognizes different personalities and learning needs will also make it a priority to provide opportunities for children to find private spaces for themselves in the very public setting of most classrooms.

Materials

Beyond displaying ongoing learning, we want our classrooms to be places that curious children will find intriguing, places in which they encounter possibilities that trigger the desire to find out more. The public library is a great place for an educator to start. Books of all kinds, from rich, enticing stories to fascinating factual accounts, along with field guides, maps, and other repositories of information, well-organized and readily accessible, will inevitably draw students into new worlds. It is quite amazing to see the intent focus with which even pre-literate kindergarteners pull meaning from well-designed graphics, or to watch a pair of children animatedly discussing the information they are encountering. Along with large collections of books on topics under study, relevant to the developmental range of students, there should be enough other books readily at hand to intrigue every kind of learner, from dinosaur- or bird-lovers to mythology mavens or bridge builders, reflecting the wide spectrum of both development and interests in any classroom. Watching children freely engage with books of their choice often provides the first indication of their passions.

An inquiry-focused classroom will also have a range of open-ended materials available for play and experimentation, at all levels of development. There are many games or building materials, for example, that offer limitless possibilities for children of all ages.

In keeping with the values of student independence, resourcefulness, and agency, classroom materials will be organized for children to manage as independently as possible, as they purposefully carry out plans for exploring their ideas.

What might the classroom sound like?

Inquiry-oriented classrooms are often pervaded with a buzz of conversation and interaction, sometimes loud and excited, sometimes quieter

and more focused. Some people find it easier than others to work in the midst of so much activity, and each educator will find a balance that works for them and for the individuals in their classroom.

How is time organized?

True learning takes time. The expectation of constant interruption precludes focus and engagement. If we want students to become deeply engaged, we need to give them time to do this. Educators will therefore work, within the non-negotiable limits of their schedules, to ensure long blocks of time for students to immerse themselves in investigating, reading, writing, thinking, discussing, browsing and all the other facets of an inquiry-based program. There needs to be time for exploration at a child's own pace as well as for teacher-planned use of time. Only through genuine and repeated opportunities to manage their own time do children build the kinds of self-regulation skills that have been repeatedly shown to make key differences to their success in school (and in life).

If educators or children believe that time is short, there will be little room for the kind of messing about with ideas and materials and following of false leads that lead to true insight. It also takes time for children to build sufficient familiarity with objects or ideas to know what is worth asking about them.

Cultivating Curiosity: Starting the Environmental Inquiry Process

As educators set up their classrooms to support environmental inquiry, they are also thinking in concrete and specific terms about where to begin. How will they provoke the kind of curiosity that leads to and sustains a focused inquiry? How can they find out what their students are thinking – what intrigues them, what they wonder, and what they would like to know more about? Do they just wait in the hope that something will emerge? Above all, how can they make plans without taking over the students' learning?

While open to the many directions an inquiry may take, an educator usually gives considerable thought to a topic before launching a study. Whether it arises organically, out of observed student interests, or externally, from designated curriculum expectations, or from a mix of both, the educator considers beforehand how to give a topic sufficient scope to engage all learners. They also give thought to identifying some key "big ideas" or the main purpose that makes the topic meaningful and worth studying. They research potentially useful materials and resources and gain content knowledge that will help them to maintain focus through the diversity of pathways that students may follow. Though they may or may not have a specific endpoint in mind (compare, for example, Lisa's and Carol's stories in Part 2), they usually begin with an overall (albeit flexible) idea about what directions student learning will take, as well as key concepts with which they consider it important for students to engage.

There is no single way to begin an inquiry. Students have diverse personalities, skills, talents, and interests. As a result, educators may use a variety of strategies to stimulate interest and engage students in common experiences before asking them to share their questions about a topic. Table 5 lists a few strategies that educators have found effective. Each strategy is then discussed in more detail in the section that follows.

Table 5: Cultivating Curiosity

Help students connect a topic to their lives
Take your class outside
Elicit prior knowledge
Read to children
Provide opportunities for children to build community in their own way
Provide opportunities for children to observe natural phenomena
Pay attention to spontaneous questions
Provide hands-on experiences
Start with simple questions
Revisit related questions or topics from previous inquiries

Help students connect a topic to their lives

> It is the affective elements – the subjective experience and observations, the communal relationships, the artistic and mythical dimensions, the ritual and ceremony, the sacred ecology, the psychological and spiritual orientations that have characterized and formed Indigenous education since time immemorial.
>
> – Gregory Cajete, *Look to the Mountain: An Ecology of Indigenous Education* (1994)

Students are especially keen to explore a topic when they appreciate its relevance to their own experience. To help them make this connection, educators in an inquiry-based learning environment may ask their students to bring in an object related to the current topic and connect it to aspects of their own lives. This invites the whole child, personal experiences and all, into the learning process.

For example, a Grade 1 teacher started the year by asking her students to bring in all the seeds they could find (see "Zoe's Story" in Part 2, p. 187). The children's excitement around the topic quickly grew as the classroom collection built momentum.

The strength of this strategy lay in its utter simplicity – this was a project that every child could manage on their own, on the way to school, on the playground, munching on an apple. Looking everywhere for seeds, they began to see the world in a new way. Everyone's sample immediately found a place within the classroom collection, which led to a strong sense of belonging and investment in the learning for every member of the classroom community.

Take your class outside

The essence of environmental inquiry lies in its connection with the world outside the classroom walls. This means spending significant amounts of time in the natural environment – fall or winter, rain or shine – to fully appreciate its wonders and forge lasting bonds. Students need meaningful opportunities to explore their environment. This need not involve an excursion to a distant forest or river. A short walk around the school neighbourhood or to the local park, encouraging students to investigate their surroundings using all of their senses, can awaken curiosity and spark questions. Children are avid collectors, and analyzing their collections from outdoor ventures is a wonderful beginning to an inquiry. Many of the teachers' stories in Part 2, as well as the chapter on experiential learning, convey the richness of outdoor learning in more detail.

Elicit prior knowledge

Questions often emerge as students describe what they already know about a topic. This may first occur on either an individual or a group level. Educators sometimes begin an inquiry by asking students to draw or write about what they know about the topic. Once each child has documented his or her ideas, the educator might bring the entire class together in a Knowledge Building Circle. At that point, the educator might ask, "What are you interested in learning more about?" Conversely, a KB discussion might provide the first encounter with a topic, followed by individual reflections.

Read to children

Reading a story or information book to the class is a powerful way to trigger curiosity and knowledge about a topic. For example, in "Marlo's Story" (Part 2, p. 226), a simple picture book launches an extensive investigation into rocks and their place in the community. "Carol's Story" (Part 2, p. 168) recounts how a retelling of a Haida creation tale stimulates children's thoughts about their place in the universe. Books serve both as a catalyst for thinking and as a source of information. When presenting informational texts, an educator may read only a couple of pages before a flood of ideas and questions pour forth. At other times, especially in more narrative contexts, there may be value in asking children to hold their thoughts until they have heard the whole story. In all cases, it is remarkable to see how even students new to the English language can glean meaning (and rapidly build vocabulary) from a series of engaging books.

The profound value of story in making sense of the world is common across most cultures. Grounding learning in stories and storytelling offers a point of connection between Indigenous ways of learning and more school-based approaches.

Provide opportunities for children to build community in their own way

Especially in the early years, as children are just becoming aware of what it means to be in school, it can be challenging to find a topic that everyone will immediately connect with. Opportunities for engaging in common but unforced experiences, often through sustained and purposeful social play, can be an important step in developing a classroom culture of shared learning. In "Stephanie's Story" (Part 2), the first inklings of a kindergarten learning community appear as the class comes together in a freely chosen construction project. Later on, the experience of nature and pursuit of shared questions further cement and enrich this early sense of community.

Provide opportunities for children to observe natural phenomena

Children become deeply engrossed in witnessing natural processes. Whether they are tracing the path of an ant or watching a bird take off in flight, observing pumpkins rot or waiting for a butterfly to emerge from its chrysalis, these mysteries of life always generate myriad questions. Introducing

living examples of natural change usually provides an immediate and compelling common focus for a class, in which almost every student is sure to find something that intrigues them.

Pay attention to spontaneous questions

Many children's questions come up spontaneously when you least expect them. Such questions arise in all kinds of situations, ranging from overheard observations in play to sudden insights during discussions.

Unprompted student questions are often the most genuine instances of curiosity. Even if they seem vague or initially difficult to fathom, and whether or not they take the form of classic questions, children's spontaneous wonderings provide educators with valuable clues about their thinking processes and interests. This is especially true in the very early years, when four-year-olds, for example, may still be learning what a question is and how to ask it. Rather than interrupt what is happening at the time, an educator might note these questions as they come up and bring them later to the group for consideration, supporting or even initiating a full-scale inquiry in this way.

At times, a spontaneous observation elicits immediate interest that generates a more sustained look. For example, a Junior Kindergarten boy at the Lab School approached his teacher in the schoolyard, remarking, "There's something very weird happening. The sun and the moon are both out at the same time." Before long, a crowd of children had gathered to puzzle over this strange occurence – thinking about why it was surprising, how to make sense of the phenomenon, how it meshed with what they thought they knew, and so on. Their ideas, imaginings, and theories formed the basis for a prolonged investigation into day, night, and the solar system.

In another kindergarten playground, a child summoned his teacher to watch rainwater disappearing down a drain. "Where is the water's real home?" he wondered. Within a short time, his question had become the focus for a class-wide study of the water cycle (Stephanie Hammond, personal communication).

Sometimes, spontaneous discussions in one curriculum area can open up unexpected possibilities in another. A group of Grade 4 students at the Lab School were comparing the contemporary staging of a recently attended Shakespearean play with their understanding of staging in Shakespeare's day. A girl commented that in Elizabethan times, the theatre would have lacked a roof "because there was less light then." This intriguing comment evoked widespread interest in the curriculum topic of "Light," and a study was launched on the spot (Richard Messina, personal communication).

Provide hands-on experiences

Many children need to physically engage with materials to really think about them. Hands-on experiences such as planting, digging through soil to deconstruct its composition, or holding a worm can be deeply engrossing to children and inspire many observations and questions.

Start with simple questions

The simplest questions have rich potential to provoke students into seeing the familiar anew. One class began a study of plants by sorting a motley collection of objects (amassed on an outdoor excursion) into "living" and "non-living" categories. It soon became clear that the boundaries between living and non-living things were much fuzzier than originally assumed, awakening speculations, arguments, and theories about the meaning of these terms (literally, the meaning of "life") that turned a fairly mundane exercise into a profound philosophical investigation that drove inquiry for many months.

A focus on children's questions does not preclude an important role for educator questions as well, especially questions that probe the implications of a theory or cast new light on a topic or problem.

Revisit related questions or topics from previous inquiries

Questions posed in a previous inquiry sometimes relate closely to a current area of study. Revisiting points of interest from past learning can create helpful entry points for further questioning in a related topic.

Sometimes, starting with a longstanding question that people have pondered for millennia (such as what matter consists of) helps students to connect their own thinking with past ideas and situate their own speculations within an ongoing historical process of knowledge construction.

What Is the Role of the Educator?

One practitioner of inquiry-based learning has described the educator's role as that of an "expert learner" alongside less experienced learners. In modelling expert learning, an educator's passion for (and resulting knowledge about) a topic can be quite inspiring for children (see "Cindy's Story" in Part 2, p. 204). As the students move forward with their questions and theories about the world, the educator proceeds with unanswered questions of their own, not only about the topic under study but also about the students and how they relate to the topic, to each other, and to their own learning.

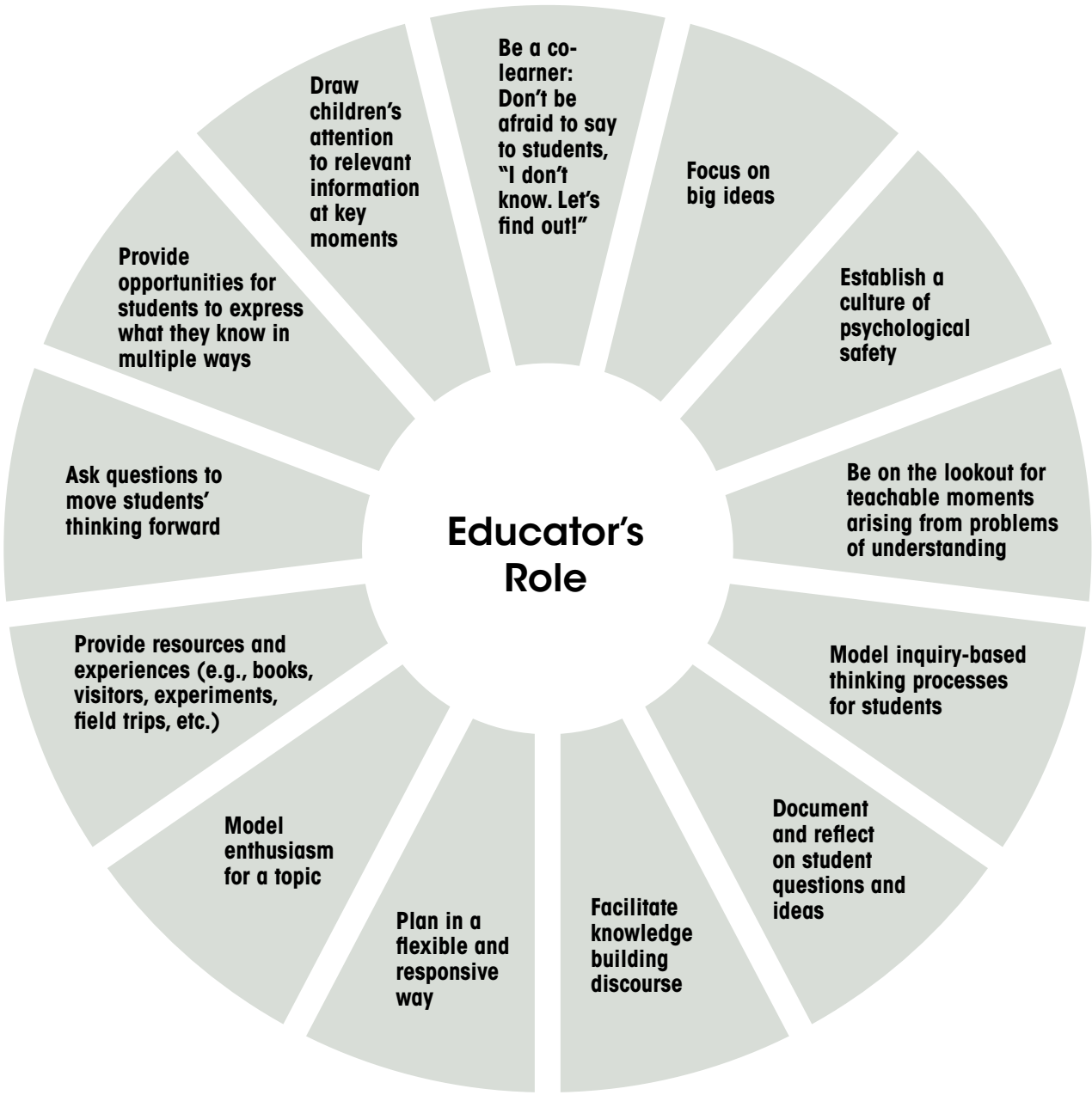
Figure 3 suggests the complexity of an educator's multifaceted role within an inquiry-based learning environment. Depending on their degree of experience in this mode, an educator may exercise only a few of the roles described in Figure 3. For example, many educators already "provide opportunities for students to express what they know in multiple ways," but may have less experience "documenting and reflecting on student questions" to inform subsequent planning. As educators become more comfortable moving from a teacher-directed to a student-centred classroom, they gradually build more roles into their instructional repertoire.

In many classrooms, the teacher remains the keeper and arbiter of knowledge, who transmits information through sequenced lessons organized to cover predetermined curriculum expectations. In contrast, an overall examination of Figure 3 suggests that the primary role of an educator in an inquiry-based learning environment is to "facilitate knowledge building among participants in a setting dominated by interactions among students" (Kozak & Elliot, 2014, p. 90).

However, "facilitation" in the narrow sense is not the only role that an educator will play during the course of an inquiry. There will be times where more teacher-directed instruction becomes appropriate to the topic, question, or learning needs of the class. Every educator will encounter moments at which the momentum of student-driven inquiry stalls in circular speculations that go nowhere. At such impasses, they must decide whether (or for how long) it is productive to leave the students struggling, and to decide when teaching a specific skill or offering a piece of pertinent new information is the best way to move things forward.

This kind of direct instruction in no way detracts from the children's sense of autonomy as they pursue their learning, but rather serves to support them in achieving learning goals they have come to care about. Using judgement to decide when and how much teacher direction is appropriate is part of what is involved in the facilitation process. Similar judgements may be called for in deciding when to introduce other kinds of more "authoritative" knowledge found in books or other repositories of expertise.

Figure 3: The Educator's Role in an Inquiry-based Learning Environment



Some of the roles in Figure 3 are self-explanatory. Others, such as modelling inquiry-based thinking processes and flexible planning, may be less obvious to educators who are new to this kind of learning.

Modelling inquiry-based thinking processes for students

Educators model inquiry-based thinking processes when they pose the kinds of open-ended questions that help students become independent problem-solvers. As Scardamalia notes, "By serving as a model of expert learning, the educator helps students gain insight into the executive processes by which learners take charge of their understanding" (2000, p. 6). Examples of these kinds of questions often include the use of metacognitive language:

- "What do you **notice**?"
- "What do you **think** might happen if …?"
- "Does this **remind** you of anything?"
- "I **wonder** why your plant grew shorter than Samira's?"
- "What can we do to **find out**?"

- "**Why do you think** that happened?"
- "How has your **thinking** changed?"
- "What **evidence** supports your **idea**?"

Along with this kind of metacognitive modelling, an educator's own demonstration of lively curiosity and enthusiasm for a topic makes an enormous difference to how wholeheartedly students will plunge into the learning.

Planning in a flexible, dynamic, and responsive way

Rigid adherence to a predetermined sequence of lessons in a unit plan rarely accomplishes the fundamental goals of inquiry-based learning and knowledge building. When learners are offered opportunities to explore and satisfy their curiosity, their pursuit of their own questions often leads them down exciting and unexpected pathways. In an inquiry-oriented environment, educators allow students' questions, ideas, and conceptions to chart the course of their learning and influence the direction of planning. But how do educators do this?

Table 6 provides examples of lead-in actions that educators might use. It illustrates the dynamic interplay between students' questions and educators' responsive planning.

Table 6: A Sample Sequence of Lessons

Key Actions	Example
Choose a key concept related to curriculum	Soil Ecosystems
Brainstorm all possible directions it can go, how it might connect to big ideas in the curriculum, and to other strands or areas of the curriculum.	Rocks and minerals; planting, worms, food, composting, agriculture, insects, habitats, archaeology, geology, subways and tunnels
Brainstorm initial supporting resources that may be useful.	Magnifying glasses; information and story books; field trips; guest speakers; soil samples; multi-media resources
Decide what the first lead-in experience(s) will be.	Take students outside to collect soil
Gather together in a Knowledge Building Circle to talk about the first lead-in experience, in order to assess what students know and want to know.	Document questions and theories that arise in discussion "What did you notice? What do you know about soil? What do you wonder?"
Reflect on the students' shared questions and ideas and how they could be used to inform subsequent planning.	"Hmm. Many of the children posed questions about worms and how they help soil. We might benefit from seeing some worms in a terrarium or even a vermicomposter."
Decide if students will be exploring questions individually, in small groups, or as a whole group.	Students who are not yet skilled readers and writers may need more adult support to pursue questions. Kindergarten students may initially engage more easily in small group settings with fewer self-regulation demands. Students in older grades are generally more able to branch out into groups to independently investigate different questions.

Look for teachable moments and problems of understanding

Students don't always know how to move forward with their questions. As they begin to gather information from expert sources, as well as through observation and experimentation, they are likely at some point to come to a roadblock in their understanding. For example, they may be unable to find age-appropriate reading materials relating to their questions. Educators need to identify such moments and be prepared to support their students using some of these strategies:

- Guiding a student to reformulate their question to make it more precise and answerable
- Encouraging students to bring problems of understanding to a Knowledge Building Circle in the hope that other students can help to clarify the problem
- Directing students to helpful resources; the educator may need to rewrite, read aloud, or paraphrase a difficult text
- Teaching a mini-lesson to clarify the problem of understanding, especially if others have reached a similar impasse

> As the teacher engaged in this kind of learning process, it's about knowing that the kids will be heading down a particular road, and that they may need to know certain things in order to reach their destination. If they need to know x in order to learn y and z, then I need to be aware of that and somehow find a way to show them x.
>
> – Ben Peebles, Grade 5/6 Teacher, The Laboratory School

Focus on the big ideas in the overall curriculum expectations

Lab School Principal, Richard Messina (2001), notes, "In coverage-oriented instruction, topics are merely checked off and students move on whether there is understanding or not" (p. 21). However, when teachers focus on the larger overarching ideas and key concepts, they discover that students' questions are more likely to connect with or exceed curriculum expectations. This was the case for teachers in the Toronto and York Catholic District School Boards who piloted environmental inquiry in the first edition. At the end of the school year, they reviewed the content that had been covered and realized that their classes had addressed all of the required curriculum expectations and more!

Establish a culture of psychological safety

According to Dr. William Blatz, the first director of the original Institute of Child Study Laboratory School, a child's sense of security within a learning setting provides a necessary foundation for their learning to flourish (Blatz, E. Bott & H. Bott, 2010). This fundamental sense of security allows them to take intellectual risks, ask genuine questions, and posit half-formed theories. They need to feel confident that they will neither be judged nor ridiculed and that their contributions needn't always be correct or sophisticated.

To create a culture of psychological security, educators pay close attention to the social and emotional lives of their students. Building relationships is a priority, both with and among students, as well as with their families. An educator is careful not to skew a child's offerings through undue praise or criticism. Instead they are careful to model patience and neutrality through a variety of techniques:

- Encourage children to take time to think before giving an answer. Tell them to close their eyes and think about a question for a few moments before answering (Ogu & Schmidt, 2009).
- Receive children's ideas in a neutral manner, perhaps paraphrasing what they say without judgement. Summarizing a child's contribution before throwing it back to the group makes their ideas available for reflection and encourages children to think for themselves instead of seeking teacher validation. "Paolo thinks that sand comes from rocks and Andrea says it is dirt from the ocean. What do you think? Where does sand come from?" (Ogu & Schmidt, 2009, p. 15). When paraphrasing what a student has said, it is important to check in with them to ensure you have conveyed their intended meaning ("I think I heard Tibor say X. Is that what you meant, Tibor?") Resist the temptation to interpret a less-than-clear offering in terms of your own wishes.

- Be a co-learner. Don't be afraid to say, "I don't know. Let's find out!" When an educator acknowledges their own lack of knowledge, students are more likely to admit their own uncertainties. On occasion, the educator may also refrain from answering in order to encourage students to problem-solve: "That's a great question! How can we try to figure it out? Where can we look?"

Inquiry and Assessment: Why, How, and for Whom?

> A vision of schools in which the purpose is deep understanding of ideas and concepts requires a dramatic change in the assumptions underlying education and it requires a different view of schools, schooling, teachers, teaching, and, particularly, assessment.
>
> – Lorna M. Earl, *Teaching for Deep Understanding* (2004)

New paradigms of learning such as inquiry will necessitate new paradigms for assessing the learning. The open-ended nature of the inquiry process can lead to the common misconception that inquiry is somehow incompatible with assessment. If all ideas are both embraced and improvable, how can we begin to adjudicate among them? In reality, it is almost impossible to speak of inquiry without speaking of assessment. Every aspect of student involvement – every piece of work, every expressed idea – both advances their learning and provides essential information about them as learners. As an example, a careful drawing of what they see both reveals a child's understanding and helps them to further develop this understanding.

Ongoing and productive, a great deal of assessment in an inquiry-based classroom can be characterized in terms of reflective questioning. The child's ongoing assessments drive their inquiry: Is this the best question to ask? Will this help me figure out an answer? Is this answer fully satisfying? How am I fitting into the learning community? The educator's ongoing assessments drive their teaching: How can I help this student become fully engaged? What skills do I need to teach to whom? How can I best move thinking forward? This last question involves a complex and multi-layered piece of reflection. It encompasses an educator's self-assessment, questions about children, and questions about the topic and its key ideas.

Students continually assess the quality and utility of their ideas and situate them in the broader social and intellectual class context. Educators assess the growth of student ideas, skills, learning strengths, and emotional investment both as a group and individually. The entire learning community assesses where the inquiry is going and how to best achieve its purposes. In line with the idea that "virtually all classroom activities, whether formal or informal, provide teachers with information that can be used to monitor learning progress" (Fostaty-Young, & Wilson, 2000, p. 13), assessment is an ongoing process inextricably embedded in everyday classroom life throughout an inquiry.

Why assessment?

Like all assessment, inquiry-based assessment can be considered *as* learning, *for* learning, or *of* learning (Ontario Ministry of Education, 2010).

As Learning: Assessment gives educators a window into a child's thinking and understanding. This informs their next steps in developing a responsive curriculum and providing appropriate supports.

For Learning: Assessment allows educators to provide meaningful, explicit, and actionable feedback to students. This allows them to identify areas for growth and participate in targeting areas that need attention.

Of Learning: Assessment provides concrete and accessible information to parents and other educators. This demonstrates the growth of a child's understanding and skills as well as indicating how they engage and apply those skills.

While a piece of assessment will frequently serve more than one purpose, not every function will be covered in every instance of assessment. In an inquiry-based classroom, assessment as and for learning tend to be prioritized. Along with informing the teaching and learning process, these modes of assessment provide crucial information that can be used for reporting purposes.

In assessment as and for learning, timely feedback can help the child understand what is going well in terms of their skills, learning process, and content knowledge. They can then make authentic use of this knowledge, not as an exercise in self-improvement, but because it will help them to find out what they want to know and convey what they have learned. Working with a student in this area, the aim is for the child to develop the ability to reflect upon their own thinking and thereby assume increasing responsibility for their own learning.

How does assessment apply to inquiry?

At the heart of assessing a student's engagement in inquiry is the question of what it means to know an individual child, both as a unique learner and as a member of a learning community. How do the two roles interact and support each other for that child? Inquiry provides a lens through which to view a child's thinking, questioning, and application of skills in the pursuit of meaningful knowledge and real-world problem solving.

Because inquiry requires an ongoing synthesis of ideas, many skills will be assessed in an embedded way as they are used for real purposes. Getting to know a child in this way takes time – as Robin Shaw, Lab School teacher, described it, "We are looking for things that grow over time. It takes a whole unit, or year, to form a profile for a particular child." Such an expansive view allows an educator time to watch the slow growth of complexity, sophistication, and depth of thinking in learners. It also recognizes that children (like adults) may be very different kinds of learners in different situations, depending on the area of study, their perceived place in the social fabric of the classroom, and the kinds of activities and projects undertaken. It is therefore a educator's responsibility to ensure sufficient diversity of topics and learning over the year to build a multi-dimensional portrait of an individual.

What might assessment of inquiry look like?

In creating a full picture of a learner, the assessment of students in an inquiry-based setting will take many different forms, depending on its purpose.

- Embedded or Decontextualized? Though often embedded in a learning activity, there are times where an educator might structure a more explicit assessment to gain a clearer picture of certain aspects of their students' learning. For example, they may ask targeted questions to find out what a child understands about a given concept.
- Individual or Group? An assessment may be individualized or it may ask a question common to all. A wide range of individual responses will be both expected and appropriate.
- Explicit or Implicit? Children may or may not realize that they are being assessed in some way. But they will always understand that the purpose is to help the educator know them better in order to better support their learning and well-being at school.
- Multiple Sources of Assessment: Individually or in a group, assessment may involve speaking, writing, art, math, building, digital creations, or imaginative play, to name just a few possibilities.
- Multiple Purposes for Assessment: The intention may be to elicit prior knowledge, document the growth of understanding, or to elicit reflection upon changes in understanding. An educator may also be assessing narrower skills that will help the child pursue their questions or express their understanding.

It is less likely that inquiry-based assessment will

- take the form of a multiple-choice test
- require one-phrase answers
- hope to elicit the same response in everyone
- only occur at the end of a unit

What do we look for?

Throughout the grades, beyond subject-specific expectations, there are significant markers of engagement and learning approaches that educators look for. They ask whether (or how) the child

- demonstrates curiosity
- shows focus
- persists in the face of difficulty
- works hard to achieve goals
- sustains interest in a topic
- shows excitement or pleasure in learning new things
- closely observes the world
- is organized
- shows flexibility
- is open to other ideas
- clearly communicates ideas and understanding
- asks rich questions
- revises a theory in the face of counter-evidence
- makes predictions
- reasons logically
- builds arguments and counter-arguments

There are also a host of relevant social skills to be considered, including the ability to listen attentively or collaborate respectfully and productively with others.

Understanding common developmental trajectories in key areas provides a useful framework for assessing many aspects of a child's involvement in the inquiry process. As children get older, the expectations change. Once established, each area remains important throughout a child's schooling as they spiral back to old issues at new levels of maturity. Table 7 provides a developmentally informed summary of learning criteria that can guide what a teacher might watch or listen for at various stages of the inquiry process.

Table 7: Summary of Developmentally Informed Learning Criteria in Inquiry

Grade Level	Knowledge Building Discourse	Experimentation and Theory Building	Exploration and Research	Depth and Expression of Content Knowledge
Early Years Children are just learning how to engage in ideas as a community as they begin to realize that others have viewpoints of their own. They are becoming aware of the interests of others and starting to find common interests with peers. Developmental differences mean that expectations are still strongly individualized.	**How does the child ...** Participate actively: offering questions, ideas, theories? Participate as an onlooker: watching and listening to peers? Make connections? Take turns? Respectfully agree or disagree with ideas regardless of who offers them?	**How does the child ...** Observe and describe phenomena? Ask focused questions? Offer predictions? Identify outcomes? Note (mis)match between prediction and outcome? Show causal thinking?	**How does the child ...** Engage in hands-on exploration? Show curiosity? Explore books, photos, or other sources of information? Listen attentively to information? Connect new information with pre-existing knowledge or personal experience?	**How does the child ...** Express understanding in diverse ways? Retain and convey information? Apply new concepts in different contexts? Change ideas in response to new information?
Primary Incorporating and building upon the learning assessed in the Early Years, children more intentionally engage as members of a learning community. Though individual responses remain varied, group expectations become more generalized.	**How does the child ...** Share knowledge, experiences, and theories? Engage in topic-centered discussion? Listen to and build on to the ideas of others? Show appreciation for other ideas? Justify ideas? Suggest next steps?	**How does the child ...** Organize and record observations? Ask productive questions? Reason logically? Think causally? Build simple explanatory theories? Test theories experimentally?	**How does the child ...** Express and pursue interests? Independently access resources? Identify relevant information? Make connections to previous learning or experience?	**How does the child ...** Show depth of understanding in a variety of ways? Reflect on own understanding? Reflect on community understanding? Convey ideas orally and in writing? Explain their thinking so that it makes sense to others?
Junior Children are encouraged to pursue their own interests within the broader community, while bringing this knowledge back to the group to deepen collective understanding.	**How does the child ...** Contribute to group knowledge building? Identify and offer productive ideas? Identify problems of understanding? Develop and refine promising questions? Incorporate conflicting ideas into a higher level theory?	**How does the child ...** Develop testable hypotheses? Design experiments to answer questions? Draw and justify conclusions? Create models and analogies? Build complex theories? Test theories against observations? Revise theories in face of counter-evidence?	**How does the child ...** Rigorously investigate questions? Find relevant information for building personal and community understanding? Summarize and synthesize information? Critically analyze information, including assessing credibility of source?	**How does the child ...** Reflect on growth of personal understanding? Reflect on growth of community understanding? Apply knowledge to real-world phenomena? Summarize knowledge clearly and engagingly for an outside audience?

How do you assess students in an inquiry-based learning environment?

Inquiry-based assessment, evaluation, and reporting is as student-centred as the inquiry-based learning process itself, and can be characterized as follows:

- It focuses on the growth of each student over time, rather than comparing them to other students or to a statistical average.
- It makes thinking processes explicit.
- It embeds assessment into everyday classroom life throughout the inquiry.
- It focuses on learning skills and higher-order thinking skills as well as the accumulation of information.
- It aims to be helpful and transparent for students and families as well as for the educator.
- It is based on ongoing and varied sources of student expression.
- It supports the development of "students' self-assessment skills to enable them to assess their own learning, set specific goals, and plan next steps …" (Ontario Ministry of Education, 2010, p. 6).

In an inquiry-based classroom, the educator assesses student progress on a continuous basis throughout the school year, collecting and using a wide range of information to provide an informed and comprehensive picture of the students' learning. As well as helping each student situate themselves in the learning, using multiple sources of evidence "increases the reliability and validity of the evaluation of student learning" (Ontario Ministry of Education, 2010).

Some examples of authentic assessment sources include

- student questions
- inquiry lab books
- portfolios
- visual art
- anecdotal observations
- transcripts of KB discussions
- culminating projects

Some strategies for working with each of these sources for assessment are described in the section that follows.

Student questions

Even as they move an inquiry forward, students' questions also provide an educator with invaluable information about how they understand a topic. Through recording questions that arise during Knowledge Building Circles and in other conversations, it often becomes possible to trace the growth of children's thinking.

A key aspect of a teacher's role is to help children refine their own initial questions – as scientists do – to make them more answerable, thinking about what they are really asking and how to best ask it. Students ask many different kinds of questions, ranging from simple factual queries to causal questions to questions that deeply probe the implications of a theory or attempt to make sense of inconsistencies. And some questions – the more philosophical "wonderings" – go beyond the scientific to probe fundamental assumptions about the world and how it works. Each type of question has an important place in inquiry – we need the details as well as the big picture – and the diverse kinds of questions offered by different students enrich the learning process for everyone.

Determining the scope of a question is not always straightforward. Word choice or grammar do not always signal a question's purpose or function; sometimes a pertinent factual or statistical question serves to probe a much deeper idea. While identifying a child's preferred mode of questioning provides valuable information for an educator, it is also important to see how and whether the range and scope of their questions broaden over time. As an inquiry proceeds, educators can profitably draw students' attention to the way in which certain types of well-timed questions may be especially valuable in extending and deepening group understanding, while others (perhaps more simply answered through a Google search) may do less to advance the overall course of the inquiry. Table 8 offers suggestions for assessing students' questions.

Table 8: Assessing the Content and Quality of Students' Questions

Assessment Considerations Arising from…	
…the content of a student's question	…the quality of a student's question
What does this question tell me about this student's interests and curiosity?	Is this question formulated precisely enough to be answerable?
What does this question reveal in terms of gaps in this student's content knowledge?	Does this question represent this student's ability to make connections among ideas?
What evidence of existing content knowledge does this student's question reveal?	Does this student tend to ask questions that are fact-based, higher-order in nature, or a combination?
Does this question build on recently learned information or experiences, revealing a consolidation of learning?	Has this student shown growth in the questions that they ask?
Does this question show an understanding of what information will help the group to move forward?	Does this question play a valuable role in advancing group knowledge?

Inquiry lab books and portfolios

Inquiry lab books are notebooks in which learners record all kinds of information related to their inquiry, including their

- initial questions
- causal theories
- observational sketches and diagrams
- reflections on experiments
- notes on research from books, internet sources, and guest speakers
- notes and/or drawings from field experiences
- new questions and theories

With each entry dated, the lab book archives a learner's ideas and research over time and provides a window into the evolution of their thinking. By contrast, a more conventional test reveals a slice of their knowledge as it manifests itself at one particular moment in time.

> If you are paying any attention whatsoever during this inquiry process you will have a really fine-grained understanding of what the child understands; and a much more fine-grained understanding than if you were only to rely on a series of tests. Even a really well-written test only reveals what a student happens to recall or output on a particular day. But with inquiry, they have multiple ways of demonstrating their understanding over time. So you see their developing understanding, as opposed to a snapshot in one moment.
>
> – Ben Peebles, Grade 5/6 Teacher, The Laboratory School

Drawings and other forms of visual art

New insights into how children understand the world, that don't always come out in verbal exchanges or written communication, sometimes emerge through drawings and other visual modes of expression. Especially with English language learners or the less verbally forthcoming, art offers educators another window into what a child notices and how they connect their observations of phenomena.

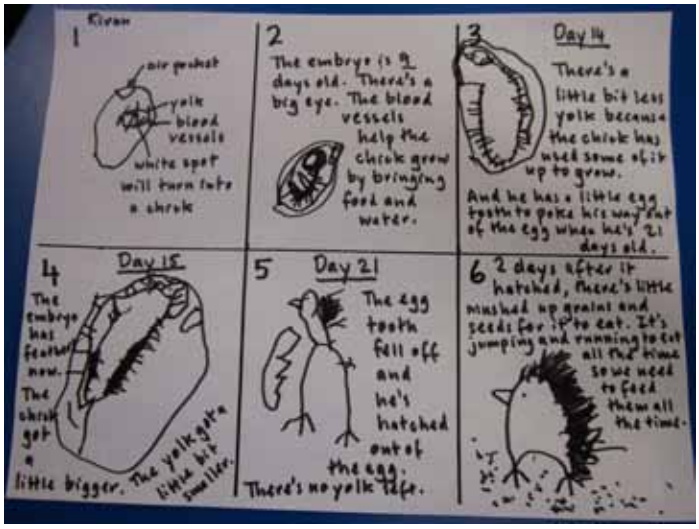
In Junior Kindergarten, students were studying the development of a chicken, from egg to hatchling and beyond. Notice the knowledge and vocabulary that was revealed through this JK student's drawing of a chicken's development from "a little dot" to "growed up," including the suggestion of a new life cycle beginning (Photo 1).

Photo 1: JK Drawing and Scribed Reflection, Example 1

The drawings in Photos 2 and 3 show quite different focuses and kinds of understanding. Through such comparisons an educator builds context for their own understanding of the different ways children have been thinking about the process.

Photo 2: JK Drawing and Scribed Reflection, Example 2

Photo 3: JK Drawing and Scribed Reflection, Example 3



Drawings illuminate a student's perspective and allow the educator to consider their attention to detail. By noting what is included or excluded, an educator may identify which elements of an experiment or observation a student finds most relevant or memorable, as well as what they might be overlooking. Analyzing and interpreting evidence of student learning in this manner is an essential step in the assessment process (Ontario Ministry of Education, 2010). Figure 4 shows in more detail how comparisons of student responses can inform a teacher's understanding.

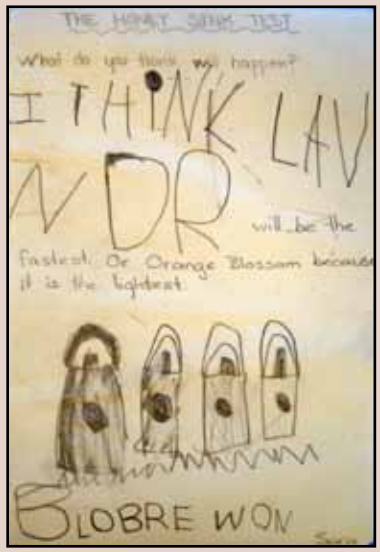
At the same time, not all students are comfortable representing ideas in drawing, and a cursory scribble needs to be probed further. Often the true value of the drawing lies in the ideas that emerge when an educator engages with the child to discuss their work.

Figure 4: Opportunities for Assessment through Inquiry

The four examples below were created in response to a child-designed experiment during a study of bees. Identical little metal balls were to be dropped simultaneously into four different kinds of honey. Each student made a prediction as to which metal ball they thought would sink the fastest (a test of viscosity!). They then considered the results.

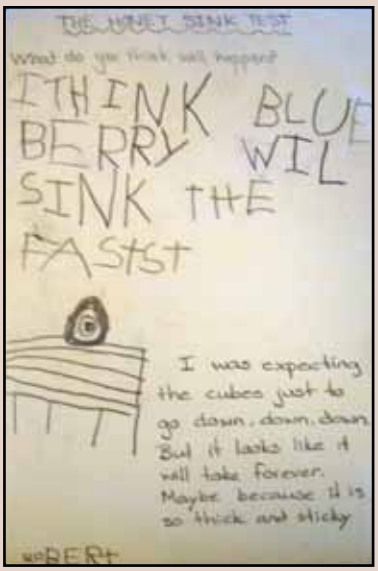
In this example the child reports that her prediction was correct, and makes an observation that one ball never made it all the way to the bottom – a fairly straightforward observation, but notice how the drawing clearly shows the balls sinking at different rates.

In the second example, the student has not only made a prediction but has also offered a plausible theory to support her thinking. The drawing effectively illustrates the uniformity of the jars and balls being used – proper scientific method.



In this example, the student has offered a prediction and makes a close observation of the results, implicitly reflecting upon her expectation that the balls would have sunk to the bottom more quickly. Despite the more rudimentary drawing, this student's illustration carefully notes the variable colours of the honeys. Note that the student does not seem to consider being "right" in her prediction of particular importance.

In the fourth example, the student actively reflects upon his prior assumption of what would happen (very meta-cognitive). He goes on to offer a theory for why the balls, particularly the one pictured, seem to be sinking so slowly. Again, note that the student does not bother to add that he was correct in his prediction. He seems much more interested in understanding what happened!



Each of these responses highlights different ways of seeing and thinking about the world. Rather than comparing them on a hierarchical scale, the teacher can use these artifacts to better understand and communicate each student's thinking to others.

Documenting observations

Student-to-student small-group interactions

When students work collaboratively, it is sometimes difficult to precisely determine the accomplishments and learning of individuals. Yet the interactions that occur among students during small-group work can significantly reveal their developing understanding. Once students have developed the maturity and independence to independently investigate their questions in pairs or small groups, an educator can casually walk around the class to observe and listen to student interactions, while informally recording notable remarks, questions, or observations. In this way, the educator can assess the extent to which a student has internalized newly acquired concepts. The way in which a student spontaneously extends or applies newly acquired concepts within the group may offer the clearest sign of their understanding or misunderstanding.

Mini-conferences

Holding mini-conferences with individuals or research groups as they investigate problems of understanding offers another assessment opportunity. Touching base with each group can provide a detailed sense of each student's level of understanding, as well as highlighting the learning skills and work habits that are instrumental in student success.

Table 9 offers some suggestions from the Ontario Ministry of Education for assessing learning skills and work habits.

Table 9: Learning Skills and Work Habits in Grades 1 – 12*

Learning Skills and Work Habits	Sample Behaviours
Responsibility	The Student: • fulfils responsibilities and commitments within the learning environment; • completes and submits class work, homework, and assignments according to agreed-upon timelines; • takes responsibility for and manages own behaviour.
Organization	The Student: • devises and follows a plan and process for completing work and tasks; • establishes priorities and manages time to complete tasks and achieve goals; • identifies, gathers, evaluates, and uses information, technology, and resources to complete tasks.
Independent Work	The Student: • independently monitors, assesses, and revises plans to complete tasks and meet goals; • uses class time appropriately to complete tasks; • follows instructions with minimal supervision.
Collaboration	The Student: • accepts various roles and an equitable share of work in a group; • responds positively to the ideas, opinions, values, and traditions of others; • builds healthy peer-to-peer relationships through personal and media-assisted interactions; • shares information, resources, and expertise and promotes critical thinking to solve problems and make decisions.
Initiative	The Student: • looks for and acts on new ideas and opportunities for learning; • demonstrate the capacity for innovation and a willingness to take risks; • demonstrates curiosity and interest in learning; • approaches new tasks with a positive attitude; • recognizes and advocates appropriately for the rights of self and others.
Self-regulation	The Student: • sets own individual goals and monitors progress towards achieving them; • seeks clarification or assistance when needed; • assesses and reflects critically on own strengths, needs, and interests; • identifies learning opportunities, choices, and strategies to meet personal needs and achieve goals; • perseveres and makes an effort when responding to challenges.

*Source: Ontario Ministry of Education (2010)

Hands-on activities

Insights into students' conceptual understanding abound as children immerse themselves in focused experiential explorations.

Table 10 provides an example of one teacher's observations during a class inquiry on structures. As the students worked with a variety of building materials, she walked around and conversed with them about their structures.

The simple act of jotting down students' actions and comments can provide educators with worthwhile information. As an inquiry progresses, the teacher might periodically revisit an activity to reflect on how a student's structures and understanding are developing over time. However, the timing of these conversations is important, and an educator should be sensitive to when it is appropriate or useful to move in with their own observations and thought-provoking questions. There is a delicate balance between extending learning in this way and interrupting a child's focused absorption in an investigation. Fortunately, the child's response to your questioning will usually let you know how welcome or productive it is in the moment.

Table 10: Example of a Teacher's Assessment Notes for a Grade 2/3 Inquiry about Structures

Teacher Question	Student Response	Indication of Initial Understanding
"Why do you think this tower won't stand?"	"The skinny tower won't stand because is doesn't have a big base."	• Importance of form to a structure's stability
"Why do you think the tower fell over?"	"My tower fell over when I put this block on top because it is heavier than the ones underneath it."	• Importance of form to a structure's stability and strength
"Do you think this tower will stand?"	"This tower will not fall over because the pieces [unifix cubes] stick together. If they didn't stick together, we could probably just breathe on it and it could fall over."	• Importance of the type of materials to the strength of a structure • The action of external forces can affect a structure's stability

Knowledge building discourse

When a student contributes an idea to help the group tackle a question or problem of understanding, they provide the educator with knowledge about how they engage in the learning, how they express their thinking, and their depth of understanding. During a KB discussion, an educator may consider these areas:

- Language and communication: Does the student convey thoughts in a clear and coherent manner that allows their classmates to understand and respond?
- Ability to interact with diverse ideas and perspectives: Does the student listen to other students' ideas? Do they productively agree or disagree?
- Contribution to community knowledge: Does the student make connections and build upon other ideas?
- Ability to use authoritative sources constructively: Is the student's understanding deepened by information they receive from a variety of sources?
- Understanding of key concepts: Has the student revealed a misconception?
- Flexibility of ideas: Does the student modify their ideas in the face of counter-arguments or counter-evidence?
- Providing supporting explanation: Does the student provide a logical argument or empirical evidence for ideas?
- Participation: What role does the student play in the discourse? (e.g., asking questions, offering facts or theories, listening carefully and summarizing/synthesizing what they have heard)

There are various methods for recording the questions, ideas, and theories in KB discussions that make this information readily available for assessment purposes. For example

- Write down the main question(s) being discussed and record students' ideas underneath for later reflection and analysis.
- Grade 1 teacher Zoe Donoahue often uses a tally chart for categorizing student comments, such as the one shown in Figure 5.

Figure 5: Knowledge Building Discourse Tally Chart

Knowledge Building Discourse				
Date:				
Student	Theory	Supporting Evidence	Question	Build-on

Revisiting questions

Revisiting questions at points throughout an inquiry is a common way to gauge the growth of student learning. This allows educators to ascertain the growth of learning over time, to determine whether students are incorporating new information into their developing understanding, and to identify what they are learning and how they are learning it.

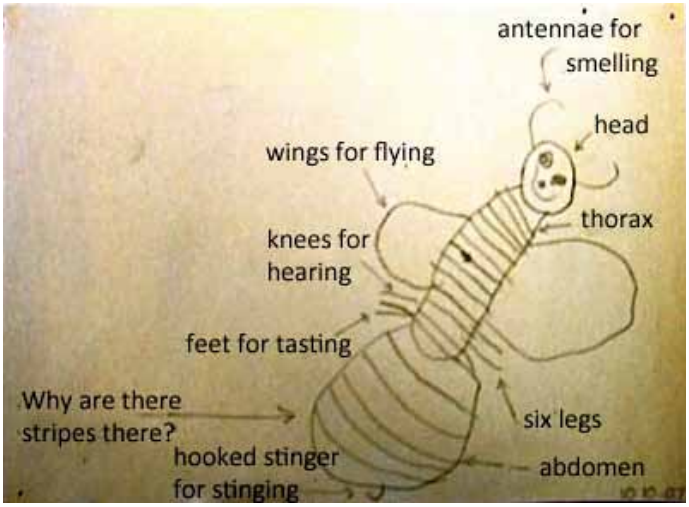
This strategy offers opportunities for self-assessment, making the assessment process transparent for the student. When students revisit earlier work, they see concrete evidence of their own growth, regardless of where they stand among their classmates (Fostaty-Young, & Wilson, 2000). They are encouraged to critically reflect upon their own learning.

Consider Photos 4 and 5: two drawings made by the same child in Carol Stephenson's SK class. The drawing in Photo 4 was created on September 14, when Carol asked the class to draw everything they knew about bees. This initial drawing revealed this child's preliminary knowledge about bees, as Carol scribed his words. The drawing in Photo 5, created on October 10, revealed clear growth in this child's anatomical understanding of bees. His fine-motor control had not improved significantly, but he had a different focus and awareness of what might be important to communicate in a drawing. We also see here how the attentive act of drawing not only reveals knowledge but can lead to new questions (lower-left corner).

Photo 4: What Do You Know about Bees?*

*Text enhanced to ensure legibility. Original grammar has been maintained.

Photo 5: Revisiting the Same Question*



*Text enhanced to ensure legibility. Original grammar has been maintained.

Culminating activities

Despite the pedagogic stress on the *process* of developing understanding in inquiry-based learning, the creation of summative projects that summarize and communicate learning can provide new and compelling motivation for students at certain stages of their investigations. Such culminating activities require students to organize the wide array of ideas and information they have encountered and provide them with confirmation that their many questions have led to some answers. In designing projects that effectively share learning with an audience (whether classmates, families, or other classes in the school), students are forced to confront their own problems of understanding as they clarify their ideas for someone who may be unfamiliar with the topic. Sometimes, this sharing prompts new questions and knowledge building among classmates. At other times, it provides the deep satisfaction of closure (for the time being, anyway), affirming for students that the inquiry had purpose, that learning has taken place, and that certain goals have been met.

Culminating projects take a variety of forms, on many scales. They can be the work of groups or individuals. As well as offering motivation and a sense of closure to students, they provide educators with yet another lens on learners – how they organize and communicate information to an outside audience, for instance. They can play a significant role in developing critical skills, such as learning to categorize and rank information in terms of its overall importance. Students learn to communicate succinctly as they extract key points and synthesize their findings for an audience in an engaging and informative fashion.

Figure 6 provides an example of a teacher-created summative assignment in Ben Peebles' Grade 6. This carefully structured project asks students to develop culminating demonstrations through an explicit process in which reflection on earlier knowledge building generates new questions, research and information. Finally, students are asked to find a way to tie their learning together and communicate their overall understanding to an audience. The stress placed on the importance of conveying ideas to people outside the immediate learning community shows how deeply connected understanding, reflection, and communication can be. Another noteworthy aspect of this assignment is that the ongoing project work occurs in class where learning support and monitoring are ongoing. This presents a very different model than the typical science fair project in which students bring in home-created artifacts that can be quite starkly detached from their classroom learning.

A few other recent examples of student-created projects include

- constructions (e.g., Biodomes in "Lisa's Story," Part 2, p. 219)
- environmental documentaries
- environmental raps (shared with the school at an assembly)
- murals or 3-D models
- an in-class science fair, with experiments demonstrated to other classes in the school
- Grade 3 students teaching Grade 2s all they have learned about worms
- individual books about self-chosen topics (shared in a gathering with parents)
- environmental action projects (see "Murray's Story" and "Mike's Story," Part 2, p. 262 and p. 251)
- powerpoint presentations (shared in class)
- books on topics written for and shared with younger children in the school

Student participation in assessment

Knowledge Building calls for embedded, concurrent, and transformative assessment in the inquiry process. This suggests that students can play an important role in assessing their own progress and that of the entire learning community. The beauty of inquiry is that, from the beginning, students' questions define their goals. For example, when a student asks, "Do all plants need sun to live and grow?" that student is shaping a learning goal.

As a class builds knowledge over time, an educator will often identify points at which it is important to pause and consider questions such as: "What do you think are some of the most important things that we have learned about so far? What do we still not understand or need to know about?" Student participation in this kind of discourse serves as an authentic form of self-assessment. With teacher guidance, their ideas may help to form the basis for different kinds of learning tasks or assessment tools such as rubrics, surveys, homework assignments, group projects, etc.

Figure 6: Example of a Grade 6 Culminating Activity

STEM Fair Project

As a class we have built our knowledge about electricity, and our thinking has expanded into considering a wide range of topics that are related to our original thinking about circuits. For the next couple weeks, you will have the chance to explore a topic in depth, to research it in detail, and to share your new understanding by creating an artifact, experiment or display for a STEM fair in our classroom.

This project will have 3 parts: Knowledge Building, deeper research, and sharing in our STEM fair. I don't need to remind your that we have limited time left this school year, so you will have to be efficient to finish on time. You will not have time to waste time!

Part One: Knowledge Building

We have explored several topics so far as a class. In this part of the project, you will review everything we have learned as a community about your chosen topic, and create a special Knowledge Forum note detailing where we are now in our knowledge. You will use what we already know to decide what more you need to research about your chosen topic.

- Carefully read all the notes related to this topic in our Knowledge Forum view.
- Build on or add a new note with any information that you researched last time, but didn't yet have a chance to contribute.
- When you are ready, go to the Super Note View, and create a Super Note for your chosen topic. The purpose of this note is to summarize what we know about this as a community, and to decide what more we ought to learn. You will also have the chance to look at the knowledge built by other groups of students from past years.
- Read as many other Super Notes as you can, and look for ways your topic connects with others.
- Use the "We Need Deeper Research" scaffold to decide on the main research questions you will pursue in the next section.

Part Two: Research

In this part of the project, you will research and learn more, to deepen the knowledge that we built as a class.

PRINT a copy of your Super Note, paying special attention to what you wrote under the "deeper research" scaffold.
Using your computer or pencil and paper, take detailed notes from books and online sources. You should use at least 3 different sources.
Check in with Ben for feedback!

Part Three: STEM Fair Sharing!

In the final part of the project, you will create an artifact, demonstration, experiment, or display that will help others understand what you have learned about your chosen topic in your research. I am open to your ideas and creativity about what form this could take. Be inventive!

- Come up with an idea for how you could share some of what you know.
- Ask yourself:
    - Will my idea really help others understand this topic deeply?
    - Is it feasible to complete in the limited time we have?
- Run your idea by Ben, and get approval and some feedback.
- Make it happen!

Our STEM Fair will take place on June 2nd... make sure you use your time wisely.

Thinking About Different Learners

There are many different ways that students come to inquiry and knowledge building. Any approach that prioritizes communal processes of knowledge construction needs to be especially careful not to lose sight of individuals in the exciting momentum of group learning. It cannot always be assumed that communal knowledge advancement has necessarily reached every student. While it is often (though not always) clear who is thriving in a class inquiry, it is also crucial to consider the outliers, who may need thoughtfully tailored opportunities that allow them access to the knowledge under construction. There are many reasons for differences in engagement and understanding – development, culture, brain processes, family life, gender, personality, and so on – and to give the topic its due is well beyond the scope of this book. Apart from the obvious implications for assessment, respecting differences among learners lies at the heart of all responsive teaching.

Developmental considerations

A large body of research has documented children's developing ability to recognize that others do not see the world exactly as they do, coming to realize that human beliefs and actions only make sense in the light of a point of view. This ability to explicitly recognize other perspectives, or what is commonly called a "theory of mind" (e.g., Wellman, 1990), starts to emerge in the preschool and kindergarten years as four- and five-year-olds begin to reliably appreciate that other people have opinions and feelings different from their own. It continues to grow in refinement and complexity into adulthood.

These developmental considerations have implications for knowledge building in the early years. While conversations that expose children to different points of view are an important means for building this awareness of other minds, an educator cannot assume that young children will fully understand the idea of a perspective, nor that knowledge building talk among four-year-olds will in any way resemble that of fifth graders. With this in mind, a significant portion of early years education (as laid out in the most recent Ontario Kindergarten curriculum document) is designed to further the ability to see the world through someone else's eyes, largely through conversation, social and imaginative play, and exposure to the inner lives of characters in stories.

Kindergarteners are only beginning to build the self-regulation skills needed to wait their turn and listen attentively in group settings. More accustomed to responsive one-on-one dialogue with an accommodating adult, they are just developing the social awareness and control to stay on topic, make themselves clear for a less accommodating peer, or interpret a peer's less-than-clear verbal messages. For these reasons, educators of this age group often find it useful to introduce initial KB talks quite informally, in very small groups, so that viewpoints can be exchanged without the management issues that frustrate children and educators alike.

As children become more familiar with knowledge building exchanges, gradually enlarging the group size can increase the scope of the students' thinking. But even after children gain a basic awareness of other perspectives, there is still a long developmental trajectory in their growing capacity for group knowledge building. How they understand the nature of knowledge will affect the way they pursue it, and it takes many years before the staunch realism of preschoolers gives way to the more nuanced belief that knowledge is humanly constructed and that conflicting ideas can legitimately co-exist but are also subject to evaluation (Kuhn, Cheney, & Weinstock, 2000; Kuhn, 2010). It also takes time before a child learns to evaluate an idea on its own merits, independently of who proposes it, or to realize that friendship is not a reason for blanket agreement.

Cultural considerations

Of course, development will look very different in different cultural settings, and a child's beliefs about school and knowledge will often reflect deep-seated intellectual beliefs and values in their broader cultural milieu. It is therefore essential for an educator to keep in mind the powerful cultural influences that students will bring to their learning. To be motivated and engaged at school, children need recognition of and appreciation for these values, even when they may not mesh fully with an educator's own assumptions about optimal ways to learn. While appreciation for diverse ideas can be a strength of inquiry-based learning, it is still worth reflecting upon our unexamined cultural assumptions and expectations for the way this might look in a Canadian classroom.

For example, direct questioning may not be everyone's way of showing curiosity. It is important to start with the working assumption that every child will be interested in something and observe your students closely to find out how different children reveal that interest. Asking questions is only one possibility. Spending long periods studying things is another. Also consider what kinds of questions are important to them. For some children, mastering vast bodies of facts may be their preferred route to understanding, and one that can involve considerable conceptual creativity if you look for it. For others, it might be the deep pondering of metaphysical mysteries. Such different approaches are often both individual and cultural; either way, all types of questions have a valuable role to play in building understanding.

There are likewise a multitude of cultural and individual ways of listening attentively, and demands for strong eye contact may confuse a child who has learned more indirect ways of showing respect and paying attention.

Thinking about Indigenous learners, Doug Anderson has identified tensions between the technology-driven endeavours of European science and the more holistic, relational views that saturate many Indigenous cultures. These disjunctions may have an impact on how some Indigenous students relate to mainstream curriculum. Another discontinuity between the cultures has been identified by Barbara Rogoff and her colleagues (e.g., Rogoff, Paradise, Mejía Arauz, Correa-Chávez, & Angelillo, 2003; Paradise & Rogoff, 2009), who describe "observation and pitching in" (or "Learning through Intent Community Participation") as a fundamental participatory mode of learning for many Indigenous and Mexican-American children. These observations remind us that "active learning" can take many forms, and serves as a warning to not underestimate the learning of the child who quietly watches and listens to what others say and do.

Students who are new to the English language need equal opportunities to show curiosity and ask questions at school. "Inviting students to [share their questions] in their first language as well as in English enables them to draw on their strengths, including their existing academic, linguistic, and cultural knowledge. This approach also enriches the class environment by exposing English-speaking students to the advantages of knowing more than one language and of cultural diversity in general" (Ontario Ministry of Education, 2005a, p. 15). Finding ways to forge links with non-English-speaking family members, communicating through interpreters, siblings, body language, or showing the child's work, will go a long way toward making school a more meaningful place for the student.

Considering individual differences

Entangled with, but not limited to development and culture, are as many ways of learning and engagement as there are learners, each with its own strengths and liabilities. Some children are risk-takers, plunging with enthusiasm into whatever is on offer; others are naturally cautious, watching and biding their time until they have fully assessed what is going on. For some students, verbal expression is their primary mode of coming to know (and showing what they know); others learn and show their learning differently. Some children are highly social, embracing with enthusiasm the possibilities of group work; others are introverted and more comfortable with solitude. It is important that the values accorded to risk-taking, verbal negotiation of ideas, and community processes in knowledge building environments do not end up relegating some children to the margins.

In any inquiry, educators are often aware of an imbalance in the amount that students contribute. They wonder how best to support children who appear less engaged in the learning or fail to grasp concepts that others have moved forward with. Students at both ends of the learning spectrum can pose challenges to sustaining an inclusive, democratic classroom. A student with unusually advanced understanding of a topic needs opportunities to explore further at their own level without either being constrained by the less formed ideas of the group or shutting down conversation with their confident answers to still-emergent questions. What to do with the most dominant voices – whether advanced or not – can be a conundrum, and some have found that allowing many opportunities for individual and small-group work can help to mitigate their outsized influence.

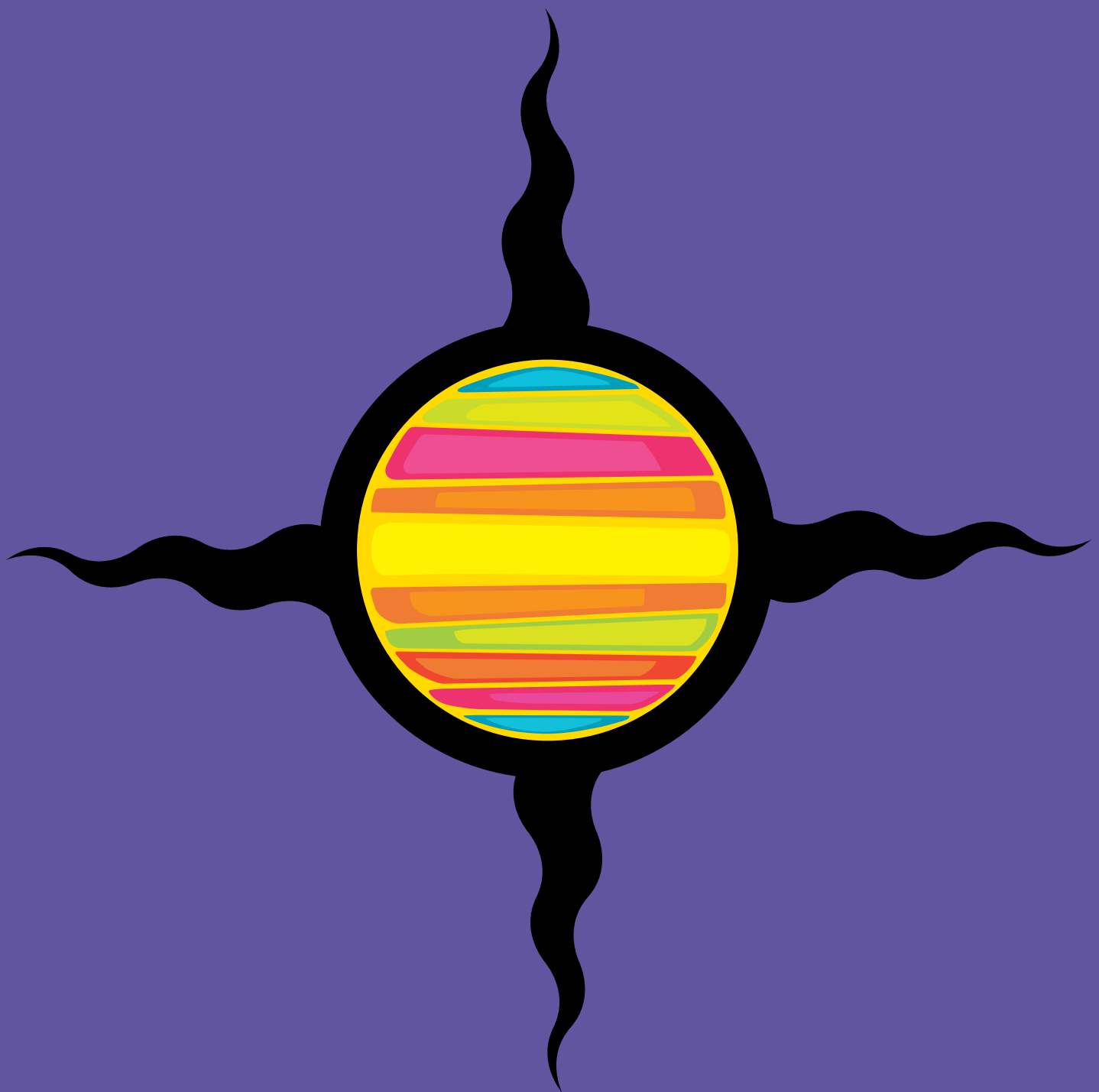
To ensure that she doesn't lose sight of individuals, one Grade 4 teacher, Robin Shaw, gives each child a notebook for recording their thoughts (in

drawing or writing, sometimes scribed by the teacher). "Each time we started a new concept, each child answered open-ended questions so I could understand where each child was coming from before the able kids immediately started putting ideas out. I also had kids individually reflect following each activity, then [I] put these [thoughts] into the [Knowledge Forum] database – this way I could make accessible to everyone ideas that would not have otherwise appeared in the database." Over the course of the inquiry, children returned periodically to their notebooks see how their thinking had developed. In this process, Robin was sometimes surprised by what she learned. Some children who had appeared less knowledgeable or engaged showed themselves to have thought deeply and productively about concepts, while for others, the frequency and articulateness of their verbal communications had obscured some significant areas of confusion.

Summary of Chapter

Over the past 50 years or more, the work of educational practitioners and theoreticians has demonstrated a broad range of interpretations of "inquiry-based learning." It has not been our intent in this section to provide a definitive interpretation, but rather to lay out some features that in our experience help to create rich, focused, and engaging problem-centred environments and to show a range of possibilities for the environmental learning offered by this approach. Put simply, children's curiosity is key – both the starting point and endpoint of all inquiry work. We do not feel that releasing all decision-making to the students provides for useful learning, but instead favour thinking about classrooms in which educators use their understanding of children, learning, and subject matter to thoughtfully guide students as they explore questions they care about with growing skill, rigour, and persistence. Our vision of inquiry highly values structured processes of group knowledge building that benefit the classroom learning community; navigating the productive tensions between individual and group learning is both the challenge and the great reward of this approach.

Lighting the Fire: The Spirit of Learning
Indigenous Lens on Branch I



Lighting the Fire

Learning from the Heart

Inquiry-based learning reflects a simple, profound truth: learning is most powerful when rooted in the heart. The heart is our connection to Spirit, which in turn is what unifies all things. The heart is the seat of the fire igniting our whole being. We gain understanding and knowledge most meaningfully in relation to the inner spark that lights the fire of learning, rather than when learning is externally imposed. Externally imposed learning separates knowledge into artificial categories – as if the world were merely a huge *machine* with *no spirit* – and makes it harder to place anything in relation to broader contexts. And so, we learn best when we feel a strong, inner, *spiritual* connection with everything around us. This truth is deeply reflected through Indigenous worldviews.

Indigenous worldviews emphasize the spiritual source of our world, without separating Spirit from matter and nature. Matter, which Eurocentric thought tends to see as reality, is more like an immanent *symbol* of Spirit to Indigenous thinking. *This is a complete reversal of the usual modern worldview*, where symbols are seen as abstract, even fanciful, representations of material realities. Indigenous perspectives ultimately see Spirit as the greater reality, preceding matter in the creative order. This creative order transcends time, so Spirit and matter co-exist constantly in the process of Creation. Everything is always *coming into being* from a spiritual source. In a way, this is obvious: the origin of all things is unseen, beyond even the most microscopic forms, and ultimately beyond space and time. The origin of all things is a Great Mystery.

The emphasis on Spirit as the basis of the world has far-reaching implications. In some ways, this emphasis corresponds with the principles of inquiry-based learning.

Wonder

It is an immutable law that all growth proceeds from within, from the unseen. A child is not constructed from her disparate parts but is rather *brought into being*, emerging from what ultimately appears to be a vanishing point. In the same way, learning proceeds from within the child, which corresponds to the sense of wonder emphasized in inquiry-based learning. Wonder is innate and sacred, and cannot be imposed from without. While all beings are sacred, children are especially so because they are closer to their spiritual source than adults. As different children are given different gifts, they are drawn in wonder to the world in unique ways; they bring their unique gifts with them on their learning journey.

This does not mean we all have to "be spiritual." Many people are motivated more by materialistic concerns. But our worldly motivations arise from inner *emotional* or heartfelt attachment to those external motives. Learning is born from that which is pregnant with *inner meaning*.

And so we learn best *from the inside out*. Even rote learning is best done with a high level of inner motivation. Each person has his or her own intuitive way of growing into his or her relationship with the world. This does not mean educators should abandon all "worldly" learning agendas. It *does* mean we need to respect and connect with children's inner lives, through strategies that bring them closer to the knowledge they need. Invite, and see. Invite in another way, and see – until the spark is lit. Rather than impose learning paths, we tell a story,[1] or go somewhere with purpose, or show something fun or new, and the path is taken up by learners. The late Anishinaabe Elder, Art Solomon (1990), elegantly described how we nurture our innate sense of wonder:

> The traditional way of education was by example, experience, and storytelling. The first principle involved was total respect and acceptance of the one to be taught, and that learning was a continuous process from birth to death. It was total continuity without interruption. Its nature was like a fountain that gives many colours and flavours of water and that whoever chose could drink as much or as little as they wanted to whenever they wished. The teaching strictly adhered to the sacredness of life whether of humans, animals or plants.

This way of learning is for educators as much as for students. To paraphrase from the first edition of *Natural Curiosity*, when a student's heart and spirit are engaged, learning naturally blossoms. When the same happens for the educator, practice is transformed. Rather than feeling worried about what might happen if we move away from a learning path prescribed by adults, we need to feel a kind of freedom in approaching children. They will lead the learning in the way it needs to happen for them.

[1] Stories are essential vehicles for connecting with Spirit. Rather than having mere amusement as their main purpose, stories in Indigenous cultures are more likely to be revered as accounts that reflect higher truths.

Coming to Know

Because we learn from the inside out, learning is a journey of emergence from Spirit into a relationship with knowledge. Indigenous thought sees knowledge as an active process (like a verb) in which we develop a way of living and being in relation to what is learned. This is different from the Eurocentric emphasis on knowledge as a *thing* (a noun) that can generally be grasped by those who have the aptitude to do so. Indigenous ways of learning respect the emerging *personal connection* of each learner to what is being learned, through her inner voice and heart.

"Coming to know" (Cajete, 2000)[2] is a way of describing distinct Indigenous views on the process of learning via more intuitively connected pathways. Indigenous ways of coming to know respect the individual's relationship with and responsibility for what is being learned, and explore stories and other diverse approaches to the subject at hand, learning pathways that appeal to diverse learning styles in non-prescriptive ways. Coming to know ultimately invites us to *explore* our emergent learning process as part of our own journey, rather than challenging us to enter into externally imposed, isolated theme areas.

[2] For clarity and flow, this edition avoids substituting "coming to know" for "knowledge" throughout the document, as well as many other possible ways of trying to reflect Indigenous perspectives in English. Ultimately, the best way to understand Indigenous perspectives is through fluency in an Indigenous language, rather than twisting English into knots.

The idea of coming to know is reflected in some of the characteristics and practices of inquiry-based learning:

- The end point or final product is not known at the outset, but rather attained along the journey of learning.
- Prior knowledge and experience are elicited during this journey.
- There is a greater emphasis on interactivity with children.
- There is respect for learner agency and understanding one another, with an emphasis on seeing the same thing from multiple sides, over multiple times (revisiting questions), and through diverse methods.
- There is more time provided for reflection and guarding against cursory observations.
- There is emphasis on
  - process-oriented (vs. goal-oriented) learning
  - lifelong, seamless, holistic learning
  - many entry points to learning
  - listening to and carefully watching students over time, rather than talking to (or at) them
  - emotional security, supported through informal and non-judgemental (versus highly scrutinizing) approaches

All of these ways of supporting inquiry-based learning respect that the journey to knowledge is unique to each individual, best achieved when each of us is respected for the gifts we carry inside of us, and touched in ways that support the *natural emergence* of these inner gifts. This is why many Indigenous cultures have ceremonial ways of naming children in relation to the spiritually endowed gifts they bring. Such gifts are our sacred responsibility. Our names reflect our mission, and we must *find the meaning of our names, and live them out in the process of living our lives.*

Spiritual Relationship

Children intuitively connect everything in ways that inform their outer world from a spiritual place, seeing how all things are unified from within. In the teachers' stories in Part 2, Carol Stephenson shares her struggle to help Senior Kindergarten children consider their external world while also "looking in":

> One student's question, "What is your life about?" seemed a little challenging ... I was astonished and impressed by their responses, and the generosity of their vision. It was yet another reminder to not let any of my own hesitations stand in the way of what children, even as young as 5, can engage with. Here were some of their answers:
>
> *It means the moonlight and the Sun.*
> *It means being with your family.*
> *It's about being with friends.*
> *And your brothers and sisters.*
> *And your cousins.*
> *It's about people being nice to us.*
> *And us being nice to other people.*
> *It's about having food and living in a house.*
> *It's being nice to older people.*
> *And to younger people.*
> *Do not try to trick people or hurt them.*
> *Do not lie.*

From an Indigenous perspective, these answers are an excellent basis for relating to and learning about our world. The Moon and Sun cannot be divorced from love for family or from the responsibility for human kindness. They are, in a very real sense, our Spiritual Grandparents in the unending, sacred, unified circle of life.

Quality and Character

It is perfectly natural that a 5-year-old should arrive quickly at kindness as an essential quality of the universe. Given the chance, children are receptive to what is good.[3] Reaching a child's inner fire requires focussing on their *qualities,* which always precede and assign value to any quantity.[4] An emphasis on inner qualities connects with an emphasis on values and character in the learning process. *Mino Bimaadiziwin* ("living in a good way" in Anishinaabemowin) is a phrase reflecting how we must strive from an early age to follow our life path from a spiritually centred place of kindness, respect, and love.

Healthy parenting instincts tell us that the goal of nurturing children is the same as protecting what is sacred. We help our children come into their better nature by making them feel respected, safe, and loved. This is why an emphasis on emotional security – the foundation for developing empathy and compassion – is so essential in an inquiry-based environment. Compassion supports learning that is more fully felt in relation to what is within and around us. A sense of separation, of being apart from what we learn, has little place in such a learning process.

Knowledge approached from a foundation of good character and values takes on a different quality. It is imbued with meaning based on deeper understanding rather than being a collection of mere information. This requires a radical step away from creating citizens who are satisfied with surface knowledge about things, towards the nurturing of people who have the capacity, inner motivation and habit of delving deeply into what they would really *love* to know and *need* to know. It is a shift from merely living *under* what is legal (the letter of the law) to living *up to* what is good (the spirit of the law). It is the difference between knowledge as advantage over others and knowledge that is shared in the service of others. Emotional security, and the development of inner qualities like compassion, supports the sharing and *building of knowledge with others.*

Heart-based Knowledge Building

Learning from a heartfelt personal level does not mean an individual can ever own knowledge. The goal is *not* a society of specialists and technocrats who work in isolation from one another and from the people in general. Closely connected to the importance of learning from the heart is the Indigenous value placed on *putting our best knowledge together*, which is related to the principles of knowledge building and "idea diversity" emphasized in both editions of *Natural Curiosity*.

[3] Only a society preoccupied with war and conquest, where much of religion has degenerated to serve material interests, and where children are torn from their mothers and communities and thrown into boarding schools, could produce the savage children in Lord of the Flies, a novel widely read in Canadian schools. Indigenous people know too well the sad results of radical experiments that wrench children from family and institutionalize them. The residential school experiment was designed to crush the values and character of whole nations of people, and led inevitably to community breakdown, violence, and despair.

[4] A focus on quality should have the effect of improving quantitative aspects of learning, since larger quantities of knowledge can be assimilated with proper internal motivation. The emphasis on qualitative standards of learning is reflected in how we assess students in an inquiry-based learning environment.

The Anishinaabe value of *Debwewin* lends insight into knowledge building, and the importance of respecting diverse ideas in a context of inquiry-based learning. Debwewin can be translated as "heart-based knowledge." When we truly approach knowledge from our heart and spirit, such knowledge *cannot belong to a mere individual*. Another way to translate Debwewin is "to *speak* from the heart" (Goulais & Curry, 2005). If a person can find Debwewin within, it is her responsibility to share that truth as well as she is able. This is not the same as sharing any old thing; if knowledge is not connected through the heart, then it is hardly worth sharing, and the *quality* of what we know is in question. We may have facts, but without deeper understanding and connection with a wider holistic context, facts can too easily be turned to destructive ends.

The principle of Debwewin is *integral to community life*, since anyone who has a heartfelt truth contributes to the whole community when they step forward to share that truth. But even the most highly valued truth arising from an individual is only part of the full truth; there are in fact many of these truths, so great value is also placed on hearing and understanding the perspectives of others. Human knowledge is enriched by the diversity that comes from our highest individual truths being put together. Spirit manifests differently through different beings, so the fullest approach to the truth appreciates and attempts to unify these manifestations. *And so we need to assemble, hear and consider our highest and most deeply considered personal truths* (Borrows, Johnston, as cited in Simpson, 2011, p. 59).

The ideas embedded in the value of Debwewin indicate why Indigenous worldviews are less likely than Eurocentric views to see diversity as a source of conflict. Some practices emphasized in the inquiry-based approach to learning reflect the relatively high Indigenous value placed on diverse truths; most notably, the practice of "Knowledge Building Circles" resonates with Indigenous cultural and social tendencies.

The Circle of Learning

Indigenous societies have distinct ways of assembling knowledge, ways that encourage people to speak their own truth from the heart, to better reach the ears and hearts of others. Meaning and knowledge are made on an ongoing basis through the sharing of diverse personal truths across the community. The shared generation of knowledge and meaning across a community is often grounded in ceremony, and involves detailed systems to ensure accountability to a range of concerns. Indigenous political and ceremonial traditions are detailed and diverse, but generally have ways to increase how knowledge comes alive, and ensure that the widest consideration is given to an issue. This means taking the time to hear many possible angles.

The "talking circle" is one simple way in which diverse truths can be assembled and respected. It serves to bring us to a shared understanding of our common truth or purpose. A talking circle is by no means a full expression of any particular Indigenous nation's governance structure (these are quite complex), but it does distill some key principles common to many of those structures. Knowledge Building Circles, encouraged as part of inquiry-based learning environments, owe much to the talking circle.

Talking circles differ according to the Indigenous cultural context, but they share some common underlying principles:

Table 11: Principles of Talking Circles

All are heard who wish to be heard
Non-interference
Deep consideration and respect
Common purpose
Speak from the heart

The ideas embedded in these principles owe much to oral teachings shared by Harold Ashkewe with the author (1989-93), and to Simpson (2011) as cited in Wemigwans (2014).

All are heard who wish to be heard

The opportunity to speak is offered to each person in the circle, even though every person's opinion or desire may not be acted on. Speaking is never mandatory.

Non-interference

People should not be interrupted. This principle reflects the value of non-interference: all must be free to follow their own spirit. This principle extends far beyond our human family to the wider world around us.

Deep consideration and respect

We need to listen and speak out of respect for others. As we love one another, we truly see one another, and deeply respect what we see in others. It is vital to be slow to judge each other, and take care in how we speak of others' ideas, even if we disagree. Patience and kindness are critical.

Common purpose

Movement in any direction, such as making a decision or rejecting an idea, or considering all possible consequences of a decision, is focused on the idea or decision, rather than on the people who speak.

Speak from the heart

People are encouraged to speak from the heart, with honesty, so that we may hear and consider their truth as well as possible. Building knowledge in this way is centred in how we serve and live in balance with our relatives, continually defined by our inner qualities and truth, which ultimately emanate from our spirit.

In a classroom environment, the consideration and understanding of each child's reality is the ideal, along with a way to help children understand one another's realities, to the greatest extent possible. We need to support children to move as deeply as possible within themselves to the seat of their being, where their individual truth lies, and then to move together and assemble those truths. Then, even in the dire world circumstances in which we now leave them, the path to the healing and recovery of their world can be made clear – not by us, but by them.

Our failure to ignite and share our spirits is barbarism. Set apart from one another, it becomes easier to succumb to self-interest, indiscriminately accelerated material progress, and the acquisition of *things*. In such a world, our shared purpose, our deeper selves, and love itself, are dimmed. But together we survive. Given a chance, our inner fire can be shared sincerely, which brings light to others. Our combined light is the real meaning of civilization. The great Nehiyaw (Plains Cree) Chief Payepot exhorted his people to remember this truth on his deathbed in 1908.

> My people, love one another. I want you to keep together. You don't know what the future holds. There will come a day when carts will no longer need horses. The white man may even be foolish enough to try to fly. Mark my words. Stay together. Love one another.
>
> – Abel Watetch, *Payepot and His People* (2007)