The Process of Developing a Technology-rich, yet Culturally-relevant Science Curriculum for Grades 9 and 10

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Themes for the Presentation:

- The Context of KiHS
- Curriculum
- Instruction
- Assessment
- Looking Forward

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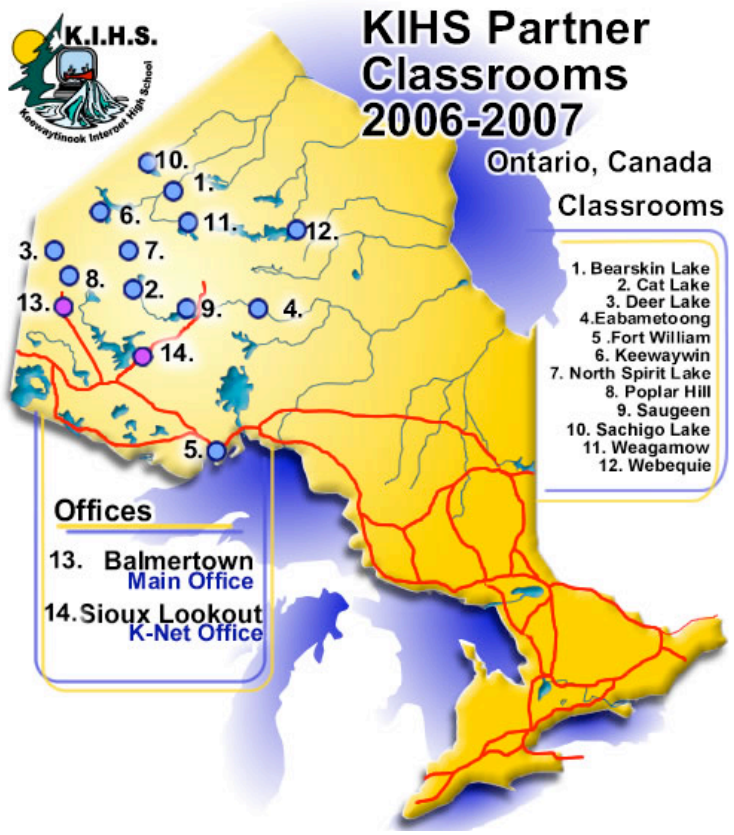
Northern Ontario: KiHS Locations

School Classrooms



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KiHS PHILOSOPHY

Northern youth need the opportunity to continue strengthening their **family and community bonds** as well as **their linguistic and cultural knowledge**, while completing their secondary school education at home. Secondary school course delivery via telecommunications capitalizes on the **technological capabilities** of the participating First Nations to ensure that our youth fully **utilize *their* potential**, and that of the **technology available to us in the twenty-first century**.

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KiHS

IS THE FIRST INTERNET HIGH SCHOOL APPROVED BY THE ONTARIO MINISTRY OF EDUCATION

KiHS

USES CUTTING EDGE TECHNOLOGY AND EXPERTISE TO BRING YOU HIGH SCHOOL PROGRAMMING

Keewaytinook Okimakanak (Northern Chiefs Council) started KiHS because the Chiefs know that a high school at home is needed and IT CAN BE DONE!!!

And, you can remain living in the north!!!

STAY AT HOME
BUT
STAY IN SCHOOL!

Stay close to your family and friends.

Travel the Internet, making computer friends and contacts throughout the north and around the world.

JOIN THE NEW GENERATION OF HIGH SCHOOL STUDENTS AND MAKE KEEWAYTINOOK INTERNET HIGH SCHOOL YOUR FIRST CHOICE FOR HIGH SCHOOL TODAY!

CONTACT
KiHS Balmertown
1-800-387-3740
kihs@knet.ca
OR
CHECK OUT OUR WEB SITE
http://kihs.knet.ca

Revised: May 2007

KiHS

KEEWAYTINOOK INTERNET HIGH SCHOOL

Online Secondary School for Aboriginal Youth in Small Ontario Communities

KiHS Brochure (1)

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WHAT'S BEING OFFERED?

In September, 2007, KiHS will offer a full grade 9 and 10 program, including Academic courses in Grade 9 and some grade 11 and 12 courses online.

For a list of courses that will be offered in 2007/2008, please contact your local KiHS teacher.

WHO'S ON LINE?

Currently, twelve communities are involved. They are the First Nations of:

Bearskin Lake	Cat Lake
Deer Lake	Eabametoong
Fort William	Keewaywin
North Spirit Lake	Poplar Hill
Sachigo Lake	Saugeen
Weagamow	Webequie

WHERE DO WE GO FOR CLASSES?

You attend school all day at your KiHS community classroom, arranged by your Local Education Authority and Chief and Council.

WHO HELPS US?

You will spend the day with a *trained teacher (mentor)* in your community.

The *teacher mentor* helps you use your time wisely and helps you if you are stuck in your courses.

WHERE IS THE INSTRUCTOR?

On line, of course!!!

Every teacher mentor teaches one subject to students in all the communities. For example, your teacher mentor may be the *course instructor* for mathematics. The *course instructor* for geography will be the teacher mentor in another community.

DO THE CREDITS COUNT?

YES!! KiHS is a Council operated private school inspected by the Ontario Ministry of Education. KiHS is authorized to grant credits in subjects leading to the Ontario Secondary School Diploma (OSSD).

HOW DOES IT WORK?

Classes are semestered. You take two courses at a time. You spend half a day on each course. Courses start in September, November, February, and April. That makes eight (8) credits in a year.

1. At the beginning of the week, you sign on to your computer and download the week's activities.

2. Every morning, you log on to your computer and read your daily mail and the announcements.

3. You go offline, and do your assignments. This may involve:
   - working on your own
   - working in small groups with others in your classroom
   - Searching on the Internet

5. Before the end of the day, you will upload what you have done during the day. You will add comments to the online class discussion.

6. The next morning, you download what other students have written, as well as your new work for the day. You can reply to what the other students and teachers have said when you upload your work in the afternoon. And so it goes.

KiHS Brochure (2)

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Poplar Hill KiHS Classroom

http://kihs.knet.ca/drupal/node/41

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3.0 KiHS: THE PEOPLE
3.1 THE STUDENTS: STANDARDS AND EXPECTATIONS
3.1.1 School Routines

1. Classes begin at 9:00 a.m. and end at 4:00 p.m. with an hour break for lunch at noon.
   A community which changes the hours must:
   - make sure that class time totals the same number of minutes as outlined above;
   - confirm the changes with the KiHS principal OR vice principal.
2. A two-hour Study Period takes place four times a week in the evening so that you can complete your assignments if time is required.
3. Breaks of five minutes maximum take place once in the morning and once in the afternoon.
4. You are expected to be present all day, every day. Attendance of under 90% in any one month is considered unsatisfactory.

5. If you miss a lot of classes without an acceptable excuse, you will be asked to withdraw from a course, even if you are passing the course.
   Acceptable reasons for absence include:
   - illness with parental or medical proof;
   - death in your immediate family.

   Unacceptable reasons for absences include:
   - sleeping in
   - having to babysit, do laundry, or other home responsibilities
   - escorting family members to hospital or medical appointments
   - being away from the community for any reason other than personal illness or impending death of an immediate family member.
6. You are expected to be on time, every time.
   - If you are more than five minutes late you are marked late.
   - If you are more than 30 minutes late you are marked absent for that morning or afternoon. However you should still come to school because the lessons still need to be completed.
7. You can get an alarm clock from KiHS if you need it to help you to get to school on time.

8. All KiHS students sign in and out of the classroom as they would in the work world where they are paid by the hour. Signing in and out is also done for the five minute break, and in the evenings. If you leave during a class session without agreement from your teacher, you will be considered absent and marked absent.
9. Head phones are used only for specific language based lessons. Headphones are not to be used at other times or for other purposes.
10. There will be no smoking inside the KiHS building or classroom, or anywhere on KiHS grounds or other school grounds around the KiHS classroom.
11. The telephone in the classroom is for KiHS program use only. The teacher will take a message for you if required; however do not plan on using the phone to reply to messages.
12. The KiHS classroom is meant only for students and visitors including parents, Local Education Authority Members and the Chief and Council.
    The school is not open to your friends, brothers and sisters, or other community members. Please let them know so that we do not embarrass them by telling them to leave.

KiHS Handbook (3)

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6.0 ONTARIO PROVINCIAL SCHOOL REQUIREMENTS

In 1999, the province of Ontario created new guidelines for secondary school courses. In Grades 9 and 10, KiHS follows the Ontario guidelines so that you know you are getting the same types of courses that you would at any other secondary school in Ontario.

Each course has a five-character identification code in which:

- the first three characters refer to the subject,
- the fourth character refers to the grade or level, (1 = first year, high school);
- the fifth character refers to the type of course

D = academic	P = applied
O = open	L = locally developed
E = workplace preparation	

5.2 2007- 08 COURSES

	Term 1A	Term 1B	Term 2A	Term 2B
Gr. 9	BTT1O GLS1O MPM1D	ENG1L MFM1P SNC1L	ENG1D ENG1P MAT1L NAC1O SNC1P	CGC1P HIF1O LN_AO
Gr. 10	CHV2O/GLC2O SNC2P	CHC2P GLC20C	ASM2O MFM2P	ENG2P TGJ2O
Gr. 11	ENG3E PPZ3O	HPC3O		MEL3E
Gr. 12		ENG4E		

Courses at KiHS for 2007-2008

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Science Course at KiHS

SNC1L Science, Grade 9, Locally Developed Compulsory

SNC1P Science, Grade 9, Applied Compulsory

SNC2P Science, Grade 10, Applied Compulsory

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Culturally Relevant Curriculum in Science

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What are the characteristics of culturally responsive science curricula?

- It begins with topics of cultural significance and involves local experts.
- It links science instruction to locally identified topics and to science standards.
- It devotes substantial blocks of time and provides ample opportunity for students to develop a deeper understanding of culturally significant knowledge linked to science.
- It incorporates teaching practices that are both compatible with the cultural context, and focus on student understanding and use of knowledge and skills.
- It engages in ongoing authentic assessment which subtly guides instruction and taps deeper cultural and scientific understanding, reasoning and skill development tied to standards.

Alaska Native Knowledge Network (2000). p. 7

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Goals of the Ontario Science Program:

Achievement of both excellence and equity underlies the three major goals of the science and technology program at the elementary level:

1. to relate science and technology to society and the environment
2. to develop the skills, strategies, and habits of mind required for scientific investigation and technological problem solving
3. to understand the basic concepts of science and technology

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Science as a Way of Knowing (ON):

Science is a way of knowing that seeks to describe and explain the natural and physical world. An important part of scientific and technological literacy is an understanding of the nature of science, which includes an understanding of the following:

- what scientists, engineers, and technologists do as individuals and as a community
- how scientific knowledge is generated and validated
- how science interacts with technology, society, and the environment

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Fundamental Concepts	
Matter	Matter is anything that has mass and occupies space. Matter has particular structural and behavioural characteristics.
Energy	Energy comes in many forms, and can change forms. It is required to make things happen (to do work). Work is done when a force causes movement.
Systems and Interactions	A system is a collection of living and/or non-living things and processes that interact to perform some function. A system includes inputs, outputs, and relationships among system components. Natural and human systems develop in response to, and are limited by, a variety of environmental factors.
Structure and Function	This concept focuses on the interrelationship between the function or use of a natural or human-made object and the form that the object takes.
Sustainability and Stewardship	Sustainability is the concept of meeting the needs of the present without compromising the ability of future generations to meet their needs. Stewardship involves understanding that we need to use and care for the natural environment in a responsible way and making the effort to pass on to future generations no less than what we have access to ourselves. Values that are central to responsible stewardship are: using non-renewable resources with care; reusing and recycling what we can; switching to renewable resources where possible.
Change and Continuity	Change is the process of becoming different over time, and can be quantified. Continuity represents consistency and connectedness within and among systems over time. Interactions within and among systems result in change and variations in consistency.

Fundamental Concepts in ON Science and Technology Curriculum

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“Big Ideas”

Big ideas “go beyond discrete facts or skills to focus on larger concepts, principles, or processes.”

Grant Wiggins and Jay McTighe, Understanding by Design (1998), p. 10

“Big ideas” are the broad, important understandings that students should retain long after they have forgotten many of the details of something that they have studied. In this document, big ideas describe aspects of the fundamental concepts that are addressed at each grade level. Developing a deeper understanding of the big ideas requires students to understand basic concepts, develop inquiry and problem-solving skills, and connect these concepts and skills to the world beyond the classroom.

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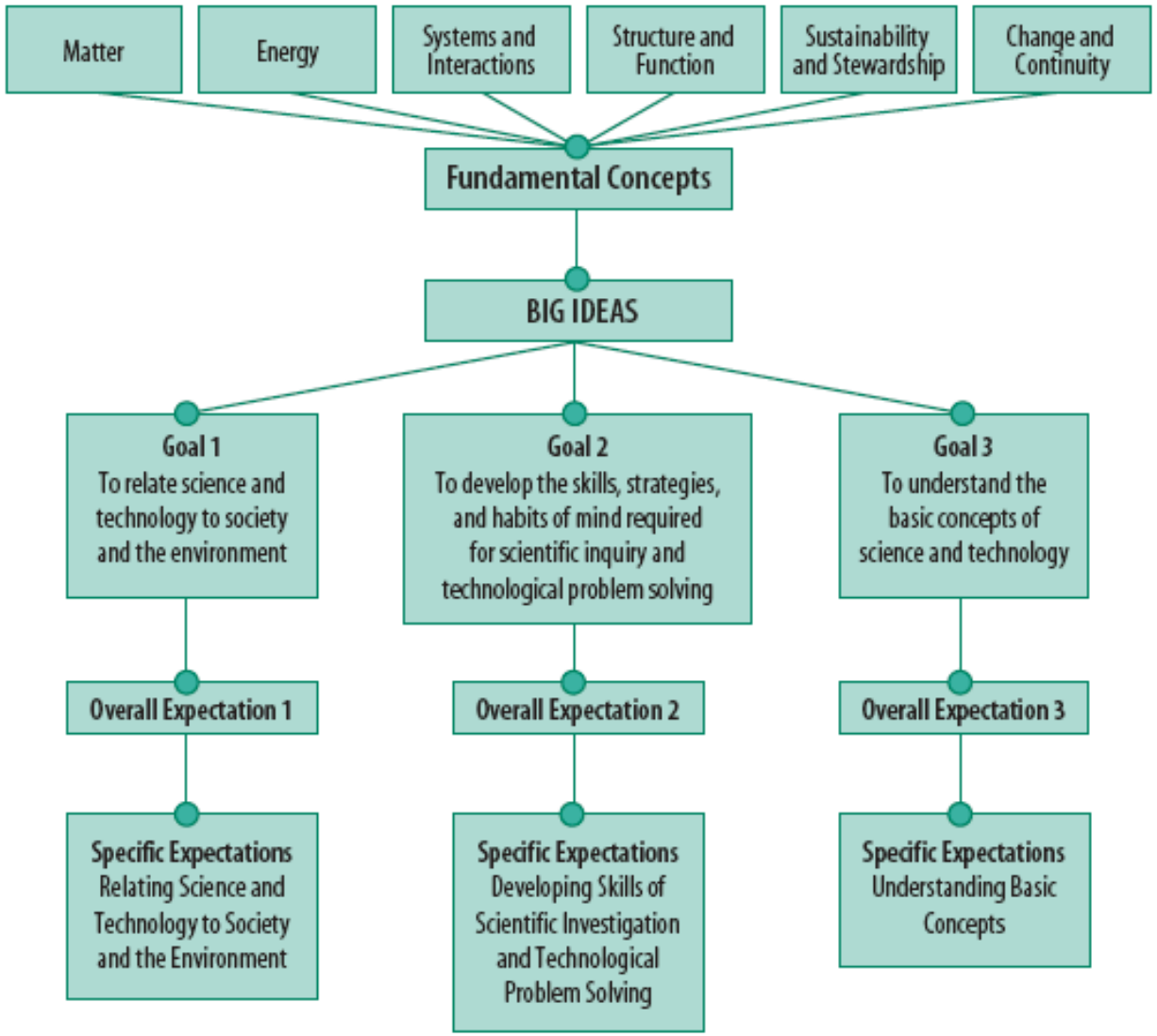

Connections within ON Science and Technology Curriculum

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Alignment of Strands

Elementary Science and Technology	Grade 9 Science
Understanding Life Systems	Biology
Understanding Structures and Mechanisms	Physics
Understanding Matter and Energy	Chemistry
Understanding Earth and Space Systems	Earth and Space Science

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Elementary Science and Technology Curriculum Overview				
	Understanding Life Systems	Understanding Structures and Mechanisms	Understanding Matter and Energy	Understanding Earth and Space Systems
Grade 1	Needs and Characteristics of Living Things	Materials, Objects, and Everyday Structures	Energy in Our Lives	Daily and Seasonal Cycles
Grade 2	Growth and Changes in Animals	Movement	Properties of Liquids and Solids	Air and Water in the Environment
Grade 3	Growth and Changes in Plants	Strong and Stable Structures	Forces Causing Movement	Soils in the Environment
Grade 4	Habitats and Communities	Pulleys and Gears	Light and Sound	Rocks and Minerals
Grade 5	Human Organ Systems	Forces Acting on Structures and Mechanisms	Properties of and Changes in Matter	Conservation of Energy and Resources
Grade 6	Biodiversity	Electricity and Electrical Devices	Properties of Air and Principles of Flight	Space
Grade 7	Interactions in the Environment	Form and Function	Pure Substances and Mixtures	Heat in the Environment
Grade 8	Cells	Systems in Action	Fluids	Water Systems

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Grade 9 and 10 Science Curriculum Overview				
	Biology	Physics	Chemistry	Earth and Space Science
Grade 9 Academic	Sustainable Ecosystems	The Characteristics of Electricity	Atoms and Elements	The Study of the Universe
Grade 9 Applied	Sustainable Ecosystems and Human Activity	Electrical Applications	Exploring Matter	Space Exploration
Grade 10 Academic	Tissues, Organs, and Systems of Living Things	Light and Geometric Optics	Chemical Reactions	Climate Change
Grade 10 Applied	Human Tissues, Organs, and Systems	Light and Applications of Optics	Chemical Reactions and Their Practical Applications	Earth's Dynamic Climate

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Culturally Responsive Instruction in Science

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Instructional Practices

- From the work of Padron, Waxman, & Rivera (2002) on effective instructional strategies for Hispanic students in the US, we see proposals for:
  - Culturally-Responsive Teaching
  - Cooperative Learning
  - Instructional Conversations
  - Cognitively-Guided Instruction
  - Technology-Enriched Instruction

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Instructional Practices: Resilience

In a *Review of Research on Educational Resilience* Waxman, Gray, & Padron (2003) cite McMillan and Reed (1994) to describe four factors that appear to be related to resiliency:

- personal attributes such as motivation and goal orientation,
- positive use of time (e.g., on-task behavior, homework completion, participation in extracurricular experiences),
- family life (e.g., family support and expectations), and
- school and classroom learning environment (i.e., facilities, exposure to technology, leadership, and overall climate).

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Curriculum Considerations (ON Document)

- **Instructional Approaches**
- Health and Safety in Science and Technology Education
- Cross-Curricular and Integrated Learning
- Planning Science and Technology Programs for Students With Special Education Needs
- Program Considerations for English Language Learners
- **Environmental Education**
- **Antidiscrimination Education in the Science and Technology Program**
- Critical Thinking and Critical Literacy in Science and Technology
- Literacy and Numeracy in the Science and Technology Program
- **The Role of Information and Communications Technology in Science and Technology Education**
- The Role of the School Library in Science and Technology Programs
- Guidance in Science and Technology Education

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Instructional Approaches

- Effective instructional approaches and learning activities draw on **students' prior knowledge**, **capture their interest**, and **encourage meaningful practice** both inside and outside the classroom. Students will be engaged when they are able to see the connection between the scientific and technological concepts they are learning and their **application in the world around them and in real-life situations**. (p.28)
- Research and successful classroom practice have shown that **an inquiry approach**, with emphasis on learning through concrete, hands-on experiences, best enables students to develop the conceptual foundation they need. (p.29)
- Students will investigate scientific and technological concepts using a variety of equipment, materials, and strategies, and both manual and technological tools and skills. **Equipment, tools, and materials are necessary for supporting the effective learning of science and technology by all students**. (p.29)

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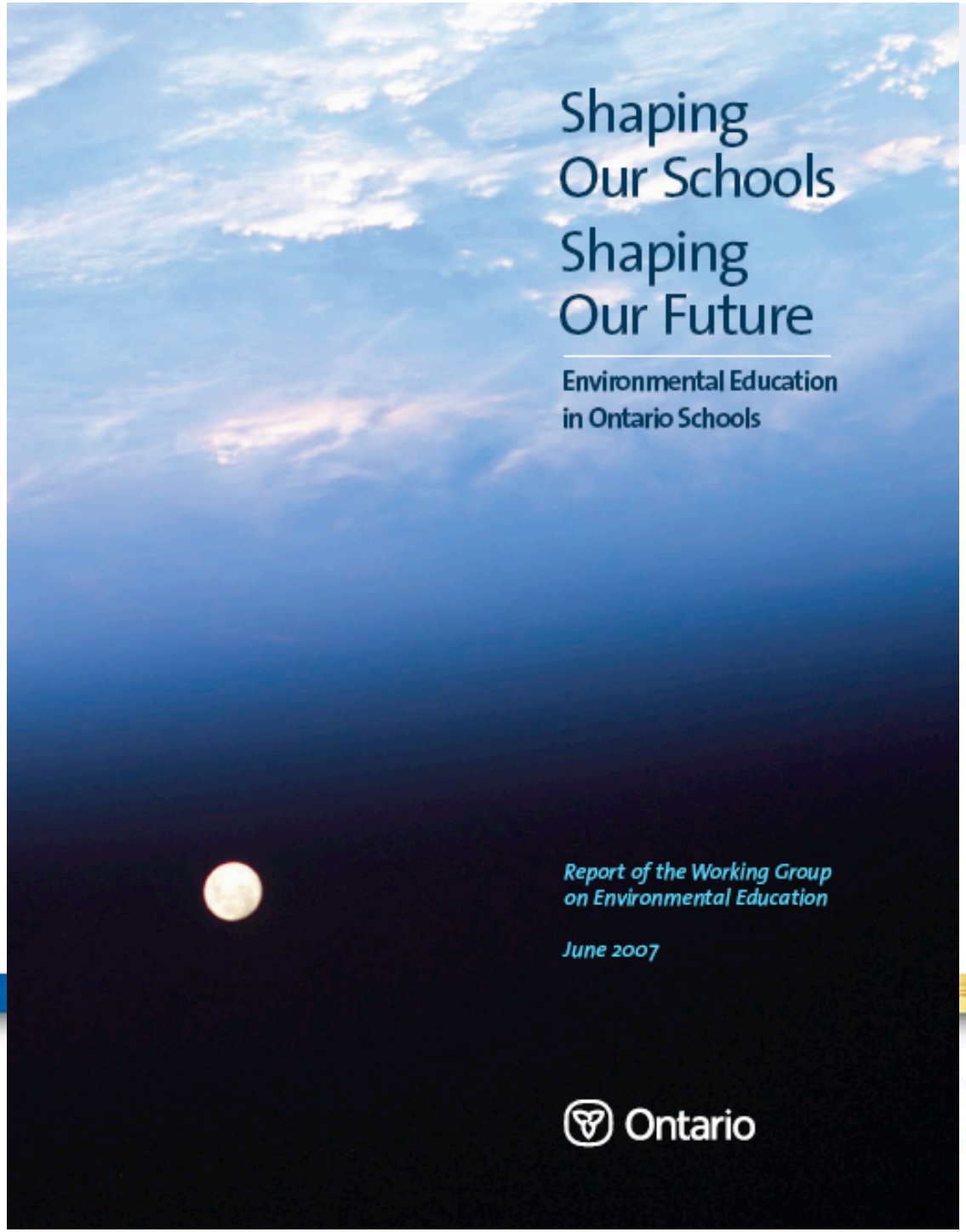

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Environmental Education (1)

Environmental education is education about the environment, for the environment, and in the environment that promotes an understanding of, rich and active experience in, and an appreciation for the dynamic interactions of:

- The Earth's physical and biological systems
- The dependency of our social and economic systems on these natural systems
- The scientific and human dimensions of environmental issues
- The positive and negative consequences, both intended and unintended, of the interactions between human-created and natural systems.

Shaping Our Schools, Shaping Our Future: Environmental Education in Ontario Schools (June 2007), p. 6

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Environmental Education (2)

The increased emphasis on science, technology, society, and the environment (STSE) within this curriculum document provides numerous opportunities for teachers to integrate environmental education effectively into the curriculum. The STSE expectations provide meaningful contexts for applying what has been learned about the environment, for thinking critically about issues related to the environment, and for considering personal action that can be taken to protect the environment.

…

One effective way to approach environmental literacy is through examining critical inquiry questions related to students' sense of place, to the impact of human activity on the environment, and/or to systems thinking.

(p. 36)

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Antidiscrimination Education in the Science and Technology Program

- The science and technology program provides students with access to materials that reflect diversity with respect to gender, race, culture, and ability. Diverse groups of people involved in scientific and technological activities and careers should be prominently displayed.
- There are also expectations in the curriculum that require students to look at the perspectives or world views of Aboriginal cultures as they relate to science and technology.

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Data Collection using HOBO's

- Wide range of USB-based stand-alone data logger applications for indoor, outdoor, and underwater monitoring. The battery-powered data loggers can be used to measure temperature, humidity, light intensity, voltage, current, and power

- Ideal for inquiry-based activities and assessments

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U12-012

HOBO® Temperature/RH/Light/ External Data Logger

Zoom

Less

The HOBO U12 Temp/RH/Light/External Logger contains internal sensors for monitoring three common indoor parameters, as well as 3rd party sensors when using the 4-20 mA cable. A fourth channel accepts a wide range of external sensors, including temperature, AC current, AC voltage, CO2, 4-20mA, and DC voltage cables.

Less

Quantity	1-9	10-99	100+	1
$US	$125	$116	$106	Add

Note: A complete system requires a logger, software, and communications.

Product Features:

- 12-bit resolution provides high accuracy
- Large memory for long-term deployments or fast sampling
- Five models to choose from, with flexible measurement options
- Programmable and push button start

Less

Overview

Note: A complete system requires a logger, software, and communications.

Environment: Indoor

Measurement: AC Current
Temperature
Relative Humidity
DC Voltage
4-20mA
AC Voltage
Carbon Dioxide
Light Intensity

Product ID: U12-012

Product Name: Temperature/RH/Light/ External

Product Type: Data Loggers

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Applications of HOBO data loggers

- **Energy conservation** - use data loggers with internal light intensity sensors for lighting analysis. Mount one logger externally and another internally and record light levels. Find the percentage difference between outside and inside light levels to design day lighting systems to save energy.

- **Food storage problems** – taking temperature data from several warehouses allows for comparisons of temperature swings and general climate fluctuations. This type of data analysis can lead to corrective action, such as sealing off roofs or installing better environmental controls. (Translate to food storage issues in communities).

- **Humidity levels in homes** – relative humidity (RH) and temperature measurements using the HOBO data loggers can provide data about conditions within homes and crawlspaces. Healthy RH levels are in the range of 30-50% are considered most suitable for a healthy environment, molds prefer RH levels over 60% (source: Alaska Building Science Network, 2002, p. 38).

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HOBO Data Loggers

- Easy to operate
- Simple to download data to PC or Mac
- Low cost
- Built-in sensors
- Water-proof models available
- Large memory storage
- Real-time display of temperature and relative humidity
- Accurate and reliable

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Culturally Relevant Assessment in Science

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What is Culturally Relevant Assessment?

- Ezeife (2003) notes that we must begin with what the students know, believe and practice in their daily lives and focus our assessment towards new learning.
- Solano-Flores and Nelson-Barber (2001) discuss the need for input from community leaders and elders in creating assessment tools.
- Estrin and Nelson-Barber (1995) argue we must present students with choices about how and when they will be assessed.

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Pre-Assessment Actions

- Input from community leaders and elders in creating assessment tools (Solano-Flores and Nelson-Barber (2001)
- Use familiar cultural resources
- Give explicit information about the purpose and meaning of the assessment
- Document the context surrounding the assessment (time of day, location, recent events)
- Give opportunities for practice (Estrin & Nelson-Barber, 1995)

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The Assessment

- Hands-on (Solano-Flores and Nelson-Barber, 2001)
- Flexibility in content
- Linking to instruction
- Avoiding ‘packaged’ assessment items
- Open-ended formats (avoid T/F and multiple choice items)
- Give plenty of time for completion
- Use cooperative assessment strategies as well as individual ones
- Do not rely on mastery of English to complete well (Estrin & Nelson-Barber, 1995).

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What is Culturally Relevant Assessment?

- Inquiry-based assessment is the key!

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Inquiry-Based Assessment

At the risk of repeating ourselves, it is:

- Flexible
- Hands-on
- Open-ended
- Less structured
- Cooperative, collaborative
- Tailored to student interests
- Promotes critical thinking abilities
- Enhances sense of student ownership
- Promotes construction of new knowledge

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Inquiry-Based Assessment

- Socially interactive
- Application of knowledge
- Promotes communication
- Student-centred, Teacher-facilitated
- Involves multiple intelligences: spatial, linguistic, body-kinesthetic, and logical-mathematical
- Promotes understanding of key concepts
- Assesses all key competencies in the new Ontario Science Curriculum (2007)

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Achievement Charts for Science Grades 1-8, 2007

The categories of knowledge and skills are described as follows:

- ***Knowledge and Understanding:*** Subject-specific content acquired in each grade (knowledge), and the comprehension of its meaning and significance (understanding).
- ***Thinking and Inquiry:*** The use of critical and creative thinking skills and inquiry and problem-solving skills and/or processes.
- ***Communication*****:** The conveying of meaning through various forms.
- ***Application*****:** The use of knowledge and skills to make connections within and between various contexts.

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Post-Assessment

- Review with their students the results of important assessments
- Analyze assessment results for signs of cultural bias and ask themselves critical questions:
- Is there a pattern to the types of items students have missed?
- Are the items missed free of cultural bias?
- If assessment items with cultural bias were removed would the student's score increase? (Hinkle, 1994)

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Assessment Summary

- Solarsh and Alant (2006), describe three influential factors that must be addressed for minimizing cultural bias and increase cultural validity in assessments.
- These general factors are very applicable for science-specific assessments:
  - The factors within the child and the intellectual, social, and cultural environment in which they live;
  - The factors involved in testing and in the test setting;
  - The test itself, including the language, context and presentation of the stimuli, the methodology, administration, and scoring of the test.

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Looking Forward

- Recognition of local knowledge and needs
- Community involvement (parents and elders)
- Planning for Ministry Inspection by integrating expectations as planning proceeds (mapping expectations). Using big ideas.
- Curriculum efficiency a high priority, culturally relevant curriculum should not expand an already busy curriculum
- Local focus where appropriate
- Computer competency, for example using electronic data collection (+ techie on each site)

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