

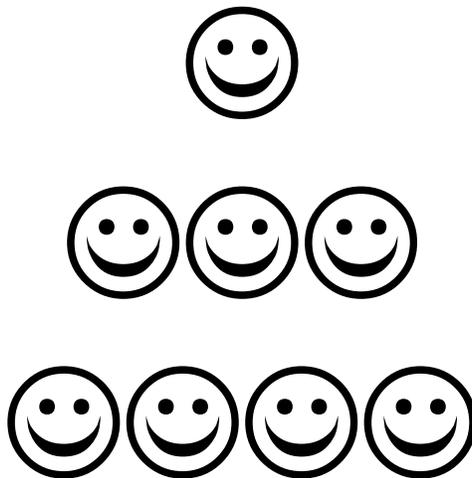
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# Toqwa'tu'kl Kjjitaqnn / Integrative Science

ThoughtTraps ∞

## **PROGRAM OVERVIEW**

for: **MSIT 101/103, 201/203, 301/303, and 401/403**



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**University College of Cape Breton**  
**MSIT Course Manual**

Version 2.1 (DRAFT) by  
TEAM UCCB MSIT 2001

(WRITTEN BY CHERYL BARTLETT)

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## Program's enabling assumption

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### Acknowledging ...

That Nature ... which we often also refer to as the natural world, the Cosmos, or our Universe ... is an interconnected whole in which we humans are but one simple part, living on the planet Earth in a solar system located close to the edge of the Milky Way galaxy, with its hundreds of billions of stars like our Sun. And that, beyond our galaxy ... throughout the remainder of the Universe ... lie hundreds of billions of other galaxies with their stars. And also that, the matter from which we humans are made originated in stars ... so they are, indeed, our ancestors --- truly, we are all related.

... LET'S TRY A NEW APPROACH TO UNIVERSITY SCIENCE EDUCATION — ONE WITH AN INNOVATIVE ENABLING ASSUMPTION:

The TOQWA'TU'KL KJIJITAQNN / INTEGRATIVE SCIENCE program holds, as its Enabling Assumption, that mutually respectful discussions about Nature can occur between the world views of Aboriginal Peoples and Western Science ... i.e. that there is common ground between the knowledges, as well as differences which are to be respected.

In that TOQWA'TU'KL KJIJITAQNN / INTEGRATIVE SCIENCE is an entirely new approach to university science education ... new science courses have been created to serve as its curricular framework. These courses have been given the label "MSIT" ... from the Mi'kmaq word meaning "everything together", or holistic.

## Program's name

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“Toqwa’tu’kl Kjjitaqnn” comes from the Mi’kmaq phrase meaning “bringing knowledges together” ... and denotes the effort to bring together Aboriginal and Western scientific understandings of Nature.

“Integrative Science” is the companion name in English for the same idea, namely the bringing together of Western scientific and Aboriginal understandings of Nature.

“Integrative” is also used elsewhere in leading edge activities in this new millennium ... to denote the intentional awareness and inclusion in an activity ... of human mind, consciousness, and spirit. “Integrative medicine” is an excellent example.

“Science” reflects the understanding that the scientific pursuit is as old as the consciousness of our human species ... for it is a practical engagement with the real world, and essential for human survival. Scientific pursuit in the Aboriginal world view is a way of knowing that embraces interdependence in Nature, and answers to questions are tested by both the immediate reality and the long term sustainability of life. Scientific pursuit in the Western world view is a way of knowing that prizes objectivity, and answers to questions are, ideally, tested in artificial (experimental) situations. At the heart of the pursuit, regardless of world view, are the human abilities to ask questions, recognize patterns, think creatively, think critically, and communicate understandings to others.

the challenge has to be such that it can be met  
without boring us to death ... or killing us outright

- only when knowledge is conditioned by respect can it be truly shared •
- consciousness is conditioned by environment •

## Program's major objectives

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The Universe in which we humans live,  
 whether it be the places our feet tread or the night skies our eyes behold,  
 is characterized by constant flux and interdependency.

This statement could easily have been issued by researchers in the most recent leading edge areas of modern science. Its sentiment can also be found within the much, much older legends of many Aboriginal peoples around the world.

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Major objectives of the Toqwa'tu'kl Kjjitaqnn / Integrative Science program are:

- ☞ 1) to recognize that there is **Common Ground** between Western science and Aboriginal understandings of Nature, such as that stated above, and to begin to articulate more of it
  - and thus, realize that Western science and Aboriginal views as “ways of knowing” are not mutually alien
  - ☺ *such that, for example* ... one understands that mathematics is simply the preferred metaphor of expression for relationships in Western science ... i.e. a symbolic language ... and that understandings and expressions of relationship are also of central importance in Aboriginal world views ... and are embedded in the structure of many languages
  
- ☞ 2) to do the above while also learning both Western science and Aboriginal knowledge
  - and thus, establish foundational nodes for connected understandings ... to enable growth in personal understandings of both knowledges
  - ☺ *such that, for example* ... the “territory of science is mapped” towards understandings of the fundamental unity of its knowledge base and the Universe, the commonality of its approach to problems, and the significance of its role in modern life ... and the “ecology of Aboriginal education is mapped” towards understandings of the fundamental relationship between Aboriginal peoples and the natural environment, and recognition of the natural laws of interdependency in life

- ☞ 3) to recognize the differences between Western science and Aboriginal views
  - and thus, help establish the necessary mutual respect for true sharing of knowledge
  
- ☞ 4) to introduce Aboriginal understandings of Nature into the post-secondary science curriculum
  
- ☞ 5) to foster a personal sense and understanding, including from both the Western scientific and Aboriginal perspectives, of “connectedness and interdependence in our Universe”
  
- ☞ 6) to increase the participation rate of Aboriginal students in, and numbers of graduates from, post-secondary science and technology programming
  
- ☞ 7) to employ “mindful learning” techniques ... including, especially, “asking questions” and “recognizing patterns” ... to ...
  - accomplish the program’s objectives with respect to *content* and *knowledge*
  - come to realize the *complementarity of science and art*
  - foster *creative thinking skills*, as well as *critical thinking skills*
  - acquire additional skills for *self-directed learning* and *life-long learning*

# Program's place within the Bachelor of Science Community Studies (BScCS) four year degree

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## Degree Core (48 credits)

- 1) Problem Centred Studies 100: Analysis and Decision Making (6 credits)
- 2) Problem Centred Studies 200: Applied Research (6 credits)
- 3) Problem Centred Studies 300: Community Intervention (6 credits)
- 4) science and technology perspectives (6 credits): Phil 222, or equivalent
- 5) world views and values (3 credits): Phil 201, or equivalent
- 6) Aboriginal perspectives (3 credits): Mi'kmaq Studies at 100 or 200 level, or equivalent
- 7) business perspectives (3 credits): Bus Ad 111, Bus Ad 231, or equivalent
- 8) public communication (3 credits): Commun 105, or equivalent
- 9) effective writing (6 credits): Engl 100, Engl 205 + Engl 207, or equivalent
- 10) computer literacy (3 credits): Phil 115, Comput 111, or equivalent
- 11) statistics (3 credits): Math 135, Bus Ad 182, Psych 201, or equivalent

## Area of Concentration ... Toqwa'tu'kl Kjjitaqnn / Integrative Science\* (42 credits)

### **a) University (24 credits)**

- 1) 3 credits: MSIT 101
- 2) 3 credits: MSIT 103
- 3) 3 credits: MSIT 201
- 4) 3 credits: MSIT 203
- 5) 3 credits: MSIT 301
- 6) 3 credits: MSIT 303
- 7) 3 credits: MSIT 401
- 8) 3 credits: MSIT 403

### **b) Technology (18 credits)**

- 1) 3 credits: Chem 121
- 2) 3 credits: Chem 122
- 3) 3 credits: math or physics \*\*
- 4) 3 credits: math or physics \*\*
- 5) 3 credits: environmental \*\*\*
- 6) 3 credits: environmental \*\*\*

\* program fully approved, Feb 2001, by Maritime Provinces Higher Education Commission, Fredericton

\*\* math or physics: choose 6 credits from Math 131/132, Phys 100, or Phys 111/112

\*\*\* environmental: choose 6 credits from option "a" or "b"

- a) • 3 credits from one of: Envir 211, Envir 214, Geol 111, or EnvH 211  
• 3 credits from one of: Envir 315 or Envir 335
- b) • 3 credits + 3 credits via both of: Envir 315 and Envir 335

## Student's Electives (30 credits)

- |               |                |
|---------------|----------------|
| 1) 3 credits: | 6) 3 credits:  |
| 2) 3 credits: | 7) 3 credits:  |
| 3) 3 credits: | 8) 3 credits:  |
| 4) 3 credits: | 9) 3 credits:  |
| 5) 3 credits: | 10) 3 credits: |

## Work Placements (each at least 120 hr, paid or voluntary)

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_

## **Program's MSIT courses**

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### **Required for the BScCS Toqwa'tu'kl Kjjitaqnn / Integrative Science**

#### ■ **MSIT 101/103 Sense of Place, Emergence, and Participation**

- concepts about consciousness in Cognitive Science: the brain and building blocks of consciousness
- Indigenous educational foundations: Spiritual Ecology, Mythical, Environmental
- concepts about consciousness in Aboriginal world views: natural laws of interdependence
- concepts from Mi'kmaq, including language
- patterns in Nature, and pattern recognition by humans

#### ■ **MSIT 201/203 Ways of Knowing**

- Big Questions about Nature in Western science: cosmology, physics, chemistry, geology, biology
- Indigenous educational foundations: Visionary, Artistic, Affective, Communal
- concepts about Nature in Aboriginal world views: natural laws of interdependence
- concepts from Mi'kmaq, including language
- Mi'kmaq natural resource management

#### ■ **MSIT 301/303 Cycles & Holism**

- energy flow and transforms ... dynamics of natural phenomena

#### ■ **MSIT 401/403 Wholeness**

- wholeness ... health, disease, and healing ... dynamics of natural phenomena

### **Optional for the BScCS Toqwa'tu'kl Kjjitaqnn / Integrative Science**

#### ■ **MSIT 211-251 & 351 (ecosystems and organisms) ... biodiversity**

- MSIT 211 Ecosystems of Cape Breton (also, cross-listed as Biol 211)
- MSIT 221 Water, Soils, Minerals, & Climate
- MSIT 231 Animals of the Land
- MSIT 241 Animals of the Rivers, Lakes, and Sea
- MSIT 251 Applied Botany (also, cross-listed as Biol 251)
- MSIT 351 Plants 2

## Program's "questions" and "patterns" learning approach

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Much of the content in the MSIT courses is structured around **questions** and **patterns**.

### **Question: Why?**

### **Answer: Two reasons ... because:**

- 1) **asking questions** is of central importance in the scientific pursuit, whether it is within the Aboriginal or Western world views. It is also at the heart of creative thinking, which plays a critically important role in science and many other human endeavours.
- 2) **recognizing patterns** is something all humans do naturally. So, for Toqwa'tu'kl Kjjjitaqnn / Integrative Science we chose to exploit this natural tendency — our human desire for the overall pattern or “big picture” — for the purposes of *learning*.

☺ This approach could be compared to climbing up to a high point, for example the top of a mountain, to get a “big picture” view or understanding of the surrounding countryside. This is something you probably would automatically think of doing if:

- you were trying to find your way in new territory and wanted some “orienting directions”, or
- you felt lost and wanted to re-establish your bearings.

The importance of being “patternable” (or, sensitive to the rich and varied patterns that surround us in Nature) is equally essential in scientific pursuit from the Aboriginal perspective, where one must be able to become a “magical or spiritual being” to ask the relevant questions, to think creatively towards their resolution, and to implement the appropriate answers.

☺ This approach may take one into the “land of the eagle” in many Aboriginal stories.

BUT ... in spite of the way the MSIT courses are structured or taught ... when all is said and done ...you, the student, have to ...  
**“MAKE THE PATTERN TALK TO YOU”.**

☺ In addition to learning science, this approach using **questions** and **patterns** should facilitate efforts to:

- connect understandings among the different disciplines of natural science,
- recognize the Common Ground between Western science and Aboriginal world views,
- appreciate the interconnectedness and interdependence of the Universe, and
- begin to understand how to develop self-directed and life-long learning skills.

... all of which are major objectives in Toqwa'tu'kl Kjjitaqnn / Integrative Science

?  
???  
?????



!!!! pattern !!!!

The Ability to Work with Pattern ... is Key to Excellence in:

**question asking**  
**creative thinking & creative expression**  
**metaphoric thinking**  
**analytical thinking**  
**map-making**  
**story-telling**

... all of which are emphasized in the MSiT integrative science courses ...  
... and are also found in a multitude of other human activities!

## Program's "mindful learning" approach

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One of the major objectives of Toqwa'tu'kl Kjjitaqnn / Integrative Science is:

☞ to recognize and use, **brain-based learning, or "mindful learning" techniques** ... to:

- accomplish the program's objectives with respect to *course content* and *knowledge integration*
- emphasize the value of *questioning* and *pattern recognition*
- come to realize the *complementarity of science and art*
- foster *creative thinking skills*, as well as *critical thinking skills*
- acquire additional skills for *self-directed learning* and *life-long learning*

☺ Brain-based learning works with new understandings that **the brain is a highly flexible organ** (not a rigid and fixed organ with "on" and "off" switches, as earlier ideas may have had it). This flexibility forms the basis of a concept known as **neuroplasticity**.

- the brain changes in response to stimulation — both moment to moment and on a long-term basis
- the stimulation for change in the brain comes from the environment — which can be the brain itself, the remainder of the body, and world outside the body
- the brain is able to adapt — to learn from its environment and from experience, and even in some cases compensate for damage or injury

- consciousness is conditioned by environment •

Toqwa'tu'kl Kjjitaqnn / Integrative Science and MSfT will emphasize

**question asking**  
**creative thinking & creative expression**  
**pattern recognition**  
**metaphor**  
**map-making**  
**story-telling**

... which are cognitive tools that reflect natural ways of learning,  
 i.e. that could be referred to as "mindful" or "brain-based", and are also

... cognitive tools that the Mi'kmaq people have always used.

Brain-based learning can also be referred to as:  
 brain on learning, mind on learning, mindful learning, more than just memorization

## Program's ThoughtTraps<sup>©</sup>

- 
- ☺ The MSIT ThoughtTraps<sup>®</sup> ... are a series of draft manuals that have been written specially for the Toqwa'tu'kl Kjjitaqnn / Integrative Science program. To date, the following ThoughtTraps<sup>®</sup> have been created:
- ThoughtTraps<sup>∞</sup> Program Overview
  - ThoughtTraps<sup>∞∞</sup> Scientific Pursuit of Knowledge
  - ThoughtTraps **1** MSIT 101 / 103 Sense of Place, Emergence and Participation
  - ThoughtTraps **2** MSIT 201 / 203 Ways of Knowing
- ☺ The ThoughtTraps<sup>®</sup> ... are an outline of the concepts covered in both the program as a whole and in its specific MSIT courses.
- ☺ The ThoughtTraps<sup>®</sup> ... are intended to help start the Common Ground discussions called for by the program's enabling assumption.
- ☺ The ThoughtTraps<sup>®</sup> ... will, we hope, eventually grow into a complete textbook for the program.
- ☺ The ThoughtTraps<sup>®</sup> ... in their present format should, therefore, be seen as a beginning, not an end. They are a "work in progress".
- ☺ It is the hope of the UCCB MSIT development team ... that students and others will help bring the ThoughtTraps<sup>®</sup> to a fuller realization ... by adding more understandings from the Mi'kmaq world view, other Aboriginal world views, and the Western science world view ... and by helping to identify and articulate Common Ground.
- ☺ Constructive feedback for the ThoughtTraps<sup>®</sup> is welcome from any and all! Please contact the principle author.

the challenge has to be such that it can be met ...  
without boring us to death, or killing us outright.

- only when knowledge is conditioned by respect can it be truly shared •
- consciousness is conditioned by environment •

## **Program's ThoughtTraps<sup>©</sup> development team**

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TEAM UCCB MSIT 2001 ... for Toqwa'tu'kl Kjjijitaqnn / Integrative Science

- Principle author  
Cheryl M. Bartlett, PhD
  - Illustrator  
Basma Kavanagh (illustrations Basma<sup>©</sup>)
  - Student Research Assistants (\* NSERC summer undergraduate research awardee)
    - Nicholas Basque
    - Dina Bernard
    - Stephenie Bernard\*
    - Chantelle Cormier, BSc
    - Jasine Dennis\*
    - Shauna Gould\*
    - Nadine Lefort
    - Clifford Paul\*
    - Loren Pemberton
    - Rita Sylliboy
    - Tonia Sylliboy
  - Associated Faculty
    - Rod Beresford, MSc
    - Thomas Bouman, PhD
  - additional input from
    - Keith Demone
    - Slawa Lamont, PhD
    - Nadine Vanietti\*
  - Director, Mi'kmaq College Institute  
Eleanor Bernard, MEd
- with financial support from**
- University College of Cape Breton
  - Sable Offshore Energy Incorporated, Halifax
  - StoraEnso, Port Hawkesbury
  - Natural Sciences and Engineering Research Council of Canada (NSERC)

## Program's birth acknowledgments

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Many people helped bring Toqwa'tu'kl Kjjijitaqnn / Integrative Science into reality.

- **Murdena Marshall**, Mikmaq First Nations, Eskasoni, and Associate Professor, UCCB, and Spiritual Leader to the Mi'kmaq Grand Council who long thought about a science program like Toqwa'tu'kl Kjjijitaqnn / Integrative Science at UCCB, and then said "Let's do it!"
- **Gregory Cajete**, Tewa Nation, Santa Clara Pueblo, Assistant Professor, Educator and Scientist, University of New Mexico who said "You do it by just starting" and provided numerous ideas, and who also endorsed the program as an expert reviewer for MPHEC.
- **Jeffrey Kane**, Dean, School of Education, Long Island University, Brookville, New York who endorsed the program as an expert reviewer for MPHEC.
- **The development team** that in 1997, along with **Murdena Marshall**, wrote the initial proposal for Toqwa'tu'kl Kjjijitaqnn / Integrative Science (as Mawi-Wsitqamu'kewaq): **Diana Denny** and **Albert Marshall**, Mi'kmaq First Nations, Eskasoni; and **Cheryl Bartlett**, **Kathleen Durante**, **David McCorquodale**, and **Mary (Pixie) Williams**, faculty, School of Science & Technology, UCCB.
- Individuals at UCCB who played key roles in assisting the proposal through various inquisitional bodies, including, especially: **Cheryl Bartlett**, **Eleanor Bernard**, **Robert Campbell**, **Hubert Chiasson**, **Suzanne Drouin**, **Stephanie Inglis**, **Stephen Kavanagh**, **Richard MacKinnon**, **Terry MacLean**, **Joe B. Marshall**, **David McCorquodale**, **Arthur Tucker**, and **Ruth Schneider**.
- **UCCB's Committee on Planning and Priorities**, **Academic Council**, and **Board of Governors**, and the **Maritime Provinces Higher Education Commission (MPHEC)**, Fredericton ... all of which passed motions approving the program proposal.
- **Jacquelyn Thayer-Scott**, President & Vice-Chancellor at UCCB, under whose name all documents were submitted to MPHEC.
- **Bern Francis**, Honourary Doctorate, Mi'kmaq linguist, Mi'kmaq First Nations, Membertou, who helped launch the program into the classroom.
- **John Jerome Paul**, Director, Mi'kmaw Kina'matnewey, who assisted in innumerable ways.
- **Sable Offshore Energy, Incorporated**, Halifax, and **StoraEnso**, Port

Hawkesbury, which provided money to foster development of the Toqwa'tu'kl Kjjitaqnn / Integrative Science program.

## **Program's background (in brief)**

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Toqwa'tu'kl Kjjijitaqnn / Integrative Science was the vision of Ms. Murdena Marshall, who is an Associate Professor in Mi'kmaq Studies at UCCB, a member of the Eskasoni Band of the Mi'kmaq First Nations, and Spiritual Leader to the Mi'kmaq Grand Council in Atlantic Canada.

Ms. Marshall was instrumental in helping to develop, in the 1980's and early 1990's, courses in Mi'kmaq Studies which can be taken as part of UCCB's Bachelor of Arts, Bachelor of Arts Community Studies, and Bachelor of Business Administration degrees. Science became her focus of concern after years of observing that Aboriginal students tended to avoid it, or that the few who ventured in frequently left without completing their studies (regardless of the identity or location of the post-secondary institution). In contrast, many Mi'kmaq students excelled in other degree programs at UCCB, with numerous students graduating each year and many going on to graduate studies elsewhere. Ms. Marshall felt that if a new science program could be developed, one that showed that many concepts in modern science are not alien to the Aboriginal way of thinking, it might draw Mi'kmaq students into the sciences and thus begin to redress the distressingly low rate of Aboriginal participation and success in an essential area of modern education and modern society.

To bring Ms. Marshall's vision closer to reality, a Toqwa'tu'kl Kjjijitaqnn / Integrative Science development team worked feverishly through the winter of 1997 to propose new, MSIT integrative science courses, all of which would contain both Western science and Aboriginal knowledge towards the vision of a new science program at UCCB. Content within the courses would also help address the requirements of the 1992 United Nations Convention on Biological Diversity which bound signatory countries (e.g. Canada) to three goals: (1) to respect, preserve, and maintain traditional aboriginal knowledge; (2) to promote wide application of traditional Aboriginal knowledge; and (3) to encourage equitable sharing of benefits from traditional Aboriginal knowledge.

The full proposal for the new Toqwa'tu'kl Kjjijitaqnn / Integrative Science program was put forward to the UCCB community in June, 1997. It was brought to UCCB's Academic Council in June 1998, at which time an Ad Hoc Committee was struck to examine the proposal, to invite submissions from any interested party within the institution or the Aboriginal community, and to provide recommendations back to Academic Council. In September, 1998, the Committee recommended that the proposed program and its courses be approved by Academic Council. The proposal received approval from UCCB's Academic Council in October, 1998, and from UCCB's Board of Governors in June, 1999.

The Toqwa'tu'kl Kjjijitaqnn / Integrative Science program proposal was submitted to the Maritime Provinces Higher Education Commission (MPHEC), Fredericton, in June, 1999, where it received full academic approval (as a concentration within UCCB's Bachelor of Science Community Studies four year degree) in February, 2001. A celebration for this full academic approval of the new program (and for the successful pilot deliveries of the first year MSIT courses in academic years 1999-2000, and 2000-2001) was held at UCCB in April, 2001, with

Dr. Leroy Little Bear and Dr. Marie Battiste as guest speakers.

Toqwa'tu'kl Kjjijitaqnn / Integrative Science's first NSERC Summer Undergraduate Research Award recipients (N = 6) were announced in March, 2001.

A Team UCCB MSIT consisting of UCCB science professors, science students, and interested others continues to work on detailed development of the curricula for the integrative science courses within the Toqwa'tu'kl Kjjijitaqnn / Integrative Science program. In Fall 2001, the team will launch a website for this unique program.

Off shoots of the Toqwa'tu'kl Kjjijitaqnn / Integrative Science program are also being pursued. For example, in Summer 2001, students on the Team UCCB MSIT developed "bilingual playing cards" to depict mathematical patterns in local plants and rocks as part of the Mi'kmaq Science Culture Camp held at Chapel Island, Cape Breton, for 12-16 old Mi'kmaq junior high students in the Maritimes. Funding assistance for this special initiative was provided by NSERC's PromoScience program that seeks to encourage interest in science and technology among Canada's youth through "hands on activities".

## Program's first group of students 1999-2000 ... Amskwesewa'q

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**NOTE: names have been deleted below for privacy**

September 1999 intake for MSIT 101 / 103 / 201 / 203:

☺ J  
 ☺ A  
 ☺ S  
 ☺ A  
 ☺ J  
 ☺ L  
 ☺ J  
 ☺ M  
 ☺ E  
 ☺ S\*\*  
 ☺ C\*  
 ☺ T  
 ☺ A  
 ☺ N  
 ☺ A  
 ☺ C  
 ☺ C\*\*  
 ☺ C  
 ☺ M  
 ☺ C  
 ☺ T

\* UCCB Murdena Marshall MSIT Scholarship recipient, 2000

\*\* NSERC Summer Undergraduate Research Award recipient (\$5000.00 each), 2001

## Program's second group of students 2000-2001 ... Tapue'wa'q

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**NOTE: names have been deleted below for privacy**

September 2000 intake for MSIT 101 / 103 / 201 / 203:

☺ N  
 ☺ S  
 ☺ D  
 ☺ S\*\*  
 ☺ T  
 ☺ J\*\*  
 ☺ T  
 ☺ A  
 ☺ C\*\* (NSERC Award declined)  
 ☺ E  
 ☺ M  
 ☺ D  
 ☺ M  
 ☺ A\*\*  
 ☺ V  
 ☺ V  
 ☺ C  
 ☺ D\*  
 ☺ R  
 ☺ A (101/ 103 only)  
 ☺ A  
 ☺ R

\* UCCB Murdena Marshall MSIT Scholarship recipient, 2001

\*\* NSERC Summer Undergraduate Research Award recipient (\$5000.00 each), 2001

## Program's anticipated third group of students 2001-2002 ... Sis'tewa'q

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**NOTE: names have been deleted below for privacy**

September 2001 anticipated intake for MSIT 101 / 103 / 201 / 203:

☺ J  
☺ M  
☺ T  
☺ C  
☺ J  
☺ R  
☺ S  
☺ C  
☺ R  
☺ S  
☺ A  
☺ J  
☺ J  
☺ S  
☺ T  
☺ L  
☺ B  
☺ M  
☺ A  
☺ G  
☺ P  
☺ R  
☺ T  
☺ T

## **Degree: Bachelor of Science Community Studies (BScCS), 4 years, 120 credits**

**Concentration:** Toqwa'tu'kl Kjjitaqnn / Integrative Science

☞ ... an explanation in two parts

**NOTE:** This explanation was provided by the University College of Cape Breton to the Maritime Provinces Higher Education Commission (MPHEC) in December 2000, as part of the documents created to help MPHEC in its efforts to come to a solid understanding of UCCB's proposed new science program. MPHEC requested that the explanation be made widely available, and approved the new program in February 2001.

### **PART 1: an overview of the BScCS degree**

UCCB's Bachelor of Science Community Studies (BScCS) degree is a 120-credit (4-year) degree for students wishing to pursue an innovative approach to science education at the university undergraduate level. It fosters the understanding of science through diverse means, including content-based courses, research-based courses, student-selected opportunities, and work-related experience. As such, it seeks to provide graduates with the skills, abilities, perspectives, and science framework that will enable them to participate in a variety of meaningful ways in our modern society — a society seeking graduates with “knowledge know how” to apply to the ever expanding world of information in which we live. In contrast, conventional Bachelor of Science degrees tend to be more “specific information rich” in that they emphasize content-based courses within a disciplinary approach (e.g. BSc, concentration in Biology) as excellent preparation towards a more immediate and narrowly focused end (e.g. disciplinary research at the graduate level).

#### ■ **The BScCS degree has four major parts.**

- Concentration ..... 42 credits
- Core ..... 48 credits
- Student's Electives .... 30 credits
- Work Placements ..... 2, each 120 hours

#### ■ **The BScCS degree emphasizes science ... in four major ways:**

- science content,
- science research skills,
- science opportunities, and
- science experience in the work place.

- **Science content:** The degree's Concentration requires 42 credits of *basic science (university) and applied science (technology) content-based courses*. The specific courses required are defined by the nature of the particular Concentration, as outlined later in this document.
- **Science research skills:** The degree's Core requires 48 credits, 18 of which are in *Problem-Centred Studies (PCS) courses*. These courses foster *science research skills* through a "problem-centred" approach in which particular science or science-related issues in modern society are explored. The first year PCS courses focus on "Analysis and Decision Making", the second year courses on "Applied Research", and the third year courses on "Community Intervention". Since the students pursue these studies in small groups, the PCS courses also foster *team or group work skills*. The Core also requires 3 credits of statistics, i.e. an introduction to the *quantitative methodology* that characterizes much of modern science research. Other required courses in the Core are listed later in this document.
- **Science opportunities:** The degree's Student's Electives require 30 credits from courses that the student selects according to personal interests, career aspirations, or post-graduate plans. If the student wishes, these *may all be science or science-related courses*. Alternatively, the student may select from other areas related to science in modern society as, for example, business, information technology, communication, or humanities.
- **Science experience in the work place:** The degree's Work Placements involve two, 120 hr (paid or voluntary) work experiences in a *science or science-related environment*. Through these applied learning experiences, the student should gain a personal understanding of the value of the academic background provided by the degree's Concentration (with its content-based science and technology courses), the research skills fostered by the PCS courses as well as the additional general skills and abilities fostered by the degree's Core courses, and the customization opportunity afforded by the degree's Electives.
- **Science summary:** The BScCS degree, with its 120 total credits, provides the graduate with 63 to 93 credits in science content, science research skills, and science opportunities, plus experience in the science work place — an innovative approach to post-secondary science education which is summarized in Table 1. The "63 to 93" credit variation is due to the flexibility in fulfilling the 30 credits of Student's Electives.

**Table 1: Summary of science background, in terms of content, research skills, opportunities, and experience in the work place ... provided by the four year Bachelor of Science Community Studies (BScCS) degree vis-a-vis a conventional, four year Bachelor of Science (BSc) degree (the latter represented by the University College of Cape Breton degree, i.e. a typical BSc degree).**

	<u>BScCS</u>	<u>Bsc</u>
<b>Science content</b>		
• compulsory credits (total)	42	45*
- basic science (university courses)	18-24	45*
- applied science (technology courses)	18-24	0
<b>Science research skills</b>		
• compulsory credits		
- Problem Centred Studies (PCS) courses	18	0
- statistics	3	3
- additional mathematics	**	3
<b>Science opportunities (additional)</b>		
• elective credits		
- can be science	30	12
- must be science, or close cognates	0	30
<b>Science experience in the work place</b>		
• work placements	2	0

\* must all be from the same discipline (e.g. all biology OR all psychology)

\*\* mathematics may be part of the compulsory science content in a particular Concentration, e.g. in Toqwa'tu'kl Kjjitaqnn / Integrative Science 6 credits in math are part of the applied science requirements

■ **The BScCS degree fosters additional skills, abilities, and perspectives of direct relevance to modern science careers.**

- All the courses in the Core of the BScCS help foster abilities, skills, and perspectives that diverse science or science-related employment sectors in modern society have identified as desirable in the university graduates they seek to hire. *In contrast, more conventional Bachelor of Science degrees tend to be heavily discipline-based in the sciences and omit many of these same abilities, skills, and perspectives.* The nature of the abilities, skills, and perspectives fostered by the BScCS is apparent from the title of each required course or topic in the Core of the degree (see list below). The Problem Centred Studies (PCS) courses and the statistics course also provide science content. In total, the Core provides 48 of the degree's 120 credits.

List of Core courses, and the number of credits associated with each

- Problem Centred Studies 100: Analysis and Decision Making	(6 credits)
- Problem Centred Studies 200: Applied Research	(6 credits)
- Problem Centred Studies 300: Community Intervention	(6 credits)
- statistics	(3 credits)
- science and technology perspectives	(6 credits)
- world views and values	(3 credits)
- Aboriginal perspectives	(3 credits)
- business perspectives	(3 credits)
- public communication	(3 credits)
- effective writing	(6 credits)
- computer literacy	(3 credits)

- Many of the skills and abilities fostered by the BScCS Core courses have also been identified by research and higher education entities as important in the evaluation of undergraduate students applying for scholarships, or for entry to professional health science and post-graduate research programs. Congruencies between the evaluation criteria used by some of these entities and the BScCS degree's Core courses are outlined in Table 2 and detailed in Table 3.

**Table 2: Outline of the congruency between the abilities and skills desired (+) by select research and higher education entities, and those fostered (✓) by UCCB's BScCS 4 year degree. A dot (.) indicates no explicit request for evaluation based on that criterion.**

Criteria	NSERC <sup>1</sup>	Dalhousie		UCCB BScCS <sup>4</sup>
		Grad <sup>2</sup>	Med & Dent <sup>3</sup>	
1. General	+	+	+	✓
2. Communication	+	+	+	✓
3. Interpersonal	+	.	+	✓
4. Personal	.	.	+	✓
5. Motivation towards career	+	+	+	✓

<sup>1</sup> Natural Sciences and Engineering Research Council of Canada, for post-graduate scholarships

<sup>2</sup> Dalhousie University School of Graduate Studies

<sup>3</sup> Dalhousie University School of Medicine, and School of Dentistry

<sup>4</sup> University College of Cape Breton, Bachelor of Science Community Studies 4 year degree

**Table 3: Details of the congruency of the abilities and skills desired (+) by select research and higher education entities, and those fostered (✓) by courses in the core of UCCB's BScCS 4 year degree. A dot (.) indicates no explicit request for evaluation based on that criterion.**

Criteria -----	NSERC <sup>1</sup> -----	Dalhousie		UCCB BScCS <sup>4</sup> -----
		Grad <sup>2</sup>	Med & Dent <sup>3</sup>	
<b>1. General</b>				
1) critical thought and analysis / judgement	+	.	+	✓ PCS courses
2) problem solving	.	.	+	✓ PCS courses
3) apply skills and knowledge / carry on advanced study	+	+	.	✓ PCS courses
4) originality / creativity	+	+	.	✓ PCS courses (*)
5) initiative / independence	+	+	.	✓ PCS courses (*)
6) complete projects / meet deadlines	+	+	+	✓ PCS courses (*)
7) resourcefulness	.	+	+	✓ PCS courses (*)
<b>2. Communication</b>				
1) written	+	+	+	✓ effective writing course
2) oral	+	+	+	✓ communication course
<b>3. Interpersonal</b>				
1) interact with co-workers (share ideas, receive critical feedback)	+	.	+	✓ PCS courses
2) leadership ... plus perspectives beyond academic science	+	.	.	✓ PCS courses
- business	.	.	.	✓ business course
- Aboriginal	.	.	.	✓ Mi'kmaq course
- Western	.	.	.	✓ philosophy course
- science & technology	.	.	.	✓ philosophy course
<b>4. Personal</b>				
1) emotional stability	.	.	+	.
2) empathy	.	.	+	✓ (*)
3) reliability	.	.	+	✓ PCS courses (*)
4) perseverance	.	.	+	✓ PCS courses (*)
5) self-confidence	.	.	+	✓ PCS courses (*)
6) curiosity	.	.	+	✓ PCS courses (*)
<b>5. Motivation towards career</b>				
1) motivation / enthusiasm for career / research	+	.	+	✓ PCS courses (*)

<sup>1</sup> Natural Sciences and Engineering Research Council of Canada, for post-graduate scholarships

<sup>2</sup> Dalhousie University School of Graduate Studies

<sup>3</sup> Dalhousie University School of Medicine, and School of Dentistry

<sup>4</sup> University College of Cape Breton, Bachelor of Science Community Studies 4 year degree

\* also, fostered in the MSiT courses required by the BScCS Concentration "Toqwa'tu'kl Kjjijitaqnn / Integrative Science"

## **PART 2: an overview of the degree's Toqwa'tu'kl Kjjitaqnn / Integrative Science concentration**

■ **The BScCS Concentration entitled Toqwa'tu'kl Kjjitaqnn / Integrative Science is an innovative and leading-edge approach to modern science education.**

- “Toqwa'tu'kl Kjjitaqnn” comes from the Mi'kmaw First Nations phrase meaning “bringing knowledges together” and denotes the overall objective of the MSIT courses in this Concentration to bring together Western science and Aboriginal understandings of Nature.
- “Integrative Science” is the companion name in English for the same idea. “Integrative” is also used to denote the intentional awareness and inclusion in the MSIT courses of a learning approach that includes mind and consciousness, i.e. the application of traditional wisdom and the latest in brain research towards the context of learning.
- “Science” reflects the understanding that the scientific pursuit is as old as the consciousness of our human species, and that it plays a major role in both the Western world view and the Aboriginal world view. “Science” also reflects the understanding that it is the knowledge base of Western science which gives rise to modern technology, i.e. that modern technology is applied science.

■ **Specific courses are required for the Concentration entitled Toqwa'tu'kl Kjjitaqnn / Integrative Science.** These are listed below, and then explained in the ensuing text (as mentioned in the overview of the BScCS degree, the specific courses required by the Concentration part of the degree are defined by the nature of *each particular* Concentration).

### List of basic science (University) & applied science (Technology) courses required in BScCS Concentration entitled Toqwa'tu'kl Kjjitaqnn / Integrative Science (42 credits total)

• Basic science (University)

- MSIT 101/103	Sense of Place, Emergence, and Participation	(3 + 3 credits)
- MSIT 201/203	Ways of Knowing	(3 + 3 credits)
- MSIT 301/303	Cycles and Holism	(3 + 3 credits)
- MSIT 401/403	Wholeness	(3 + 3 credits)

• Applied science (Technology)

- Chemistry 121	General Chemistry 1	(3 credits)
- Chemistry 122	General Chemistry 2	(3 credits)
- math or physics	<i>student choice from specified course pool</i>	(3 credits)
- math or physics	<i>student choice from specified course pool</i>	(3 credits)
- environmental	<i>student choice from specified course pool</i>	(3 credits)
- environmental	<i>student choice from specified course pool</i>	(3 credits)

**Basic science ... MSIT courses (24 credits):** Toqwa'tu'kl Kjjitaqnn / Integrative Science requires eight, 3 credit MSIT science courses, "MSIT" coming from the Mi'kmaq word "*msit*" meaning "everything together" or "holistic". All MSIT courses have 3 hours of lecture, plus 3 hours of labs, per week. Overall, their embedded "bringing knowledges together" aspect emphasizes the common ground between Western science and Aboriginal world views, while also clearly recognizing and honouring their points of difference.

- With respect to Western science, the first year MSIT courses establish foundational nodes of understanding for the internal environment of human consciousness (MSIT 101/103, contributions from cognitive science and neuroscience) and the external environment of Nature (MSIT 201/203, contributions from an integrated delivery of cosmology, physics, chemistry, geology, and biology). With these foci, the MSIT 101/103 courses seek to foster the mental fluency needed to "craft information into knowledge", and the MSIT 201/203 courses the abilities to "see the big pictures" in the natural sciences and understand their interrelated flow of content and themes.

The first year MSIT courses are accepted as "science teachables" for students wishing to pursue a Bachelor of Education degree through St. Francis Xavier University. They are also accepted as an alternative way of fulfilling the Natural Science requirement in the Bachelor of Arts degree at UCCB.

- With respect to Western science, the third year MSIT 301/303 courses focus on the dynamics of energy flow in both internal and external environments, and the fourth year MSIT 401/403 courses on the dynamics of health, disease, and healing in the same. With these foci, the third and fourth MSIT courses seek to foster understandings of major integrating themes in modern science.

**Applied science ... Technology courses (18 credits):** Toqwa'tu'kl Kjjitaqnn / Integrative Science requires the student to take 6 credits of general chemistry, 6 credits of mathematics or physics, and 6 credits of environmental courses.

- The student must take the prescribed general chemistry courses, namely Chem 121/122.
- For "mathematics or physics", the student selects 6 credits from any combination of:
  - Math 131/132 (3 + 3 credits)
  - Phys 100 (6 credits)
  - Phys 111/112 (3 + 3 credits)
- For "environmental technology", the student selects "a" or "b":
  - a) one of Envir 211, Envir 214, Geol 111, or EnvH 211 (3 credits)  
plus one (3 credits) of Envir 315 or Envir 335 (3 credits)
  - b) both (3 + 3 credits) of Envir 315 and Envir 335 (6 credits)

**Applied science ... continued from previous page:**

→ The full title of each 3 credit environmental technology course is:

- |                            |                          |
|----------------------------|--------------------------|
| • Environmental 211        | Industrial Microbiology  |
| • Environmental 214        | Ecology                  |
| • Environmental 315        | Air Pollution            |
| • Environmental 335        | Solid Waste Management   |
| • Geology 111              | Physical Geology 1       |
| • Environmental Health 211 | Environmental Health Law |

■ **A student enrolled in the Concentration Toqwa'tu'kl Kjjitaqnn / Integrative Science selects 30 credits of Student's Electives, according to his or her own career interests.**

Suggestions for students with general or specific career or post-graduate aspirations are outlined in Table 4.

■ **The science background acquired through the BScCS and its Concentration Toqwa'tu'kl Kjjitaqnn / Integrative Science is congruent with the expectations of select research and higher education entities**, as shown in Table 5 (note: this Table complements information in Table 1, which is for the degree in general).

■ **The abilities, skills, and academic background fostered through the BScCS and its Concentration Toqwa'tu'kl Kjjitaqnn / Integrative Science are congruent with the expectations of select research and higher education entities**, as shown in Table 6 (note: this Table complements information in Table 2, which is for the degree in general).

**Table 4: Suggestions for courses to be taken as Student's Electives for students with specific careers or post-graduate aspirations**

<b><u>Career interest</u></b>	<b><u>Courses likely to be recommended as all or part of the 30 credits in Student's Electives</u></b>
<ul style="list-style-type: none"> <li>■ professional health sciences</li> </ul>	<ul style="list-style-type: none"> <li>• organic chemistry, biochemistry</li> <li>• molecular biology, genetics, anatomy and physiology</li> <li>• psychology</li> </ul>
<ul style="list-style-type: none"> <li>■ science teacher</li> </ul>	<ul style="list-style-type: none"> <li>• mathematics</li> <li>• organic chemistry</li> <li>• biology</li> <li>• psychology</li> </ul>
<ul style="list-style-type: none"> <li>■ natural resource management</li> </ul>	<ul style="list-style-type: none"> <li>• MSIT biodiversity courses (from optional MSIT suite*)</li> <li>• biology</li> <li>• environmental technology</li> <li>• Mi'kmaq Studies</li> </ul>
<ul style="list-style-type: none"> <li>■ government policy</li> </ul>	<ul style="list-style-type: none"> <li>• MSIT biodiversity courses (from optional MSIT suite*)</li> <li>• Mi'kmaq Studies</li> <li>• political science</li> <li>• psychology</li> </ul>
<ul style="list-style-type: none"> <li>■ ecotourism entrepreneurship</li> </ul>	<ul style="list-style-type: none"> <li>• MSIT biodiversity courses (from optional MSIT suite*)</li> <li>• Mi'kmaq Studies</li> <li>• business</li> <li>• communication</li> </ul>
<ul style="list-style-type: none"> <li>■ multimedia entrepreneurship</li> </ul>	<ul style="list-style-type: none"> <li>• business</li> <li>• information technology</li> <li>• communication</li> </ul>

\* the optional MSIT course suite contains:

- MSIT 211 ... focus: ecosystems
- MSIT 221 ... focus: minerals, soils, water, climate
- MSIT 231 ... focus: terrestrial animals
- MSIT 241 ... focus: aquatic animals
- MSIT 251 ... focus: plants (especially those of medicinal value)
- MSIT 351 ... focus: plants (advanced topics)

**Table 5: Congruency of the science background desired (+) by select research and higher education entities vis-a-vis the science background provided (✓) via diverse means in the 120 credit BScCS and its Concentration Toqwa'tu'kl Kjjitaqnn / Integrative Science.**

Criterion	NSERC <sup>1</sup>	Dalhousie		UCCB BScCS <sup>4</sup>
		Grad <sup>2</sup>	Med & Dent <sup>3</sup>	
<b>Science</b>				
• sufficiency of background	+	+	+	
				<b>✓ Science content</b> <ul style="list-style-type: none"> <li>• compulsory credits</li> <li>- basic science 24</li> <li>- applied science 18</li> </ul>
				<b>✓ Science research skills</b> <ul style="list-style-type: none"> <li>• compulsory credits</li> <li>- Problem Centred Studies 18</li> <li>- statistics 3</li> <li>- additional mathematics *</li> </ul>
				<b>✓ Science opportunities</b> <ul style="list-style-type: none"> <li>• electives credits (can be science) 30</li> </ul>
				<b>✓ Science work experience</b> <ul style="list-style-type: none"> <li>• work placements** 2</li> </ul>
				<b><u>Total BScCS science credits</u></b> maximum (with 30 in electives): 93 of 120 minimum (with 0 in electives): 63 of 120

<sup>1</sup> Natural Sciences and Engineering Research Council of Canada

<sup>2</sup> Dalhousie University School of Graduate Studies

<sup>3</sup> Dalhousie University School of Medicine, and School of Dentistry

<sup>4</sup> University College of Cape Breton, Bachelor of Science Community Studies 4 year degree

\* 6 credits in mathematics or physics required as part of the compulsory applied science content (in addition to the 3 credits in statistics)

\*\* two work placements, 120 hr each, required (may be voluntary or paid)

**Table 6: Congruency of the abilities, skills, and academic background desired (+) by select research and higher education entities, vis-a-vis those fostered (✓) by UCCB's BScCS and its Concentration Toqwa'tu'kl Kjjitaqnn / Integrative Science. A dot (.) indicates no explicit request for evaluation based on that criterion.**

Criteria	Dalhousie			UCCB BScCS <sup>4</sup>
	NSERC <sup>1</sup>	Grad <sup>2</sup>	Med & Dent <sup>3</sup>	
<b>1. General</b>				
1) critical thought and analysis / judgement	+	.	+	✓ (PCS courses)
2) problem solving	.	.	+	✓ (PCS courses)
3) apply skills and knowledge / carry on advanced study	+	+	.	✓ (PCS courses)
4) originality / creativity	+	+	.	✓ (MSIT & PCS courses)
5) initiative / independence	+	+	.	✓ (MSIT & PCS courses)
6) complete projects / meet deadlines	+	+	+	✓ (PCS courses)
7) resourcefulness	.	+	+	✓ (MSIT & PCS courses)
<b>2. Communication</b>				
1) written	+	+	+	✓ (effective writing course)
2) oral	+	+	+	✓ (communication course)
<b>3. Interpersonal</b>				
1) interact with co-workers (share ideas, receive critical feedback)	+	.	+	✓ (PCS courses)
2) leadership ... plus perspectives beyond academic science	+	.	.	✓ (PCS courses)
- business	.	.	.	✓ (business course)
- Aboriginal	.	.	.	✓ (Mi'kmaq studies course)
- Western	.	.	.	✓ (philosophy course)
- science & technology	.	.	.	✓ (philosophy course)
<b>4. Personal</b>				
1) emotional stability	.	.	+	.
2) empathy	.	.	+	✓ (MSIT courses)
3) reliability	.	.	+	✓ (MSIT & PCS courses)
4) perseverance	.	.	+	✓ (MSIT & PCS courses)
5) self-confidence	.	.	+	✓ (MSIT & PCS courses)
6) curiosity	.	.	+	✓ (MSIT & PCS courses)
7) motivation / enthusiasm for career / research	+	.	+	✓ (MSIT & PCS courses)
<b>5. Academic</b>				
1) sufficiency of science background	+	+	+	✓ (see Tables 1, 4, and 5)

<sup>1</sup> Natural Sciences and Engineering Research Council of Canada

<sup>2</sup> Dalhousie University School of Graduate Studies

<sup>3</sup> Dalhousie University School of Medicine, and School of Dentistry

<sup>4</sup> University College of Cape Breton, Bachelor of Science Community Studies 4 year degree