Geomatics 12

Guide

NOVA SCOTIA
NOUVELLE-ÉCOSSE

2007

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Geomatics 12

Prepared by the Department of Education and Early Childhood Development

This is the most recent version of the current curriculum materials as used by teachers in Nova Scotia.

Geomatics 12

Implementation Draft
April 2007

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Contents

Introduction

Background

Computers have become an integral part of everyday life in all aspects of society: at home, in the work place, and in school. As technology continues to evolve, the impact of computers and computer networks will only increase. Geomatics 12 has been developed in response to this rapid evolution and is designed to give students a broad-based understanding of the fundamental underpinnings of technology applications in Geomatics.

The Department of Education has made a commitment to provide a broad-based, quality education in the public school system and to expand the range of programming to better meet the needs of all students. The department is working in collaboration with school boards and other partners in education, business, industry, the community, and government to develop a variety of new courses.

New course options draw from and contribute to students' knowledge and skills in more than one discipline. Students synthesize and apply knowledge and skills acquired in other courses, including courses in English language arts, social studies, science, arts, mathematics, and technology.

New course options provide increased opportunities for senior high school students to

- earn the credits they require to attain a high school graduation diploma
- diversify their course options
- prepare for varied post-secondary destinations

Course options are designed to

- appeal to all high school students
- assist students in making connections among school, the community, and the workplace
- enable students to explore a range of career options

These courses offer students increased opportunities for hands-on experiences and for using technology within a variety of subject areas to expand and develop their learning and skills.

Rationale for Geomatics 12

Geomatics is not only an area of study in its own right, but an important technology support for many other disciplines and professions. The dramatic growth of digital data and the enormous impact that data representation is making on virtually every field of study are both well documented. The pervasiveness of information technology, such as databases in retailing or spreadsheets in finance, is also seen in the geographical data applications related to business location and customer analysis, transportation, resource management, planning and development of our settlements, health, and all scientific fields of study.

We are drowning in information, but starved for knowledge.
—John Nesbitt, Megatrends 2000

There is a growing student interest in high school technology courses that have direct impacts on a multitude of career options and fields of post-secondary study. Students interested in pursuing studies or careers in practically any discipline recognize that their understanding of emerging core technologies will play an increasing role in their success. Geomatics 12 introduces students to analysis, design, and problem-solving skills that will greatly enhance their ability to use a wide range of technologies and to adapt to the inevitable changes in technology they will encounter throughout their chosen careers.

Careers in Geomatics

The study of Geomatics leads to the integration of an applied technology within a wide range of potential occupations and professions in geographic based industries such as surveying or resource mapping. Geomatics has also become a core tool in the careers of urban planners, transportation engineers, police and other emergency services providers. Health researchers now rely on geomatics to visually track and explain a multitude of factors in public health issues. Business geomatics provides customer and product tracking and patterns as well as locational analysis of potential retail or distribution sites. Routing analysis permits air, sea, and land passengers or cargo flows to respond to real-time geomatic inputs. Real estate and property services are now dependant upon geomatics to function effectively. While the context is set by the discipline area, depending on the issue being analysed and explored, Geographic Information Systems or GIS is the technological toolset employed in Geomatics 12.

Students have opportunities to apply a related discipline of geography, biology, chemistry, physics, geology, sociology, economics, or whatever the topic and environment dictates by using their GIS technology to model and solve a real-world issue.

While not a prerequisite for entry into post-secondary programs in Nova Scotia, Geomatics 12 represents a solid preparation for direct entry into a community college diploma program as offered at institutions such as the Centre for Geographic Sciences (COGS) in Nova Scotia. Geomatics 12 provides a student with excellent preparation for university-degree programs from engineering to geographical and environmental sciences to commerce and

criminology, to epidemiology, to geology, to information technology, to education — all disciplines are now being exposed to the power and the decision making tools of Geomatics 12.

The Nature of Geomatics 12

Geomatics 12 is based on a learning outcomes framework that identifies knowledge, skills, and capabilities that students are expected to demonstrate as a result of their learning experiences.

Geomatics 12 is made up of four modules:

Module 1: Exploration
Module 2: Basic Skill Building
Module 3: Advanced Skill Building and Application
Module 4: Applied Geomatics Project

The project-based module is focussed on analysis, design, implementation, and deployment of a functional solution to a real-world problem. Geomatics 12 can engage students in community-based outreach projects that provide both a hands-on learning experience for the students and a lasting benefit for the community.

Course Designation

Geomatics 12 is an academic credit. Geomatics 12 may be designated as a social studies elective credit or as a technology credit to meet graduation requirements. Students who complete two modules will receive a half credit, while all four modules must be completed to receive a full credit.

Course codes for Geomatics 12 are

- 012361: Geomatics 12 (full credit)
- 012369: Geomatics 12A (half credit)
- 012370: Geomatics 12B (half credit)

Students will normally be enrolled in Geomatics 12, a full credit course; the half credit option is available in special circumstances.

Ordering of Modules

In organizing for instruction, modules can be ordered in a variety of ways. Option 1 is the preferred order. It is strongly recommended that students begin working toward their project (Module 4) as they acquire skills in Modules 1 to 3.

Option 1		Option 2
1	4	1
2		2
3		3
		4

Course Design and Components

Features of Geomatics 12

Geomatics 12 is characterized by the following features:

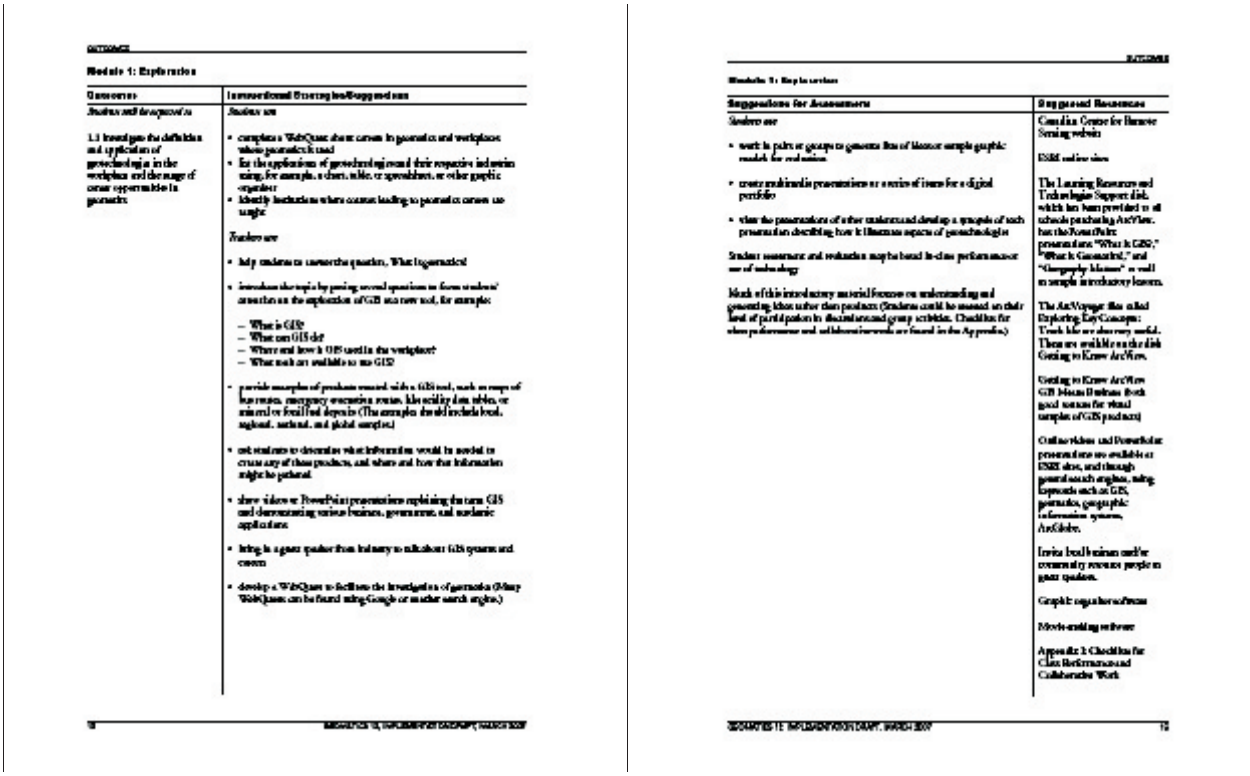
- An emphasis on integrating, applying, and reinforcing the knowledge, skills, and attitudes developed in other courses
- A connection to the essential graduation learnings
- A refining of career-planning skills to explore a wide range of pathways from school
- A relationship to the community and workplace with a focus on using real community and workplace problems and situations as practical contexts for the application of knowledge and skills and for further learning
- Hands-on, project-based learning experiences
- Development of personal and interpersonal skills required for personal and career success
- Use of technology as an integral part of the course

The Four-Column Spread

The curriculum for this course has been organized into four columns for several reasons:

- The organization illustrates how learning experiences flow from the outcomes.
- The relationship between the outcomes and assessment strategies is immediately apparent.
- Related and interrelated outcomes can be grouped together.
- The range of strategies for learning and teaching associated with specific outcomes can be scanned easily.
- The organization provides multiple ways of reading the document or of searching for specific information.

An example of the two-page, four-column spread appears on the next page.



Column One: Outcomes

This column provides specific curriculum outcomes for the module title that appears across the top of the page. While the outcomes may be clustered, they are not necessarily sequential.

Column Two: Instructional Strategies/ Suggestions

This column offers a range of strategies from which teachers and students may choose. Suggested learning experiences can be used in various combinations to help students achieve an outcome or outcomes. The suggested strategies may also provide a springboard for teachers to choose other strategies that would be effective for their students. It is not necessary to use all the suggestions that are included, nor is it necessary for all students to be involved in the same learning experience.

Column Three: Suggestions for Assessment

This column provides suggestions for assessing achievement of the outcomes in Column One: these are often linked to the Instructional Strategies/Suggestions column. The suggestions are only samples; for more information, read the section Assessing and Evaluating Student Learning.

Column Four: Suggested Resources

This column, entitled Suggested Resources, contains a variety of information related to the items in the other columns, including suggested resources, elaborations on strategies, successes, cautions, definitions, and reference to appendices.

Outcomes

Essential Graduation Learnings and Geomatics 12

The Atlantic provinces worked together to identify the abilities and areas of knowledge that they considered essential for students graduating from high school. These are referred to as Essential Graduation Learnings. Details may be found in the document *Public School Programs.*

Aesthetic Expression

Graduates will be able to respond with critical awareness to various forms of the arts and be able to express themselves through the arts.

Students will be expected to

- use layout functions to customize and display information
- select and map the best site for a new community or business service
- represent data through graphs and charts

Citizenship

Graduates will be able to assess social, cultural, economic, and environmental interdependence in a local and global context.

Students will be expected to

- apply geomatic skills to an issue-based project (social, political, economic, and/or environmental)

Communication

Graduates will be able to use the listening, viewing, speaking, reading, and writing modes of language(s) as well as mathematical and scientific concepts and symbols to think, learn, and communicate effectively.

Students will be expected to

- present and defend the map interpretations

Personal Development

Graduates will be able to continue to learn and to pursue an active, healthy lifestyle.

Students will be expected to

- investigate the practical application of geotechnologies in the workplace
- investigate a range of career opportunities in geomatics
- set deadlines and develop work plans

Problem Solving

Graduates will be able to use the strategies and processes needed to solve a wide variety of problems, including those requiring language, mathematical, and scientific concepts.

Students will be expected to

- manipulate acquired data for querying using buffering, clipping, and joining
- apply geomatic skills to an issue-based project (social, political, economic, and/or environmental)

Technological Competence

Graduates will be able to use a variety of technologies, demonstrate an understanding of technological applications, and apply appropriate technologies for solving problems.

Students will be expected to

- examine the historical evolution of geographic information system (GIS) software
- research and assess different GIS software model capabilities
- manipulate data to produce thematic representations or maps
- analyse, synthesize, and summarize geographic information

Geomatics 12 Unifying Concepts

Geomatics 12 will provide learning opportunities through which students become skilled, reflective, and critical creators and consumers of geomatics products. Specifically, students will

- develop a basic understanding of geomatics
- manage and manipulate data
- demonstrate an understanding of authentic applications of geographic information systems (GIS)
- apply knowledge and skills of GIS to query a social, political, environmental, or economic issue
- explore the career implications of geomatics
- be actively engaged in applying the geographic method of inquiry to a geomatics-based community project

Specific Curiculum Outcomes

Module 1: Exploration

Students will be expected to

1.1 investigate the definition and application of geotechnologies in the workplace and the range of career opportunities in geomatics
1.2 examine the historical evolution of geographic information system (GIS) software
1.3 identify a range of geotechnologies used to manipulate and assist in interpretation of data
1.4 demonstrate an understanding of the Geographic Method of Inquiry

Module 2: Basic Skill Building

Students will be expected to

2.1 demonstrate an understanding of GIS software buttons and tools for map creation
2.2 manipulate data to generate thematic maps
2.3 manipulate data to generate graphs, charts, or tables
2.4 query data to define and solve a problem
2.5 use layout functions to customize and display information
2.6 apply a hotlink feature to launch other media
2.7 apply geomatic skills to a social, political, economic, or environmental issue-based project

Module 3: Advanced Skill Building and Application

Students will be expected to

3.1 using various sources of geographic data, demonstrate data acquisition to create a theme layer
3.2 actively engage in collecting, geocoding, and mapping the community features
3.3 manipulate acquired data for querying using buffering, clipping, and joining
3.4 select and map the best site for a new home, business, or community service
3.5 map and analyse risk zones within a local community
3.6 identify authentic applications of a map or product

Module 4: Applied Geomatics Project

Students will be expected to

4.1 develop and document a project plan for an applied geomatics project
4.2 pose the geographic question
4.3 identify, evaluate, and acquire geographic resources
4.4 manipulate data to produce thematic representations or maps
4.5 analyse, synthesize, and summarize the geographic information
4.6 present, defend, and act upon project interpretations
4.7 develop an e-portfolio that documents their completed project
4.8 develop employability skills

Module 1: Exploration

Module 1: Exploration

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
1.1 investigate the definition and application of geotechnologies in the workplace and the range of career opportunities in geomatics	• complete a WebQuest about careers in geomatics and workplaces where geomatics is used • list the applications of geotechnologies and their respective industries using, for example, a chart, table, or spreadsheet, or other graphic organizer • identify institutions where courses leading to geomatics careers are taught *Teachers can* • help students to answer the question, What is geomatics? • introduce the topic by posing several questions to focus students' attention on the exploration of GIS as a new tool, for example: – What is GIS? – What can GIS do? – Where and how is GIS used in the workplace? – What tools are available to use GIS? • provide examples of products created with a GIS tool, such as maps of bus routes, emergency evacuation routes, lake acidity data tables, or mineral or fossil fuel deposits (The examples should include local, regional, national, and global samples.) • ask students to determine what information would be needed to create any of these products, and where and how that information might be gathered • show videos or PowerPoint presentations explaining the term **GIS** and demonstrating various business, government, and academic applications • bring in a guest speaker from industry to talk about GIS systems and careers • develop a WebQuest to facilitate the investigation of geomatics (Many WebQuests can be found using Google or another search engine.)

Module 1: Exploration

Suggestions for Assessment

Students can

- work in pairs or groups to generate lists of ideas or sample graphic models for evaluation
- create multimedia presentations or a series of items for a digital portfolio
- view the presentations of other students and develop a synopsis of each presentation describing how it illustrates aspects of geotechnologies

Student assessment and evaluation may be based in-class performance or use of technology

Much of this introductory material focusses on understanding and generating ideas rather than products (Students could be assessed on their level of participation in discussions and group activities. Checklists for class performance and collaborative work are found in the Appendix.)

Suggested Resources

Canadian Centre for Remote Sensing website

ESRI online sites

The Learning Resources and Technologies Support disk, which has been provided to all schools purchasing ArcView, has the PowerPoint presentations "What is GIS?," "What is Geomatics?," and "Geography Matters" as well as sample introductory lessons.

The ArcVoyager files called Exploring Key Concepts: Teach Me are also very useful. These are available on the disk Getting to Know ArcView.

Getting to Know ArcView
GIS Means Business (both good sources for visual samples of GIS products)

Online videos and PowerPoint presentations are available at ESRI sites, and through general search engines, using keywords such as GIS, geomatics, geographic information systems, ArcGlobe.

Invite local business and/or community resource people as guest speakers.

Graphic organizer software

Movie-making software

Appendix I: Checklists for Class Performance and Collaborative Work

Module 1: Exploration

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
1.2 examine the historical evolution of geographic information system (GIS) software	• explore the following questions: – How did the field of GIS evolve? – What is "remote sensing" and how has it changed? – Who were the main contributors to the evolution of GIS? – What is the role of GIS in today's world? • create a time line to illustrate the historical evolution of GIS • familiarize themselves with related remote-sensing terminology *Teachers can* • introduce the topic with a mini-presentation on remote sensing and its application to GIS • place examples of remote sensing around the room and initiate a discussion of their application • provide a PowerPoint presentation to demonstrate the evolution of GIS with a view to present and future trends • prepare a guided field trip on the Internet posing questions pivotal to the understanding of the historical evolution of GIS [Student research may culminate in a report for presentation (e.g., a multimedia or PowerPoint presentation, a web page, a video project, or a news release) using publishing software.]

Module 1: Exploration

Suggestions for Assessment

Students can

- define and illustrate the terms **vector** and **raster** with respect to remote-sensing and GIS technologies
- create a time line of significant historical events in the development of remote-sensing and GIS technologies (Create biographies of people involved in these changes.)

Assign a small group to each of the images of Canadian Centre for Remote Sensing (CCRS) website to identify and present the use of remote sensing for this image

Suggested Resources

Canadian Centre for Remote Sensing website

ESRI online site contains time lines

LRT Support CD #4 (August 10, 2006), which has been provided to all schools purchasing ArcView contains a slide show on remote sensing.

Appendix F: Cloze Exercise Exemplar

Module 1: Exploration

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
1.3 identify a range of geotechnologies used to manipulate and assist in interpretation of data	• investigate a representative sample of the wide range of geomatics tools available through the Internet and various text and software publications *Teachers can* • design scavenger hunts, web quests, and other exploration activities, which require the students to locate data relevant to a particular field of study, for example: – climate and flood control maps – pandemic flu maps – emergency service operation maps – forest fire maps • ask students to identify the geotechnologies that generated the maps listed above

Module 1: Exploration

Suggestions for Assessment

Students can

- given a scenario, and based on the information they have acquired, write a recommendation for which resources would yield the most useful data

- work in groups or independently to prepare a graphic presentation assessing information gathered in their research on an assigned topic (e.g., pandemic, flood control, disaster planning)

Students may be assessed in collaborative participation, quality of sources, time on task, completion of task (See checklist, Appendix I: LifeWork Portfolio)

Using Rubrics

Before completing any assigned tasks, students need to understand the criteria on which they will be evaluated. For this purpose, rubrics are very useful. Where possible, students should be given the rubric information before embarking on the task. It is worthwhile to have students work with the teacher in developing rubrics as well, as this gives them a deeper understanding of the expectations. Several examples of rubrics may be found in the appendices.

Suggested Resources

CIA World Fact Book

Municipal public records offices

Guest speaker from Geomatics Centre of Canada, Natural Resources, community or municipal planning offices, local industries, or Centre of Geographic Science (COGS)

Appendix J: WebQuest Worksheet

Useful online resources include
- Expedia
- MapQuest
- Google Earth
- NASA Worldwind
- GeoNova

Environment Canada (contains weather information)

- Geological Survey of Canada
- NOAA
- World Resources Institute
- Stats Canada E-STAT
- Provincial government data
- Natural Resources data banks

Module 1: Exploration

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
1.4 demonstrate an understanding of the Geographic Method of Inquiry	• apply the Geographic Method of Inquiry when responding to geomatics issues – Ask geographic questions – Acquire geographic resources – Explore geographic data – Analyse geographic information – Act upon geographic knowledge • investigate how data is extracted into a map. • complete a basic introductory module provided by a geomatics text (Specifically, teachers can direct students to Part 2: The Geographic Inquiry Model, pages 29–38 from Module 1 in *Mapping Our World: GIS Lessons for Educators*, 2005. This book is available for ArcView 3.x and ArcGIS 9.x) *Teachers can* • have students brainstorm a local issue and the related geographic questions (for example, "Where should the new school be built?") (Suggest both sources of data and the geographic method of inquiry to respond to this question.) • investigate topics for the student projects to be completed in Module 4.

Module 1: Exploration

Suggestions for Assessment

Students can

- demonstrate their understanding of the Geographic Method of Inquiry when using geomatics by presenting a report on a geomatics issue
- work in small groups to develop self-, group, and peer evaluations of plans for a local issue (For example, peer evaluation regarding plans for the new school)
- complete the student worksheets on pages 38–41 for Module 1: ArcView: The Basics, *Mapping Our World: GIS Lessons for Educators*, 2005.

Suggested Resources

ESRI handout "Geographic Inquiry: Thinking Geographically" in PDF format (Adobe Acrobat Reader)

Module 1: ArcView: The Basics from *Mapping Our World: GIS Lessons for Educators*. This book is available for ArcView 3.x and ArcGIS 9.x.

Geomatics SAERC video available from Learning Resources and Technology

Module 2: Basic Skill Building

Module 2: Basic Skill Building

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
2.1 demonstrate an understanding of GIS software buttons and tools for map creation	• explore the buttons, tools, and their functions to build basic skills such as opening a map and adding data • if they have not already completed this during Module 1.4, complete "ArcMap: The Basics," pages 11–28, *Mapping Our World: GIS Lessons for Educators*, 2005 (This book is available for ArcView 3.x and ArcGIS 9.x) *Teachers can* • acquaint themselves with ArcGIS by completing the tutorial "K–12 Quickstart" available on the LRT Support CD #3 (August 10, 2006) • begin by introducing and guiding students through the tutorials aimed at basic use of GIS software (For example, use the GTKAV tutorials with Getting to Know ArcGIS Desktop: Updated for ArcGIS 9, 2004. GTKAV is an acronym for "Getting to Know ArcView," and the tutorials can be found on the CD-ROM accompanying the text.) • alternately, provide students with free and downloadable copies of ArcVoyager Special Edition as a demonstration version of ArcView 3.x (This program does not save work, but familiarizes students with geomatics tools. ArcVoyager has excellent background information regarding basic skills with cartography and geography, under "Exploring Key Concepts" at the main menu. **Note**: be sure to install the ArcVoyager Special Edition, as this contains the Canadian data.) **Note**: Teachers are encouraged to structure their skill-building activities to follow this process with students: • Learn • Practice • Apply

Module 2: Basic Skill Building

Suggestions for Assessment

Students can

- demonstrate the following skills:
  - open a view
  - add a theme
  - change the legend or table of contents
  - pan
  - zoom
  - label
  - identify

- complete lab activities that highlight specific skills

- compose journal entries to explain how to perform specific tasks

- use a word processing program to create a mini teaching manual with screen captures and callouts. (See Appendix C: How to Add Data by Attaching to a Folder for a model.)

- complete a quiz to demonstrate their knowledge of ArcGIS buttons

When a student completes a tutorial in Tutorial Mode, it may be difficult or impossible to save the results. If unable to save the results, an alternate option is to acquire a screen capture of the final product. This is done by choosing "PrintScreen" and then open Paint or a word processing program and select "Paste." This can then be saved and submitted to the teacher.

Teachers can

- assess the applied lesson as a product using the specific criteria as a checklist or rubric (This assessment may stand alone or be a part of an ongoing portfolio or e-portfolio.)

Suggested Resources

Module 1: ArcView: The Basics from *Mapping Our World: GIS Lessons for Educators*. This book is available for ArcView 3.x and ArcGIS 9.x.

ArcVoyager ArcView Tutor

ArcView disc/tutor

ArcView Geography GIS Work Book and *Teachers Guide*

Getting to Know ArcView GIS or *Getting to Know ArcGIS*

ESRI Canada online lessons

Appendix E: ArcGIS 9 Button Quiz

Module 2: Basic Skill Building

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
2.2 manipulate data to generate thematic maps	• create a thematic map • create graphs, charts or tables
2.3 manipulate data to generate graphs, charts, or tables	• keep a learning log of his/her progress • participate in an interactive community of practice
	Teachers can
	• use tutorials made by ESRI and available on the LRT Support CD #3 (August 10, 2006) (The *Forest Fire* tutorial is highly recommended.) • provide resources and coaching to help students keep a learning log to document their progress through the assignment and their use of tools and buttons in the GIS software • organize students to contribute to a community of practice that may involve using web-based document sharing (for example, wiki, forum, blog)

Module 2: Basic Skill Building

Suggestions for Assessment

Students can

- produce a map showing locations of forest fires and charting the various causes of these fires
- perform peer evaluation of a learning log to document their progress through the assignment and their use of tools and buttons in the GIS software

Teachers can

- develop checklists or rubrics to assess student maps, graphs, charts, and tables (Rubrics can be created with support from the Rubistar website.)
- develop checklists or rubrics to evaluate contributions to the learning log and/or community of practices

Suggested Resources

Forest Fire tutorial found in the LRT Support CD #3 (August 10, 2006).

ESRI Canada online lessons

<Rubistar.4teachers.org>

A community of practice involves the process of social learning that occurs when people with a common interest in some subject or problem collaborate over an extended period to share ideas, find solutions, and build innovations.

Module 2: Basic Skill Building

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
2.4 query data to define and solve a problem	• create a thematic map • query the data on the map • keep a learning log of his/her progress • participate in an interactive community of practice *Teachers can* • use tutorials made by ESRI and available on the LRT Support CD #3 (August 10, 2006) (The National Parks tutorial is highly recommended.) • provide resources and coaching to help students keep a learning log to document their progress through the assignment and their use of tools and buttons in the GIS software • organize students to contribute to a community of practice that may involve using web based document sharing (e.g., wiki web, forum, blog)

Module 2: Basic Skill Building

Suggestions for Assessment

Students can

- produce a map showing locations of national parks
- describe, analyse, and interpret relationships between ecozones and the distribution of national parks
- use a simple query to find answers regarding the size of parks
- explore relationships between national parks, roads, and cities
- apply knowledge within a specific scenario (for example, a family planning a vacation to national parks)
- perform peer evaluation of a learning log to document their progress through the assignment and their use of tools and buttons in the GIS software

Teachers can

- develop checklists or rubrics to assess student maps, descriptions, queries, and relationships
- develop checklists or rubrics to evaluate contributions to the learning log and/or community of practices

Suggested Resources

National Parks tutorial found in the LRT Support CD #3 (August 10, 2006)

ESRI Canada on-line lessons

Module 2: Basic Skill Building

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
2.5 use layout functions to customize and display information	• create a thematic map using layout features for GIS mapping including: – title – neatline (border) – north arrow – scale – legend – student name – view insert – picture insert – graph/chart insert – neatness • keep a learning log of his/her progress • participate in an interactive community of practice *Teachers can* • use tutorials made by ESRI and available on the LRT Support CD #4 (August 10, 2006) (The Chapter 13 layout "Getting to Know ArcView" is highly recommended.) • provide resources and coaching to help students keep a learning log to document their progress through the assignment and their use of tools and buttons in the GIS software • organize students to contribute to a community of practice that may involve using web-based document sharing (for example, wiki, forum, blog,)

Module 2: Basic Skill Building

Suggestions for Assessment

Students can

- evaluate their map based on the criteria for GIS mapping in a check list:
  - title
  - neatline (border)
  - north arrow
  - scale
  - legend
  - student name
  - legibility of view insert
  - picture insert
  - legibility of graph/chart insert
  - neatness

- perform peer evaluation of a learning log to document their progress through the assignment and their use of tools and buttons in the GIS software

Teachers can

- develop checklists or rubrics to assess student maps and cartographic conventions

- develop checklists or rubrics to evaluate contributions to the learning log and/or community of practices

Suggested Resources

13 Layout tutorials found in the LRT Support CD #4 (August 10, 2006)

ESRI Canada on-line lessons

Module 2: Basic Skill Building

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
2.6 apply a hotlink feature to launch other media	• create a thematic map • create hotlinks from the map to photographs, documents, web pages and/or other media • keep a learning log of his/her progress • participate in an interactive community of practice. *Teachers can* • use tutorials made by ESRI and available on the LRT Support CD #4 (August 10, 2006) (The "Ice Storm 1998" and "Ecozones" tutorials are highly recommended.) • provide resources and coaching to help students keep a learning log to document their progress through the assignment and their use of tools and buttons in the GIS software • organize students to contribute to a community of practice that may involve using web-based document sharing (for example, wiki, forum, blog)

Module 2: Basic Skill Building

Suggestions for Assessment

Students can

- produce a map showing patterns of the ice storm of 1998
- explore, predict, and identify the physical features that affected the movement of this storm (From this knowledge, predict the path of the storm.)
- create hotlinks from the map to photographs of damage that occurred during the ice storm of 1998
- perform peer evaluation of a learning log to document their progress through the assignment and their use of tools and buttons in the GIS software

Teachers can

- develop checklists or rubrics to assess student maps and hotlinks
- develop checklists or rubrics to evaluate contributions to the learning log and/or community of practices

Suggested Resources

"Ice Storm 1998" and "Ecozones" tutorials found on the LRT Support CD #3 (August 10, 2006).

ESRI Canada on-line lessons

<Rubistar.4teachers.org>

Module 2: Basic Skill Building

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
2.7 apply geomatic skills to a social, political, economic, or environmental issue-based project	• review the geographic method of inquiry and follow it using the accumulated geomatics skills to pick a location for a new project (For example, pick a new Disney theme park, a new shopping mall, or a new office building. Students will explore data from previous tutorials and choose appropriate data from online sources to create a layout that justifies the location for their chosen site.) • keep a learning log of his/her progress • participate in an interactive community of practice. *Teachers can* • create their own tutorial for students (See Appendix G: Disney Theme Park Project.) • create a WebQuest containing information and data sets pertinent to the project • provide resources and coaching to help students keep a learning log to document their progress through the assignment and their use of tools and buttons in the GIS software • organize students to contribute to a community of practice that may involve using web-based document sharing (for example, wiki, forum, blog)

Module 2: Basic Skill Building

Suggestions for Assessment

Students can

- assess their own and each other's use of the geographic method of inquiry
- assess each other's use of accumulated geomatic skills using a checklist or rubric
- produce a map and defend the chosen location for the selected project
- perform peer evaluation of a learning log to document their progress through the assignment and their use of inquiry process and GIS skills

Teachers can

- develop checklists or rubrics to assess student maps, graphs, charts, tables, queries, hotlinks, and layouts (See Appendix H: Disney Theme Park Project Peer Evaluation Rubric.)
- develop checklists or rubrics to evaluate the use of the geographic method of inquiry and the accumulated geomatic skills
- develop checklists or rubrics to evaluate contributions to the learning log and/or community of practices (See Appendix K: Learning Logs.)

This activity is a synthesis of accumulated skills throughout Module 2. As such, it can be an end-of-module and/or summative assessment.

Suggested Resources

Appendix G: Disney Theme Park Project

Appendix H: Disney Theme Park Project Peer Evaluation Rubric

Appendix K: Learning Logs

Module 3: Advanced Skill Building and Application

Module 3: Advanced Skill Building and Application

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
3.1 using various sources of geographic data, demonstrate data acquisition to create a theme layer	• after a teacher demonstration, acquire data from E-STAT Canada using the E-STAT Tutorial (See Resources.) • in a jigsaw activity, work in expert groups to become proficient in the acquisition of data from different sources • share knowledge and skills in geographic data acquisition with other groups • complete "Downloading Recent Earthquake Data for Use in ArcVIEW" (See Resources.) *Teachers can* • pose a geographic question and have students brainstorm as to the possible type and source of data necessary to answer the question • demonstrate the acquisition of data from E-STAT Canada (Statistics Canada's website)

Module 3: Advanced Skill Building and Application

Suggestions for Assessment

Students can

- each student can produce a map that displays data from E-STAT Canada
- each group can produce a mini-lesson on the acquisition of geographic data from a specific source
- use earthquake data to predict active plate boundaries

Teachers can

- develop rubrics with students, and use these to evaluate the assignment

Suggested Resources

Tutorials on the LRT Support CD #4 (August 10, 2006)

E-STAT Canada

"Downloading Recent Earthquake Data for Use in ArcVIEW" (named "quakedata8x.PDF")

Useful online resources include:
- E-STAT Canada
- GeoNova
- various text and atlas data tables

Module 3: Advanced Skill Building and Application

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
3.2 actively engage in collecting, geocoding, and mapping the community features	• access PowerPoint presentations regarding the use of GPS units on various websites (See Resources.) • complete the GPS Tutorial, "Exploring Pukaskwa National Park" found on the LRT Support CD #4 (August 10, 2006) • participate in a local geocache • create a geocache for other students • complete a "Geocoding and Queries" tutorial found on the LRT Support CD #4 (August 10, 2006) • complete the "Creating Your Own Data" tutorial found on the LRT Support CD #4 (August 10, 2006) • create a map, brochure, or interactive web page of local features (These can include: tourist attractions, cemeteries, educational sites, fire hydrants, emergency services, churches, etc., using the skills acquired in the previous outcomes. Include such concepts as: – distance to other features – relationships between attributes – hotlinking to other media – creating layouts) *Teachers can* • preview and modify the PowerPoint presentation called "What is GPS" found in the Presentation folder of the LRT Support CD #4 (August 10, 2006) • invite a local geocacher into the classroom to give an instructional demonstration • setup a mini-geocache activity on the school property • take the students on a geocaching field trip • introduce the concept of geocoding • introduce the concept of creating and editing a shape file (Teachers should complete the tutorial "Creating Your Own Data" before introducing the concept to students.)

Module 3: Advanced Skill Building and Application

Suggestions for Assessment

Students can

- produce the appropriate maps based on tutorials and activities above
- supply evidence that the geocache was found
- provide group evaluation regarding the creation of their own cache
- provide peer evaluation regarding the geocaches created by other students

Teachers can

- evaluate student tutorial by examining their final products
- assess student geocaching activities based on the effectiveness of the creation and navigation of geocaching way points
  - How well did the students create the geocaching instructions?
  - How well were the other students able to follow these instructions?

Suggested Resources

These tutorials are found on the LRT Support CD #4 (August 10, 2006)

- Exploring Pukaskwa National Park
- Geocoding and Queries (named Geocode_Queries9x.PDF)
- Creating Your Own Data (named CreatingData.PDF)

DNR Garmin software for Garmin handheld GPS units. (This free software allows Garmin GPS waypoints to be uploaded directly into ArcGIS 9.x. This was built by the Department of Natural Resources in Minnesota. To find this download and instructions, perform a search for "dnr garmin minnesota" or "DNR Garmin Extension for ArcView." There is currently a "wiki" that contains all the installation instructions.)

<Geocaching.com>

Module 3: Advanced Skill Building and Application

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
3.3 manipulate acquired data for querying using buffering, clipping, and joining	• complete the tutorial "National Park" to learn how to query data [The tutorial can be found on the LRT Support CD #3 (August 10, 2006).] • complete the tutorial "Buffering" [The tutorial can be found on he LRT Support CD #4 (August 10, 2006).] • complete the tutorial "Closed for Business/Kingston" to learn how to clip and join data [The tutorial can be found on the LRT Support CD #3 (August 10, 2006).] *Teachers can* • begin by acquainting themselves with the concepts of – querying data (completing exercise 8A in *Getting to Know ArcGIS Desktop*, page 197) – buffering (completing exercise 12A in *Getting to Know ArcGIS Desktop*, page 303) – clipping (completing exercise 11C in *Getting to Know ArcGIS Desktop*, page 288) – joining (completing exercise 9A in *Getting to Know ArcGIS Desktop*, page 228)

Module 3: Advanced Skill Building and Application

Suggestions for Assessment

Students can

- produce the appropriate maps based on tutorials and activities above

Teachers can

- evaluate student tutorials by examining their final products

Suggested Resources

These tutorials are found on the LRT Support CD #4 (August 10, 2006).

- National Parks
- Buffering
- Closed for Business/Kingston

Getting to Know ArcView GIS or *Getting to Know ArcGIS Desktop*

Module 3: Advanced Skill Building and Application

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
3.4 select and map the best site for a new home, business, or community service	• complete the tutorial called "Tourism" [The tutorial can be found on the LRT Support CD #4 (August 10, 2006).] • be informed regarding the possible sources of data (See Resources column.) • brainstorm a geographic question about the best site selection for a new home, business, or community service • using data manipulation skills and data that is available, acquired, or created, create a map that answers the previous geographic question • for instance, use E-STAT Canada's demographic (e.g., age) data to determine the best location for a youth centre or a senior citizen's facility *Teachers can* • work with students to create a geographic question that models the "Tourism" tutorial noted above

Module 3: Advanced Skill Building and Application

Suggestions for Assessment

Students can

- produce the appropriate maps based on tutorials and activities above
- update an ongoing portfolio or e-portfolio containing maps produced throughout this course
- develop checklists or rubrics to assess maps
- develop checklists or rubrics to evaluate contributions to the learning log and/or community of practices

Teachers can

- evaluate student tutorial by examining their final products
- guide students during the development of checklists or rubrics to assess maps
- guide students during the development of checklists or rubrics to evaluate contributions to the learning log and/or community of practices

Suggested Resources

These tutorials are found on the LRT Support CD #4 (August 10, 2006)

Tourism

Useful online resources include:
- E-STAT Canada
- GeoNova
- Expedia
- Mapquest
- Google Earth
- Worldwind
- NASA
- Environment Canada (contains weather information)
- Google Earth and similar applications
- Geological Survey of Canada
- NOAA
- World Resources Institute
- Stats Canada E-STATS
- Provincial government data
- Natural Resources data banks

Useful local resources and municipal, provincial, and federal departments or organizations including:
- natural resources
- emergency measures organizations
- medical institutions
- fire departments
- transportation departments law enforcement

Module 3: Advanced Skill Building and Application

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
3.5 map and analyse risk zones within a local community	• complete one of the following tutorials found in Module 7: Human/Environment Interaction from *Mapping Our World: GIS Lessons for Educators:* – Water World (global flooding) – In the Eye of the Storm (Hurricane Mitch) – Data Disaster (endangered spaces) • investigate potential risk or emergency scenarios in a local community; topics may include: – salt pollution – coastal erosion – flooding – hillside erosion – traffic accidents – overdevelopment of housing or commercial – changes in animal habitat – potential pandemic – current flu (influenza) epidemic • interview professionals from local emergency measures organizations, medical institutions, fire departments, provincial and municipal transportation departments, etc., to gain an understanding of potential risks in the local area • create and analyse a map of a risk to a local area based on the above activities *Teachers can* • review the risk analysis and assessment processes found in the following tutorials found in Module 7: Human/Environment Interaction from *Mapping Our World: GIS Lessons for Educators:* – Water World (global flooding) – In the Eye of the Storm (Hurricane Mitch) – Data Disaster (endangered spaces)

Module 3: Advanced Skill Building and Application

Suggestions for Assessment

Students can

- produce the appropriate maps based on tutorials and activities above
- update an ongoing portfolio or e-portfolio containing maps produced throughout this course
- develop checklists or rubrics to assess maps
- develop checklists or rubrics to evaluate contributions to the learning log and/or community of practices
- participate in peer assessment of investigative methods and activities

Teachers can

- evaluate student tutorial by examining their final products
- guide students during the development of checklists or rubrics to assess maps
- guide students during the development of checklists or rubrics to evaluate contributions to the learning log and/or community of practices

Suggested Resources

Module 7: Human/Environment Interaction from *Mapping Our World: GIS Lessons for Educators*. This book is available for ArcView 3.x and ArcGIS 9.x.

Useful local resources and municipal, provincial, and federal departments or organizations including:

- natural resources
- emergency measures organizations
- medical institutions
- fire departments
- transportation departments
- law enforcement

Module 3: Advanced Skill Building and Application

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
3.6 identify authentic applications of a map or product	• building on the maps, interviews and activities created previously in Module 3, produce a report, letter, recommendation, presentation, website, etc., showing an authentic use of their product • present the report, letter, recommendation, presentation, website, etc., created above back to the community resource people • develop a form to solicit feedback regarding the presentation above (The form should include checklists and rubrics for the community resource people to complete. This form should measure the authenticity, usefulness, and/or helpfulness of the student's presentation and work.) • have community resource people provide the feedback using the form students have developed T*eachers can* • guide the students through the development of a form, including checklists and rubrics, for the community resource people to complete (This form should measure the authenticity, usefulness, and/or helpfulness of the student's presentation and work.)

Module 3: Advanced Skill Building and Application

Suggestions for Assessment

Students can

- produce the appropriate report, letter, recommendation, presentation, website, etc., based on the activities above
- develop a form, including checklists and rubrics, for the community resource people to complete (This form should measure the authenticity, usefulness, and/or helpfulness of the student's presentation and work)
- have the community resource people provide feedback and evaluation using the above form
- where applicable, have peers complete an evaluation using the above form
- update an ongoing portfolio or e-portfolio containing maps produced throughout this course

Teachers can

- evaluate the students' final products
- guide students during the development of evaluation forms above
- use the evaluation feedback provided by the community resource people regarding the student presentations and work

Suggested Resources

Local resources and municipal, provincial, and federal departments or organizations including:

- natural resources
- emergency measures organizations
- medical institutions
- fire departments
- transportation departments
- law enforcement

Rubric development sites may be found using a search engine.

Module 4: Applied Geomatics Project

Module 4: Applied Geomatics Project

Outcomes	Instructional Strategies/Suggestions
Students will be expected to **4.1** develop and document a project plan for an applied geomatics project **4.8** develop employability skills	**Note**: The Applied Geomatics Project is a critical component of Geomatics 12. The Applied Project provides an opportunity for students to investigate topics of particular interest while working toward achievement of curriculum outcomes in the context of particular modules or to apply and extend their learning from those modules. Project topics should be community based, engaging for the students and should afford opportunities for independent research as well as group investigations. *Students can* • generate a thesis and a proposal plan, complete with time lines, team ground rules, roles, and responsibilities, identifying helpful team behaviours, decision-making, and conflict resolution • develop a response to a request for proposals (RFP), to be submitted to a fictional or real organization, that will identify steps, sequence and schedule to answer the geographic question *Teachers can* • review the components expected in a project plan: – define the scope – roles and responsibilities – steps – deadlines • help students choose appropriate projects and give advice on the scope of projects • develop effective student teams (See Appendix P: Group Work and Team Building and Appendix M: Employability Skills)

Module 4: Applied Geomatics Project

Suggestions for Assessment

Students can

- maintain an on-going project plan
- create a team identity document that contains the rules, responsibilities, and ground rules (See Appendix P: Group Work and Team Building)
- write journal entries discussing their experiences
- set and re-evaluate project goals and tasks on a regular basis (at milestone times)

Teachers can

- provide students with a framework to use as a basis for negotiating expectations for project work
- work with students to develop peer and self-evaluation rubrics
- identify and address individual/team concerns as they arise
- set milestones for groups when portions of the project must be submitted for evaluation
- develop and maintain clearly understood task checklists for each student
- monitor students' collaborative behaviours using checklists and rubrics
- monitor student progress and provide feedback at regular intervals

Suggested Resources

Appendix I: Checklists for Class Performance and Collaborative Work

Appendix K: Learning Logs

Appendix L: Applied Geomatics Project Rubric

Appendix N: Support CD Table of Contents

Appendix O: Moral, Ethical, and Legal Issues in Information Technology

Appendix P: Group Work and Team Building

Module 4: Applied Geomatics Project

Outcomes	Instructional Strategies/Suggestions
Students will be expected to **4.2** pose the geographic question	The first activity should help students define geographic questions. This may be something they have done in an earlier geography course or that was covered in Module 1 but now needs to be more specific in order to help them identify a manageable question. **Ideas** • brainstorm for geographic questions • compare non-geographic questions to geographic questions **Sample Questions** • Where would be the best site for a local dump? New school? • What community resources such as bike trails/canoe routes currently exist or could be developed? • How could the "Rails to Trails" be developed in your community? • What rivers/lakes/watersheds are best suited for fish habitat restoration? • What is the local impact of invasive species? • Where is the best site for a new/amalgamated school? • Could your town support another Tim Horton's? Where? • Where should a penitentiary be built in your part of the province? • Is prospecting for gold viable in Nova Scotia? • What is the best site for a new business? • What type of business would fly in my community? • Should a new bus route be added to bring students from my community to the school? What route should it take? • What houses in my community are at risk of flooding? • What potential pollutants are within a drainage basin? • What is the impact of a new housing development on present infrastructure? • What part of the province should be encouraged to increase market gardening? *Teachers can* • provide a teacher-generated list of examples • create and update a list of support persons and resources to support student project needs

Module 4: Applied Geomatics Project

Suggestions for Assessment

Students can

- contribute to a group forum as they work towards defining their geographic question
- write journal entries reflecting upon their experiences
- present their geographic question to the class

Teachers can

- evaluate the geographic question based on a list of accepted factors
- provide students with formal and informal feedback on their geographic question

Emphasize that GIS arranges and displays the data but it does not ask or answer the question. What sort of question will each student ask? Encourage them to examine their own interests. In what fields or disciplines are they strongest? Perhaps a teacher has posed a question in class that has sparked an interest. Students should be encouraged to find a mentor, perhaps a subject teacher or an outside resource person such as municipal officials or someone from a professional association.

Suggested Resources

Global Connections: Geography in the 21st Century, 1997, Chapter 1

Download the ESRI document, *Geographic Inquiry: Thinking Geographically*

Teachers can create user groups, wikis, and blogs using the following sources:
- Google Groups
- Moodle
- <Mediawiki.org>

Module 4: Applied Geomatics Project

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
4.3 identify, evaluate, and acquire geographic resources	• brainstorm to identify the type of data that will help them to answer their geographic question • acquire this data from many varied sources and, where necessary, gather their own local GPS data *Teachers can* • work with students to identify the type of data that is needed to answer the geographic question • make students aware of what data is currently available at the school site and where this data is located • direct students to other sources of GIS data

Module 4: Applied Geomatics Project

Suggestions for Assessment

Students can

- contribute to a group forum as they work towards defining their data needs and sources
- write journal entries reflecting upon their experiences
- discuss their progress with the teacher on a regular basis
- document activities, decisions, problems, and accomplishments
- present their geographic data and the basis for their data choices

Teachers can

- provide students with formal and informal feedback on their progress
- read student journals and forum entries regularly and provide constructive feedback
- question students' appropriate use and storage of data resources and suggest alternatives
- look for evidence of growth in collaborative and team skills

Suggested Resources

ArcCanada disc (ESRI)

LRT Support CD #3 and #4 (August 10, 2006)

Useful online resources include:

- E-STAT Canada
- GeoNova
- Expedia
- Mapquest
- Google Earth
- NASA Worldwind
- Environment Canada (contains weather information)
- Geological Survey of Canada
- NOAA
- World Resources Institute
- Provincial government data
- Natural Resources data banks

Module 4: Applied Geomatics Project

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
4.4 manipulate data to produce thematic representations or maps	• apply appropriate skills acquired in Modules 2 and 3 to their geomatics project *Teachers can* • review and suggest the skills necessary to accomplish the outcome

Module 4: Applied Geomatics Project

Suggestions for Assessment

Students can

- contribute questions and answers to a group forum to collaborate and help each other manipulate their data
- write journal entries reflecting upon their experiences
- discuss and document their progress with the teacher on a regular basis
- document activities, decisions, problems, and accomplishments
- present their thematic representations and maps and explain how the map helps to answer the geographic question posed

Teachers can

- provide students with formal and informal feedback on their progress
- read student journals and forum entries regularly and provide constructive feedback
- question students' appropriate use and display of data resources and suggest alternatives
- look for evidence of growth in collaborative and team skills
- monitor students' work using checklists and rubrics (See Appendix I: Checklists for Class Performance and Collaborative Work)

Suggested Resources

Refer to resources outlined in Modules 2 and 3.

GIS resources at <gis.EDnet.ns.ca>

Module 4: Applied Geomatics Project

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
4.5 analyse, synthesize, and summarize the geographic information	• consider their findings (Reflect and determine to what extent their geographic question has been answered. **Example**: What has polluted the drainage basin? **Answer**: Outfall from chemicals applied to farmer's fields. How will the answer be used to all who will use it?) • compare points of view, such as those on land use (Justify choice if one possibility over another. Formulate value generalizations.) • Analyse the relationships within their geographic information, and focus on the information and maps that will best answer their geographic question • use queries to highlight relationships between layers of data, and focus on the important trends and patterns that are revealed • make predictions based on their synthesis of the data *Teachers can* • focus students on additional questions and predictions that arise from their project findings • ask "So what?" and have students form a response that considers the larger scale implications of their findings

Module 4: Applied Geomatics Project

Suggestions for Assessment

Students can

- refer to the project rubric in Appendix L: Applied Geomatics Project Rubric

Teachers can

- refer to the project rubric in Appendix L: Applied Geomatics Project Rubric
- post student exemplars on the LifeWork Portfolio website

Suggested Resources

Teachers can collect related media articles that highlight geographic questions and responses. These can be posted and shared at <gis.EDnet.ns.ca>.

Appendix L: Applied Geomatics Project Rubric

Module 4: Applied Geomatics Project

Outcomes	Instructional Strategies/Suggestions
Students will be expected to	*Students can*
4.6 present, defend, and act upon project interpretations	• construct and present a multimedia presentation that documents their progress through the geographic method of inquiry • act on the geographic knowledge that they have gained: – Share their geographic knowledge with a broader community and help others act according to it – Present their findings to the school and the wider community – Understand the widespread linkages and help others see how their lives are affected – Be willing to pose and answer the question, "Now what?" *Teachers can* • provide samples of multimedia presentations to students • provide a list of community resources and contacts • ensure that data, analysis, and project results created for educational purposes are not used to replace the work that could be done by a geomatics professional (Consult the "Nova Scotia GIS Data Agreement" for more specific information regarding the use of data.)

Module 4: Applied Geomatics Project

Suggestions for Assessment

Students can

- reflect and self-evaluate on both the process of completing their geomatics project and on the final product
- present their completed project to a wider audience that could include peers, parents, other teachers, and the surrounding community in order to garner feedback on their e-portfolio and to help further answer the question "So what?"

Teachers can

- create planned opportunities for students to present their portfolios for a range of purposes and audiences, which may include post-secondary education institutions, employers, awards committees, families, peers, and other community groups
- use the rubric provided in the resource to assess student progress

Suggested Resources

No additional resources required.

Module 4: Applied Geomatics Project

Outcomes	Suggestions for Learning and Teaching
Students will be expected to	*Students can*
4.7 develop an e-portfolio that documents their completed project	• take responsibility for their own e-portfolios • seek and accept feedback • respect copyright laws • preserve the privacy and security of their personal information • negotiate with teachers to identify appropriate e-portfolio formats • set personal, academic, and career goals • create a blog as a medium to document their reflections on learning and on the process of completing their applied geomatics project • collect artifacts that highlight their achievements, accomplishments, skills, and aspirations (Artifacts may include text, images, photographs, video, audio, or multimedia electronic forms.) • organize and store all artifacts and reflections • select, organize, and display items for presentation • meet regularly with their teachers or advisors *Teachers can* • emphasize that the e-portfolio must showcase personal attributes, skills, knowledge, and personal reflections and identify progress toward achieving career goals – Obtain and refer to the *LifeWork Portfolio: A Teaching Resource* document – Maintain ongoing dialogue with students – Provide resources appropriate for each student – Give feedback and suggestions – Provide information about portfolio format options – Negotiate a format that is appropriate for each student – Provide opportunities for students to acquire the skills they need to create their e-portfolios Additionally, teachers must recognize and encourage the roles of community, other teachers, guidance counsellors, and administration. See Appendix Q: LifeWork Portfolio for more details.
4.8 develop employability skills	

Module 4: Applied Geomatics Project

Suggestions for Assessment

Students can

- reflect and self-evaluate on both the process of creating their e-portfolio and on the final product
- present their completed e-portfolio to a wider audience including peers, parents, other teachers, and the surrounding community in order to garner feedback on their e-portfolio and to help further answer the question "So what?"

Teachers can

- ensure that assessment is ongoing throughout the completion of the project
- create planned opportunities for students to present their portfolios for a range of purposes and audiences, which may include post-secondary education institutions, employers, awards committees, families, peers, and other community groups
- use the rubric provided in the resource to assess progress and describe expectations
- ensure the assessment is used solely to determine whether the portfolio work has been completed to the best of the student's ability

Notes

LifeWork Portfolio: A Teaching Resource

Various online blog resources (e.g., Blogger)

Appendix Q: LifeWork Portfolio

Contexts for Learning and Teaching

Principles of Learning

The public school program is based on principles of learning that teachers and administrators should use as the basis of the experiences they plan for their students. These principles include the following:

1. Learning is a process of actively constructing knowledge.

   Therefore, teachers and administrators have a responsibility to

   - create environments and plan experiences that foster inquiry, questioning, predicting, exploring, collecting, educational play, and communicating
   - engage learners in experiences that encourage their personal construction of knowledge, for example, hands-on science and math, drama, creative movement, artistic representation, and writing and talking learning activities
   - provide learners with experiences that actively involve them and are personally meaningful

2. Students construct knowledge and make it meaningful in terms of their prior knowledge and experiences.

   Therefore, teachers and administrators have a responsibility to

   - find out what students already know and can do
   - create learning environments and plan experiences that build on learners' prior knowledge
   - ensure that learners are able to see themselves reflected in the learning materials used in the school
   - recognize, value, and use the great diversity of experiences and information students bring to school
   - provide learning opportunities that respect and support students' racial, cultural, and social identities
   - ensure that students are invited or challenged to build on prior knowledge, integrating new understandings with existing understandings

3. Learning is enhanced when it takes place in a social and collaborative environment.

   Therefore, teachers and administrators have a responsibility to

   - ensure that talk, group work, and collaborative ventures are central to class activities
   - see that learners have frequent opportunities to learn from and with others
   - structure opportunities for learners to engage in diverse social interactions with peers and adults
   - help students to see themselves as members of a community of learners

4. Students need to continue to view learning as an integrated whole.

   Therefore, teachers and administrators have a responsibility to

   - plan opportunities to help students make connections across the curriculum and with the world outside and structure activities that require students to reflect on those connections
   - invite students to apply strategies from across the curriculum to solve problems in real situations

5. Learners must see themselves as capable and successful.

   Therefore, teachers and administrators have a responsibility to

   - provide activities, resources, and challenges that are developmentally appropriate to the learner
   - communicate high expectations for achievement to all students
   - encourage risk taking in learning
   - ensure that all students experience genuine success on a regular basis
   - value experimentation and treat approximation as signs of growth
   - provide frequent opportunities for students to reflect on and describe what they know and can do
   - provide learning experiences and resources that reflect the diversity of the local and global community
   - provide learning opportunities that develop self-esteem

6. Learners have different ways of knowing and representing knowledge.

   Therefore, teachers and administrators have a responsibility to

   - recognize each learner's preferred ways of constructing meaning and provide opportunities for exploring alternative ways
   - plan a wide variety of open-ended experiences and assessment strategies
   - recognize, acknowledge, and build on students' diverse ways of knowing and representing their knowledge
   - structure frequent opportunities for students to use various art forms—music, drama, visual arts, dance, movement, crafts—as a means of exploring, formulating, and expressing ideas

7. Reflection is an integral part of learning.

   Therefore, teachers and administrators have a responsibility to

   - challenge their beliefs and practices based on continuous reflection
   - reflect on their own learning processes and experiences
   - encourage students to reflect on their learning processes and experiences
   - encourage students to acknowledge and articulate their learning
   - help students use their reflections to understand themselves as learners, make connections with other learning, and proceed with learning

Learning Styles and Needs

Learners have many ways of learning, knowing, understanding, and creating meaning. Research into links between learning styles and preferences and the physiology and function of the brain has provided educators with a number of helpful concepts of and models for learning. Howard Gardner, for example, identifies eight broad frames of mind or intelligences: linguistic, logical/ mathematical, visual/spatial, body/kinesthetic, musical, interpersonal, intrapersonal, and naturalistic. Gardner believes that each learner has a unique combination of strengths and weaknesses in these eight areas, but that the intelligence can be more fully developed through diverse learning experiences. Other researchers and education psychologists use different models to describe and organize learning preferences.

Students' ability to learn is also influenced by individual preferences and needs within a range of environmental factors, including light, temperature, sound levels, availability of food and water, proximity to others, opportunities to move around, and time of day.

How students receive and process information and the ways they interact with peers and their environment in specific contexts are both indicators and shapers of their preferred learning styles. Most learners have a preferred learning style, depending on the situation and the type and form of information the student is dealing with, just as most teachers have a preferred teaching style, depending on the context. By reflecting on their own styles and preferences as learners and as teachers in various contexts, teachers can

- build on their own teaching-style strengths
- develop awareness of and expertise in a number of learning and teaching styles and preferences
- identify and allow for differences in student learning styles and preferences
- identify and allow for the needs of students for whom the range of ways of learning is limited
- organize learning experiences to accommodate the range of ways in which students learn

Learning experiences and resources that engage students' multiple ways of understanding allow them to become aware of and reflect on their learning processes and preferences. To enhance their opportunities for success, students need

- a variety of learning experiences to accommodate their diverse learning styles and preferences
- opportunities to reflect on their preferences and the preferences of others to understand how they learn best and how others learn differently
- opportunities to explore, apply, and experiment with learning styles other than those they prefer, in learning contexts that encourage risk taking
- opportunities to return to preferred learning styles at critical stages in their learning
- opportunities to reflect on other factors that affect their learning, for example, environmental, emotional, sociological, cultural, and physical factors
- a flexible time line within which to complete their work

Meeting the Needs of All Students

Learners require inclusive classrooms, where a wide variety of learning experiences ensure that all students have equitable opportunities to reach their potential.

In designing learning experiences, teachers must accommodate the learning needs, preferences, and strengths of individuals and consider the abilities, experiences, interests, and values that they bring to the classroom. In recognizing and valuing the diversity of students, teachers should consider ways to

- create a climate and design learning experiences to affirm the dignity and worth of all learners in the classroom community
- consider the social and economic situations of all learners
- acknowledge racial and cultural uniqueness
- model the use of inclusive language, attitudes, and actions supportive of all learners
- adapt classroom organization, teaching strategies, assessment practices, time, and learning resources to address learners' needs and build on their strengths
- provide opportunities for learners to work in a variety of contexts, including mixed-ability groupings
- identify and apply strategies and resources that respond to the range of students' learning styles and preferences
- build on students' individual levels of knowledge, skills, and attitudes
- use students' strengths and abilities to motivate and support their learning
- provide opportunities for students to make choices that will broaden their access to a range of learning experiences
- acknowledge the accomplishment of learning tasks, especially those that learners believed were too challenging for them

Teachers must adapt learning contexts, including environment, strategies for learning, and strategies for assessment, to provide support and challenge for all students, using curriculum outcomes to plan learning experiences appropriate to students' individual learning needs. When these changes are not sufficient for a student to meet designated outcomes, an individual program plan may be developed. For more detailed information, see *Special Education Policy Manual* (1996), Policy 2.6.

A range of learning experiences, teaching and learning strategies, motivation, resources, and environments provide expanded opportunities for all learners to experience success as they work toward the achievement of designated outcomes. Many of the learning experiences suggested in this guide provide access for a wide range of learners, simultaneously emphasizing both group support and individual activity. Similarly, the suggestions for a variety of assessment practices provide multiple ways for students to demonstrate their achievements.

The Role of Technology

Vision for the Integration of Information

The outcomes in Geomatics 12 are, by nature, technology dependent; students are required to utilize an object-orientated programming language and integrated development environment. Students also need access to the information and communication technologies available in schools to facilitate learning across the curriculum.

The Nova Scotia Department of Education has articulated five strands in the learning outcomes framework areas for the integration of information and communication technology within Public School Programs.

Basic Operations and Concepts: concepts and skills associated with the safe and efficient operation of a range of information technologies

Social, Ethical, and Human Issues: the understanding associated with the use of information/communication technology, which encourages in students a commitment to pursue personal and social good, particularly to build and improve their learning environments and to foster strong relationships with their peers and others who support their learning

Productivity: the efficient selection and use of information and communication technology to perform tasks such as the exploration of ideas, data collection, data manipulation, including the discovery of patterns and relationships, problem solving, and the representation of learning

Communication: specific, interactive technology use that supports student collaboration and sharing through communication

Research, Problem Solving, and Decision Making: students' organization, reasoning, and evaluation of their learning, which rationalize their use of information and communication technology

The Geomatics 12 Learning Environment

The Classroom

Learning in Geomatics 12 should take place, for the most part, in a computer laboratory. There should be one computer per student, and students should have access to a printer. Arranging the computers in a u-shape with the open end of the facing the front of the class allows the teacher to view all screens simultaneously and also allows all students clear access to the front of the room to view the teacher, data screen, or board. Tables or counter space are necessary for students to carry out group work, write documentation, and take notes. It is anticipated that a great deal of file sharing will need to take place in this course and that file storage requirements may become considerable. It would be helpful for computers to be networked and for students have access to in and out boxes stored on a server. An alternative to this would be the use of memory sticks, which would also allow students to store and transfer files with the added benefit of being able to take their work home.

The Learning Culture

It is important to establish a culture in the Geomatics 12 classroom where critical thinking, problem solving, and collaboration are valued and encouraged. Students should perceive the teacher as an instructor when necessary, but more frequently the teacher should be perceived as a facilitator, guiding and encouraging students as they acquire problem-solving, collaboration, and technical skills. The continuous evolution of information technology in general, andgeomatics in particular, requires the teacher to be a lifelong learner, to apply prior knowledge, to be actively curious, and to model these qualities for students.

By taking an active learning approach, teachers become part of the learning community and communicate to students that problem solving is a dynamic process with multiple paths to success. It is essential that students be free to collaborate and feel comfortable to take risks in their learning. Students should be encouraged to peer teach, and teachers should be comfortable learning alongside their students.

Assessing and Evaluating Student Learning

Assessment is the systematic process of gathering information on student learning.

Evaluation is the process of analysing, reflecting upon, and summarizing assessment information and making judgments or decisions based upon the information gathered.

The Principles of Assessment and Evaluation articulated in the document *Public School Programs* should be used as the basis of assessment and evaluation, policies, procedures, and practices.

Effective Assessment and Evaluation Practices

Effective assessment improves the quality of learning and teaching. It can help students to become more reflective and to have control of their own learning, and it can help teachers to monitor and focus their instructional programs.

Assessment and evaluation of student learning should accommodate the complexity of learning and reflect the complexity of the curriculum. Evaluation should be based on the full range of learning outcomes towards which students have been working during the reporting period, be proportionate to the learning experiences related to each outcome, and focus on patterns of achievement as well as specific achievement.

In reflecting on the effectiveness of their assessment program, teachers should consider the extent to which their practices

- are fair in terms of the student's background or circumstances
- are integrated with learning
- provide opportunities for authentic learning
- focus on what students can do rather than on what they cannot do
- provide students with relevant, supportive feedback that helps them to shape their learning
- describe students' progress toward learning outcomes
- help them to make decisions about revising, supporting, or extending learning experiences
- support learning risk taking
- provide specific information about the processes and strategies students are using
- provide students with diverse and multiple opportunities to demonstrate their achievement
- accommodate multiple responses and a range of tasks and resources

- provide evidence of achievement in which students can take pride acknowledge attitudes and values as significant learning outcomes
- encourage students to reflect on their learning and to articulate personal learning plans
- help them to make decisions about teaching strategies, learning experiences and environments, student grouping, and resources
- include students in developing, interpreting, and reporting on assessment

Involving Students in the Assessment Process

When students are aware of the outcomes they are responsible for and the criteria by which their work will be assessed or evaluated, they can make informed decisions about the most effective ways to demonstrate what they know, are able to do, and value.

It is important that students participate actively in the assessment and evaluation of their learning, developing their own criteria and learning to judge a range of qualities in their work. Students should have access to models in the form of scoring criteria, rubrics, and work samples.

As lifelong learners, students assess their own progress, rather than relying on external measures, for example, marks, to tell them how well they are doing. Students who are empowered to assess their own progress are more likely to perceive their learning as its own reward. Rather than asking, What does the teacher want? students need to ask questions such as, What have I learned? What can I do now that I couldn't do before? What do I need to learn next?

Effective assessment practices provide opportunities for students to

- reflect on their progress toward achievement of learning outcomes
- assess and evaluate their learning
- set goals for future learning

Diverse Learning Styles and Needs

Teachers should develop assessment practices that affirm and accommodate students' cultural and linguistic diversity. Teachers should consider patterns of social interaction, diverse learning styles, and the multiple ways oral, written, and visual language are used in different cultures for a range of purposes. Student performance takes place not only in a learning context, but in a social and cultural context as well.

Assessment practices must be fair, equitable, and without bias, providing a range of opportunities for students to demonstrate their learning. Teachers should be flexible in evaluating the learning success of students and seek diverse ways for students to demonstrate their personal best. In inclusive classrooms, students with special needs have opportunities to demonstrate their learning in their own ways, using media that accommodate their needs, and at their own pace.

Using a Variety of Assessment Strategies

When teachers make decisions about what learning to assess and evaluate, how to assess and evaluate, and how to communicate the results, they send clear messages to students and others about what learning they value; for example, teachers can communicate that they value risk taking or lateral thinking by including these elements in determining marks.

Assessment involves the use of a variety of methods to gather information about a wide range of student learning and to develop a valid and reliable snapshot of what students know and are able to do that is clear, comprehensive, and balanced. The assessment process provides information about each student's progress toward achievement of learning outcomes that teachers can use to assign marks, to initiate conversations with students, or to make decisions in planning subsequent learning experiences.

Teachers align evaluation and assessment practices with student-centred learning practices when they

- design assessment and evaluation tasks that help students make judgments about their own learning and performance
- provide assessment and evaluation tasks that allow for a variety of learning styles and preferences
- individualize assessment and evaluation tasks to accommodate specific learning needs
- work with students to describe and clarify what will be assessed and evaluated and how it will be assessed and evaluated
- provide students with regular and specific feedback on their learning

Assessment activities, tasks, and strategies include, for example,

- anecdotal records
- artifacts
- audiotapes
- checklists
- certifications
- conferences
- demonstrations
- dramatizations
- exhibitions
- interviews (structured or informal)

- inventories
- investigations
- learning logs or journals
- media products
- observations (structured or informal)
- peer assessments
- performance tasks
- presentations
- portfolios
- presentations
- projects
- questioning
- questionnaires
- quizzes, tests, examinations
- rating scales
- reviews of performance
- reports
- sorting scales (rubrics)
- self-assessments
- surveys
- videotapes
- work samples
- written assignments

Portfolios

Portfolios engage students in the assessment process and allow them to participate in the evaluation of their learning. Portfolios are most effective when they provide opportunities for students to reflect on and make decisions about their learning. The students and teacher should collaborate to make decisions about the contents of the portfolio and to develop the criteria for evaluating the portfolio.

Portfolios should include

- the guidelines for selection
- the criteria for judging merit
- evidence of student reflection

Portfolio assessment is especially helpful for the student who needs significant support. Teachers should place notes and work samples from informal assessments in the portfolio and use the portfolio to collaborate with the student in identifying strengths and needs, selecting learning experiences, and selecting work that best reflects the student's progress toward achievement of learning outcomes.

It is important that students share their portfolios with other students so that all students may see exemplars that represent a range of strategies for expression and levels of complexity in ideas and understanding.

Outlines and other evidence of planning allow students to examine their progress and demonstrate achievement to teachers, parents, and others.

Students should be encouraged to develop a portfolio that demonstrates their achievements in a context beyond a particular course, including letters, certificates, and photographs, for example, as well as written documents. A portfolio can be very helpful when students need to demonstrate their achievements to potential employers or admission offices of post-secondary institutions.

Tests and Examinations

Traditional tests and examinations are not, by themselves, adequate to assess student learning. The format of tests and examinations can be revised and adapted to reflect key aspects of the curriculum. Some teachers, for example, have designed tests and examinations based on collaborative or small-group learning, projects, or portfolio learning. Creating opportunities for students to collaborate on a test or examination is an effective practice in the interactive classroom to assess learning of a higher order than recall of information, for example, learning that requires synthesis, analysis, or evaluation.

In learning activities that involve solving a design problem, for example, students might work collaboratively to clarify and define the task and then work either collaboratively or individually to develop a solution. Students might be given a range of questions, issues, or problems and work collaboratively to clarify their understanding of the assignments and plan responses in preparation for the examination for which only one of the questions, issues, or problems will be assigned.

The initial list of questions, issues, or problems can be developed by the teacher, negotiated by the teacher with students, or developed by students and screened by the teacher.

Process-based tests and examinations allow students to demonstrate knowledge and skills and apply strategies at multiple stages in learning processes, for example, in identifying problems, challenges, and opportunities; gathering, evaluating, and synthesizing information; generating options; and developing and evaluating solutions.

Traditional tests and examinations may present a number of problems in scheduling and resource allocation. Process-based tests and examinations may be undertaken in steps during several class periods over a number of days. Students have opportunities to revise, reflect on, and extend their knowledge and understanding. Teachers have opportunities to develop comprehensive assessments, to monitor and evaluate learning at multiple points in a process, and to use time flexibly.

Certification

In some courses, students will need to prepare to demonstrate their learning through entrance tests and examinations or to obtain or upgrade a certification. Replicating this type of assessment in the classroom can help students prepare for the conditions and assessment formats they may encounter in workplace and post-secondary situations.

To make this kind of assessment an effective learning experience, teachers should define a specific context and purpose, for example, the operation of a device, the identification of materials labels, or the demonstration of a technique or procedure.

Appendices

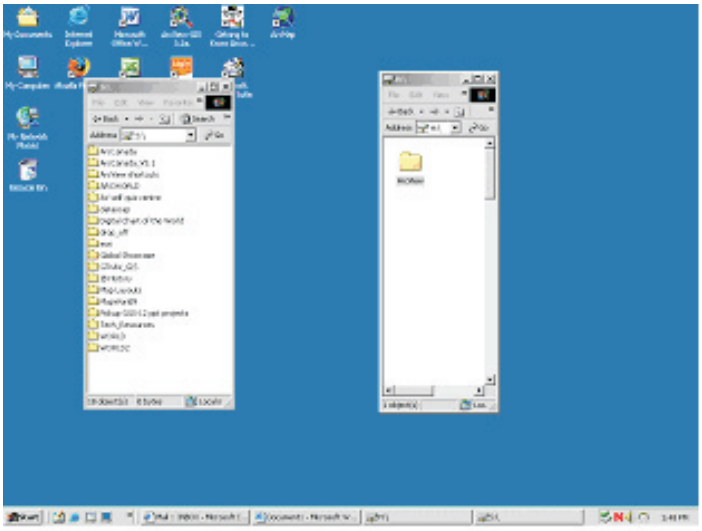
Appendix A: Instructions

Sample instructions for students to log on, create a folder for GIS data, retrieve data, and then begin the tutorial.

Note: Teachers should insert references to drives appropriate to their schools. Teachers should ensure that the read-only attribute is removed from data files after they have copied them from the CD into the network data storage drive. Technicians should ensure that students have rights to access and copy data to their own storage drives but **not** to write data to the network storage drive.

Before you begin the exercise, "ArcMap: The Basics," you will need to copy a folder of data from the [ ] drive to your [ ] drive. Follow these steps carefully, so you will have the correct data in the correct place.

1. Log in to Novell using your own username and password.
2. Double-click on My Computer
3. Reduce it to a smaller window and move it to the right of the screen
4. Double-click on your [ ] drive (the one with your user name)
5. Click on File/New/Folder to create a new folder
6. Name your new folder "arcview" (all one word)
7. Double-click on My Computer again to open up a new window



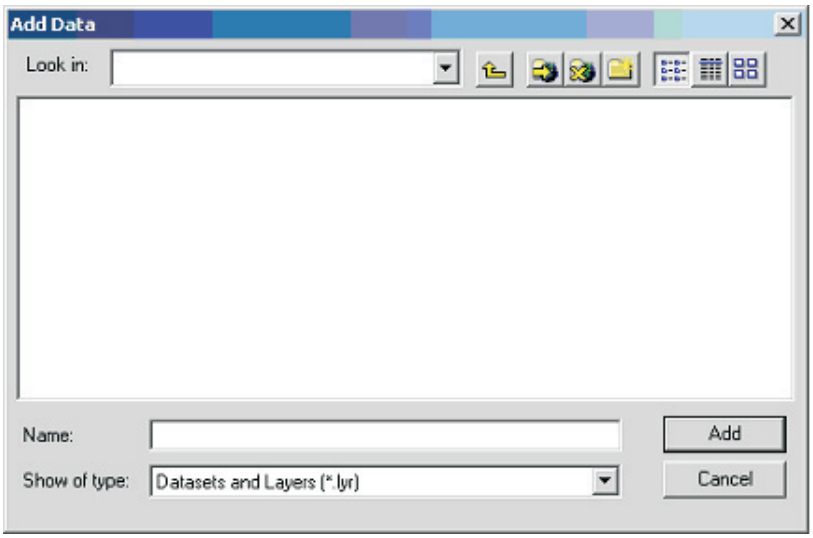
8. Move the new window to the left of the screen
9. Double-click on the [ ] drive (the ArcView drive)
10. Double-click on the MapWorld9 folder
11. Click and hold down on the Mod1 folder and drag it over to your new arcview folder in your G drive.
12. Now Double-click on your arcview folder to open it (you should see your copy of the Mod1 folder)
13. You can close your windows and begin the "ArcMap: The Basics" exercise.

Appendix B: Presentation Rubric

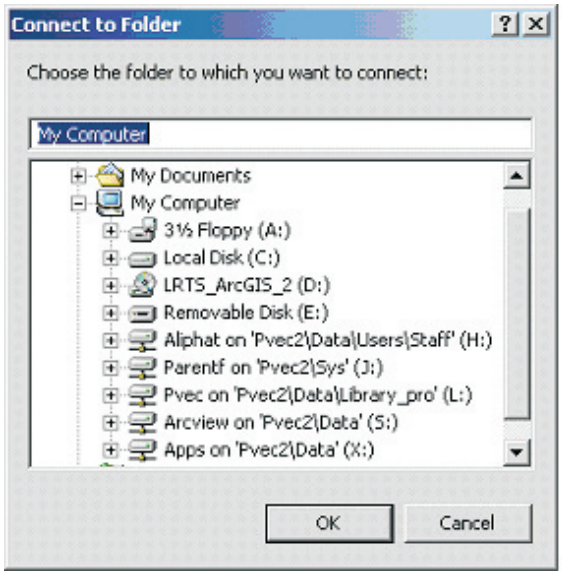
Category	4 marks	3 marks	2 marks	1 mark
Understanding Concepts	Presentation demonstrates full understanding of the concepts; clearly explained.	Presentation demonstrates good understanding of the concepts; explained.	Presentation demonstrates understanding of most of the concepts; explained.	Concepts are not clearly presented and do not reflect good understanding.
Accuracy	Content is complete, sufficient to explain the topic, accurate and well sourced.	Content is fairly complete, accurate and mostly sourced.	Content is sketchy but contains sources.	No sources are included.
Fonts and formatting	Text is clear, bold, and easily read with good balance.	Text is clear, bold, and easily read from a distance.	Text is fairly clear and easy to read.	Text is lacking in clarity; difficult to read.
Sequencing of Information	The organization of material is clear and logical, easy to follow. One point leads to the next, and summaries are used.	The organization of material is clear and logical. It is fairly easy to follow and the point is clear.	The organization of material is fairly clear, but difficult to follow through to a logical conclusion.	There is a lack of organization. The material jumps around too much.
Use of Graphics	sized, colourful, attractive, neatly presented and appropriate.	The graphics are clear, neat, attractive, and appropriate to the topic	The graphics are fairly clear and neat; they are somewhat appropriate.	The graphics appear to be hastily assembled, not appropriate, neat, or attractive.
Effectiveness	point across quickly and clearly. It teaches well, and excites interest in the topic.	The presentation gets the point across fairly well and informs well.	The presentation gets most of the point across.	The point is unclear or not very convincing.
Total mark				
Comments				

Appendix C: How to Add Data by Attaching to a Folder

Step 1: Open AcrMap
Step 2: Select “A new empty map”
Step 3: Select “Add Data” (this is a Plus sign with a half yellow triangle)
Step 4: Add Data—Select the Connect to Folder (Yellow Right Arrow on the top toolbar menu.)



Step 5: Select the [insert name of the network drive where data is stored, in this example, “S”] then select the desired folder (e.g., ArcCanada_v3.1).



From here you have Disks 1, 2 ,3, 4. Data is stored in these folders. Continue to select subfolders to arrive at the folder where data is stored, then select OK. Files or maps required will then be listed.

Appendix D: PowerPoint Project Rubric

Category	4 marks	3 marks	2 marks	1 mark
Geographic Questions	Has generated an excellent research question, which is geographic in nature, backed by many specific questions, aimed at answering the main question.	Has generated a very good research question, geographic in nature, backed by some specific questions aimed at answering the main question.	Has generated a main question and some specific questions aimed at answering the main question.	Has generated some questions.
Understanding of Concepts	Demonstrates a solid understanding of issue. Student explains the issue very well and clearly explains how the research findings answer the questions posed.	Shows a good understanding of the issue. Student explains the issue clearly, and can show how the research answers most of the questions posed.	Shows some understanding of the issue. Student explains the issue fairly well and can show how the research answers some of the questions posed.	Shows little understanding of the issue. Student attempts an explanation but is not clear about the relationship between the research and questions posed.
Content Accuracy	All content throughout the presentation is accurate. There are no factual errors or misinterpretations, and all sources are cited.	Most of the content is accurate, but there are a few pieces of information that might be inaccurate. Most sources are cited.	The content is generally accurate, but some information is clearly flawed or inaccurate. Several sources are not cited.	Content is typically confusing or contains several factual errors. Most sources are not cited.
Font Choice and Formatting (e.g., colour, bold, italic)	Enhance readability and emphasize content.	Do not interfere with readability or understanding of content.	Shows planning, but may be a little confusing or hard to read.	Makes it very difficult to read and understand the material.
Sequencing of Information	Information is organized in a clear, logical way. It is easy to anticipate the type of material that might be on the next slide.	Most information is organized in a clear, logical way. One or more slides or items of information seem out of place.	Some information is logically sequenced. Several slides or items of information seem out of place.	There is no clear plan for the organization of information.
Use of Graphics	All visual elements are engaging (size and colours, images) and support the theme/content of the presentation.	A few graphics are not engaging, but most support the theme/content of the presentation.	Graphics do not consistently engage the viewer or support the theme/content of the presentation.	Graphics generally detract from the content of the presentation.
Effectiveness	Project includes all material needed to gain a comfortable understanding of the topic. It is a highly effective aid to understanding.	Project includes most material needed to gain a comfortable understanding of the material, but is lacking one or two key elements. It is an adequate aid to understanding.	Project is missing more than two key elements. It would make an incomplete aid to understanding.	Project is lacking several key elements and has inaccuracies that make it a poor aid to understanding.

Appendix E: ArcGIS 9 Button Quiz

Match the letter of the tool or button to its definition. (Outcome 2.1)

1. _____ Print—Prints the current map document.
2. _____ Open—Opens an existing map document.
3. _____ Save—Saves the current map document.
4. _____ Find searches the attributes of the layers in your data frame and returns matching attributes
5. _____ Select Elements—Select graphics interactively and turn off all other buttons.
6. _____ Add Data—adds data to the current map document.
7. _____ Next extent—A "redo" for panning or zooming. Use this after using the "previous" extent tool.
8. _____ Full extent button—Will zoom in or out so that you can see all the data in a data frame.
9. _____ Zoom Out—Interactively zoom out by dragging a box or clicking on the map.
10. _____ Measure—measure the distance between a series of points.
11. _____ New Map File—Creates a new (empty) map document.
12. _____ Measure Angle—Measure the distance and compass bearing between two points.
13. _____ Previous extent button—"undo" for panning or zooming; takes you back to previous location.
14. _____ Pan—Interactively move to a different part of the map by dragging.
15. _____ Identify—Interactively identify a geographic feature to see its attributes.
16. _____ Zoom In—Interactively zoom in by dragging a box or clicking on the map.

Appendix F: Cloze Exercise Exemplar

Cloze exercise to accompany the PowerPoint presentation, "Geography Matters" (February 15, 2007) found on the LRT support CD #4. Path: D:\Presentations\Geography_Matters\geomatters.ppt

Notes

In order to get the most of the information in the PowerPoint presentation, teachers should use the lecture notes included with the slides. These are visible in the "Normal" view of the presentation, and can be printed for use during the lecture. Select "file/print," and in the "print what" pull-down menu, choose "Notes Pages."

As the slide show progresses, instruct students to fill in the blanks of the worksheet with the correct answers. This encourages them to think about the material and how it fits together. It also provides them with a sheet of notes to use for study purposes.
The slide titles are shown in italics, so the students can better follow the presentation.

The worksheet may also be used as a quiz following the lesson.

Answer Key for "Geography Matters" Worksheet

1	*Geography Matters*	No questions on this slide
2	*Geography and Technology*	natural, human
2a		Earth, Positioning, Information
3	*Earth Observation*	a) Spot, b) Landsat, c) RadarSAT, d) NOAA, e) ERS,
4	*Earth Observation*	scales
5	*Global Positioning Systems*	satellites, location
6	*Geographic Information Systems*	location, attribute
7	*GIS Links Data Sets*	map, table
8	*GIS Analysis*	spatial, highlighted, attribute, linked
9	*GIS Layers*	elevation, geology, relationships
10	*GIS Analysis*	analyse, Population, physical, 3-D
11	*GIS Technology*	Relational, Design, Graphics, Analysis , Reporting
12	*Summary What is GIS*	location, attribute, link
13	*Real World Applications*	spatial
14	*Environmental*	global warming, temperature
15	*Park Management*	sight
16	*Agriculture*	satellite
17	*Public Utilities*	geotechnology
18	*Health Care*	River Blindness
19	*Emergency 911*	GIS
20	*Real Estate*	distance, pictures, map
21	*Marketing*	marketing (or advertising), location
22	*ESRI Schools and Libraries Program*	no question
23	*Geography Matters*	no question

Worksheet on the "Geography Matters" Presentation

1. *Geography Matters* [no question]

2. *Geography and Technology*

   Geography affects our _____ environment and our _____ environment.

2a. Three examples of the Hi-Tech nature of geography are _____ observation, Global _____ Systems (GPS) and Geographic _____ Systems (GIS).

3. *Earth Observation*

   Five examples of Satellites orbiting Earth are:

   a. _____ The French satellite

   b. _____ The first US satellite, used during the Cold War

   c. _____ A Canadian made satellite used in the Arctic

   d. _____ The satellite that provides weather images

   e. _____ A European satellite

4. *Earth Observation*

   These satellites are able to take pictures of Earth at various _____.

5. *Global Positioning Systems*

   Using 24 _____ that orbit Earth, the GPS can provide _____ within metres , anywhere on the globe.

6. *Geographic Information Systems*

   We can describe any element of our world in two ways, _____ information that tells us the latitude and longitude where the object is, and _____ information that tells us more details about the object.

7. *GIS Links Data Sets*

   GIS links both types of information, using a _____ to display the location data, and a _____ to display the attribute information. When one is highlighted, so is the other.

8. *GIS Analysis*

   GIS software can answer _____ questions about the location of something and show them _____ on a map. It can also answer _____ questions, going to the correct information in a _____. Either way, all the information showing the answer will be _____ together.

9. *GIS Layers*

   Beginning with a base map, you can add information in layers, such as an _____ layer, showing land height, and a surface _____ layer showing rock formations. Then you can examine the _____ among the different layers.

10. *GIS Analysis*

    GIS allows us to _____ data in many ways. _____ and demographic data (languages in Ontario), _____ features for the same area

(like surface geology), or even in _____ perspectives (fly-throughs).

11. *GIS Technology*

GIS uses three types of software technology _____ Database Management Systems, Computer-Assisted _____ and _____ Software, and Statistical _____ and _____ packages.

12. *Summary What is GIS* is about describing our world with _____ data, and _____ data, and maintaining a _____ between the information.

13. *Real World Applications*

Many different organizations use GIS to solve a variety of _____ -related problems.

14. *Environmental*

GIS can be used to discover the effects of _____ _____ by examining the relationship between land cover (vegetation) and _____.

15. *Park Management*

GIS can be used to locate a visitor centre in a park, so that it is not in the line of _____ to spoil the scenery.

16. *Agriculture*

Farmers can use GIS to improve food production by monitoring the conditions in their fields and using _____ imagery to detect pest infestations.

17. *Public Utilities*

You can compare a proposed excavation site with the existing pipelines in a property by using _____.

18. *Health Care*

GIS can compare areas of mosquito breeding grounds with community locations in Guatemala, to determine who is at risk of _____ _____, a serious disease.

19. *Emergency 911*

Ambulance drivers use a GPS and _____ to determine the fastest route from a patient's home to the hospital.

20. *Real Estate*

Now, with the help of a GIS, people can find a home that fits all of their chosen criteria, such as _____from schools and shopping areas. People can also view _____ of their prospective home and a _____ of the area.

21. *Marketing*

GIS allows business owners to locate their most likely customers and minimize the cost of _____. They can also use the data to determine the _____ of a new business.

22. *ESRI Schools and Libraries Program* [no question]

23. *Geography Matters* [no question]

Appendix G: Disney Theme Park Project

Students will work in pairs.

You have been hired by the Disney Corporation to choose a site for a new Disney theme park. To be successful, this site must avoid natural disasters, have excellent transportation systems, have lots of customers and workers in the area, and be an attractive place for tourists to visit.

1. In your H: drive, create a folder "Disney" + your initials. You will be presenting this project, and you will project your Arcview 9 maps as part of your presentation. It is important that you save your work properly and can retrieve it later.

2. Go through the world data in the "Data" folder in GIS data, and choose themes that will help you pick out the best location (e.g. countries, cities, GDP, volcanoes). **Copy** the data into a folder in your data drive.

3. Create a map and layout that shows the location of the 11 existing Disney theme parks. (Research online to find the location of these parks.)
<http://thisdayindisneyhistory.homestead.com/WorldOfDisneyParks.html>
On this map, you will put another symbol for the site that you select. (Later in project.)

4. Analyse the world data about population, roads, money, and natural disasters, and select the best site for the new park. Go online and find out where hurricanes and typhoons are located, and avoid these disasters. Check through the data and identify deserts, mountains, flood plains or any other hostile environment that you should avoid. Finally, check online to find out if there are any wars or political conflict.

5. After careful consideration, choose a site that will be financially successful. Put it on your first map. Print a copy of the map and pass in.

6. Create at least three maps (world, and zoom in on your country of choice) to support your decision. You need to justify your choice. Each map should highlight a reason why you chose this location, such as near a city of middle-class people who could afford to go to Disney parks. [Hint: Use query function.]

7. Write a one page summary of your choice that supports your layouts and maps. Your presentation will include projecting for the class your original map, the supporting maps that describe site attributes or environmental realities, and the one page of notes justifying your choice. The class can critique your decision, based upon their global research about volcanoes, earthquakes, population numbers, etc.

Assessment

1. Map of Disney theme parks with your suggested location for a new park.
2. Class presentation to promote your decision.

Appendix H: Disney Theme Park Project Peer Evaluation Rubric

Name _____

You are a member of the Board of Directors of Corporate Disney. You will evaluate the presentations of the 10 companies. Complete the sheet, and pass in at the end of class. You will mark the first three maps out of ten.

Names and Location	Map 1 10/10	Map 2 10/10	Map 3 10/10	Extra Maps Bonus (5)	Justifications for Site. List reasons to support the proposal. 10/10	Total 40/40

1. Your choice for best group: _____

Appendix I: Checklists for Class Performance and Collaborative Work

For each of the following categories, rate each group from 1–5.

1 – Hardly Ever
2 – Some of the Time
3 – Usually
4 – Most of the Time
5 – Almost Always

	Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**
Group was on task, with students obviously working and producing material for the project.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Group worked quietly, made no unnecessary noise, stayed in one place, did not disrupt others.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Group is prepared to work, brought materials or used class materials, did not ask to go "begging" for things.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
Group solved its own problems, tried different approaches, persevered, did not ask for help until all other avenues had been exhausted.	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Appendix J: WebQuest Worksheet

WebQuest: Seeking Maps on the Internet

Name: _____

There is a wealth of information available on maps on the Internet. Answer the following questions by analysing online maps.

A. What is the quality of life in this community?
<atlas.nrcan.gc.ca/site/english/maps/peopleandsociety/QOL/ove_qol_uc >

B. Which province has the greatest area of high quality of life?

C. Which U.B.C. classes are closer to the Main Library? Geography or mathematics?
<sunsite.ubc.ca/UBCMap>

D. How has climate change affected South Africa?
<cbc.ca/news/interactives/gmaps/climate-change>

E. What is the most northerly destination for planes flying out of Halifax airport?
<aircanada.com/en/travelinfo/destinations/maps/index.html>

F. What is the capital city of Mongolia?
<globalis.gvu.unu.edu/?839>

G. What is the rainiest month in Peru?
<southhill.vsb.bc.ca/Departments/Humanities/Geogpraphy/Kyle/Notes/2_Atmosphere/Interactive_climate_map/climate_map.html>

Appendix K: Learning Logs

Overview

To document and assess learning, students in Geomatics 12 are required to keep a reflective learning log. Your learning log will be collected for assessment on every Day ___ of the school cycle.

The learning log should include daily dated entries that document all new skills and activities introduced in the Geomatics 12 course of study. Additionally, you must include reflective responses that are thoughtful and thorough and show some change from cycle to cycle. Responses should focus directly on learning in Geomatics 12, but can also include references to other subject areas where applicable. Some possible response starters include:

- This cycle I learned ...
- What geographic questions can be asked from the work I have done?
- What I have found difficult about what I have read/viewed/heard this week is ...
- Is what you are currently studying challenging you in any way? In what way?
- Can you make any connections between what you are learning in geomatics and everyday life, history, situations in the world, any other subject you are studying?
- Write down three questions you have for a GIS expert or other expert in the field of geomatics. Explain why you have asked those questions.
- What are you learning about yourself from what you are studying in Geomatics 12 i.e.; your own values, attitudes and beliefs?
- My writing and reading skills ... (i.e., reflect on them and your efforts, areas of strength and weakness providing specific examples)
- My listening and speaking skills ... (i.e., reflect on them and your efforts, areas of strength and weakness providing specific examples)

Some thoughts on reflection in learning logs:

> *Reflection is recorded in all aspects of the learning log. Reflection helps us to make sense of learning from experience. It allows us to stand back and get a different view of experience. Reflection allows us to repeatedly go over an experience in our own mind, and allows for honesty. By undertaking reflection, we weigh up aspects of our experiences and make judgments, and we may see our learning more clearly (i.e., in a mirror). It opens up the opportunity for deeper learning and understanding, allowing the learner to draw final conclusions.*
> (Cottrell, S. *Skills for Success: The Personal Development Handbook*, Paygrade Macmillan, 2003)

Learning Log Rubric

[pending]

Appendix L: Applied Geomatics Project Rubric

Outcomes	8–10	6–8	2	1	Score
4.1 develop and document a project plan for an applied project (to define the scope, roles, responsibilities, steps, and deadlines)	Student(s) project plan includes a time line and project log that thoroughly documents their project.	Student(s) project plan includes a time line and log to document their project.	Student(s) made some effort to build a project plan including a time line and project log to documents their project.	Student(s) made little or no effort to complete a project plan.	
4.2 pose the geographic question	Student(s) posed a thoughtful, creative question that engaged them in challenging or provocative research.	Student(s) posed a focussed question involving them in challenging research.	Student(s) constructed a question that lends itself to readily available answers.	Student(s) relied on teacher-generated questions or a question requiring little creative thought.	
4.3 identify, evaluate and acquire geographic resources	Student(s) gathered information from a variety of quality sources, including appropriate licensed databases. Sources are relevant, balanced, and include critical readings Sources of data acquired are properly cited and error-free.	Student(s) gathered information from a variety of relevant sources and cited them. Few errors noted.	Student(s) gathered information from a limited range of quality sources. Documentation was poorly constructed or absent.	Student(s) gathered information that lacked relevance, quality, depth and balance, with little effort to document their progress.	
4.4 manipulate data to produce thematic representations or maps	Student(s) developed appropriate structure for communicating product, incorporating a variety of quality sources. Information logically and creatively organized. Maps adhere to principles of cartographic design.	Student(s) logically organized the product and made good connections among ideas. Maps adhere to most principles of cartographic design.	Student(s) could have put greater effort into organizing the product and communicating ideas. Some evidence of proper cartographic design.	Student(s) work is not logically or effectively structured and does not communicate meaningful ideas. No evidence of proper cartographic design.	

	8-10	6-8	2	1	Score
4.5 analyse, synthesize, and summarize the geographic information (their findings)	Student(s) carefully analysed information and drew appropriate and inventive conclusions supported by evidence.	Student(s) product shows good effort was made in analysing the evidence collected.	Student(s) conclusions could be supported by stronger evidence. Level of analysis could have been deeper.	Student(s) conclusions involved restating information. Conclusions not supported by evidence.	
4.6 present, defend, and act upon project interpretations	Student(s) effectively and creatively used appropriate communication tools to convey their conclusions and demonstrate effective research techniques. Product displays creativity, acting upon their conclusions.	Student(s) effectively communicated the results of research to the audience. Some effort was made to act upon their conclusions.	Student(s) need to work on communicating more effectively. Student(s) showed little evidence of thoughtful research.	Product does not effectively communicate research findings.	
4.7 develop an e-portfolio that documents their completed project (by showcasing personal attributes, skills, knowledge, and personal reflections in order to identify progress toward achieving career goals)	Contains items that support personal skills and goals. Personal reflection related to selected artifacts. Identifies areas for future development; goal setting and plan of action evident. Effective use of language to communicate personal connection between portfolio contents and career goals.	Contains some items that support personal skills and goals. Some reflection on personal use of content. Identifies areas for future development; identifies goals; no clear action plan. General understanding of connection between personal development and careers evident.	Limited connection between artifacts and personal skills and goals. Little reflection on self in relation to artifact selection. Goals identified; limited details provided as to connection with skills and needs. Connection between careers and personal development not clear.	No clear connection between artifacts and personal skills and goals. Few or no written reflections. Goals section shows lack of reflection. Does not demonstrate understanding of connection between personal development and career goals.	

Appendix M: Employability Skills

Employability Skills 2000+

The skills you need to enter, stay in, and progress in the world of work—whether you work on your own or as a part of a team.

These skills can also be applied and used beyond the workplace in a range of daily activities.

Fundamental Skills

The skills needed as a base for further development

You will be better prepared to progress in the world of work when you can:

Communicate

- read and understand information presented in a variety of forms (e.g., words, graphs, charts, diagrams)
- write and speak so others pay attention and understand
- listen and ask questions to understand and appreciate the points of view of others
- share information using a range of information and communications technologies (e.g., voice, e-mail, computers)
- use relevant scientific, technological and mathematical knowledge and skills to explain or clarify ideas

Manage Information

- locate, gather and organize information using appropriate technology and information systems
- access, analyze and apply knowledge and skills from various disciplines (e.g., the arts, languages, science, technology, mathematics, social sciences, and the humanities)

Use Numbers

- decide what needs to be measured or calculated
- observe and record data using appropriate methods, tools and technology
- make estimates and verify calculations

Think & Solve Problems

- assess situations and identify problems
- seek different points of view and evaluate them based on facts
- recognize the human, interpersonal, technical, scientific and mathematical dimensions of a problem
- identify the root cause of a problem
- be creative and innovative in exploring possible solutions
- readily use science, technology and mathematics as ways to think, gain and share knowledge, solve problems and make decisions
- evaluate solutions to make recommendations or decisions
- implement solutions
- check to see if a solution works, and act on opportunities for improvement

Personal Management Skills

The personal skills, attitudes and behaviours that drive one's potential for growth

You will be able to offer yourself greater possibilities for achievement when you can:

Demonstrate Positive Attitudes & Behaviours

- feel good about yourself and be confident
- deal with people, problems and situations with honesty, integrity and personal ethics
- recognize your own and other people's good efforts
- take care of your personal health
- show interest, initiative and effort

Be Responsible

- set goals and priorities balancing work and personal life
- plan and manage time, money and other resources to achieve goals
- assess, weigh and manage risk
- be accountable for your actions and the actions of your group
- be socially responsible and contribute to your community

Be Adaptable

- work independently or as a part of a team
- carry out multiple tasks or projects
- be innovative and resourceful: identify and suggest alternative ways to achieve goals and get the job done
- be open and respond constructively to change
- learn from your mistakes and accept feedback
- cope with uncertainty

Learn Continuously

- be willing to continuously learn and grow
- assess personal strengths and areas for development
- set your own learning goals
- identify and access learning sources and opportunities
- plan for and achieve your learning goals

Work Safely

- be aware of personal and group health and safety practices and procedures, and act in accordance with these

Teamwork Skills

The skills and attributes needed to contribute productively

You will be better prepared to add value to the outcomes of a task, project or team when you can:

Work with Others

- understand and work within the dynamics of a group
- ensure that a team's purpose and objectives are clear
- be flexible: respect, be open to and supportive of the thoughts, opinions and contributions of others in a group
- recognize and respect people's diversity, individual differences and perspectives
- accept and provide feedback in a constructive and considerate manner
- contribute to a team by sharing information and expertise
- lead or support when appropriate, motivating a group for high performance
- understand the role of conflict in a group to reach solutions
- manage and resolve conflict when appropriate

Participate in Projects & Tasks

- plan, design or carry out a project or task from start to finish with well-defined objectives and outcomes
- develop a plan, seek feedback, test, revise and implement
- work to agreed quality standards and specifications
- select and use appropriate tools and technology for a task or project
- adapt to changing requirements and information
- continuously monitor the success of a project or task and identify ways to improve

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Appendix N: Support CD Table of Contents

[pending]

Appendix O: Moral, Ethnical, and Legal Issues in Information Technology

The moral, legal, and ethical issues associated with computer programming and information technology are an important part of this course. There are many issues past and present that have faced those who program and those who use information technology. Below is a list of some potential topics that students should investigate and consider when creating their own projects. By examining these issues, students may increasingly become critical thinkers aware of the ethical and moral issues associated with computer programming and information technology use.

- E-mail spam
- Spyware
- Hackers/Crackers
- Copyright
- Viruses
- Microsoft anti-trust
- Hate sites
- Pop-ups
- File sharing
- Site blocking
- Open source code

Copyright Issues

Students must respect the work of others and act in an ethically and legally responsibly manner. Just as students would not think it appropriate to steal a book from a store to support their studies or interests, students must not steal the information or works of others in the electronic environment. We are in an age where the technology to do things such as download images, data, or music files from websites is readily available. The legal right to use the technology for these purposes is, as students who pay attention to the news media understand, not always available. Students, using the school's equipment and Internet connection must follow Canadian Copyright and other laws. Students must respect the intellectual property of others and properly credit materials that are not their own original work.

Teachers and students will find many wonderful Internet resources to support learning in Geomatics 12. To ensure that these resources are used in an ethical and legal fashion, teachers should direct students to the following excerpt from *Copyright Matters! 2nd Edition*, Council of Ministers of Education, 2005.

Can Teachers and Students Copy from the Internet?

From a copyright point of view, you should be aware of the following four rules:

1. Most material available on the Internet is protected by copyright. This includes text (e.g., postings to newsgroups, e-mail messages), images, photographs, music, video clips, and computer software. Under the Copyright Act, reproduction and unauthorized use of a protected work are currently infringements. Therefore, reproduction of any work or a substantial part of any work on the Internet would infringe copyright unless you have the permission of the owner. Many Internet users are questioning the appropriateness of the rules in copyright law. Canada and other countries around the world are currently studying uses of copyright materials from the Internet. Many Internet users and service providers are asking for changes in copyright law that would allow defined uses of works on the Internet without infringing copyright. The ministers of Boards Association (CSBA), the Canadian Teachers' Federation (CTF), and others in the education community are active participants in this ongoing work.

2. Copyright protects the way in which information is expressed. The information itself is not protected by copyright. Restating ideas, facts, or information in your own words is not copyright infringement.

3. Where a work has been placed on the Internet with the message that it can be freely copied, there is an actual licence to copy the work. Sometimes the terms of the licence are subject to conditions. Common conditions are that the posting cannot be used for commercial purposes, must be circulated in its entirety, cannot be used out of context, and cannot be edited or reformatted. If you abide by the conditions, you may copy the work without infringing copyright.

4. Any works protected by copyright that are on your school's or district's Web site require copyright clearance, unless the school or district already owns the copyright in them. If the school or district does not own the copyright, permission must be obtained from the copyright owner. **The permission must be in writing**. The same would apply for students accessing student Web sites. A useful site to consult on such issues, written from the teacher's perspective, is <www.2learn.ca/copyright/copy.html>.

(Excerpted from *Copyright Matters! 2nd Edition*, Council of Ministers of Education, 2005)

Appendix P: LifeWork Portfolio

Role of the Community

Communities have a vital role to play in providing young people with opportunities for personal and social growth.

Communities can, for example,

- involve youth in community improvement projects
- encourage membership in youth groups and seek partnerships with the school to provide opportunities for volunteering
- involve youth in organizing community events
- offer safe, structured opportunities for youth to work together on projects that interest them and help them

Teachers can

- provide opportunities for students to connect aspects of their learning in geomatics to related careers/occupations/jobs and to related post-secondary training and education programs
- identify to individual students any potential artifacts demonstrating achievement in the courses they teach
- provide documentation of student accomplishments suitable for inclusion in e-portfolios
- encourage students to share their e-portfolios and give feedback

Role of the Guidance Counsellor

Guidance counsellors can

- help students identify academic and career information
- link career planning activities to the e-portfolio
- use the e-portfolio as a resource in counselling activities
- support teachers who need to acquire skills related to portfolio development

Role of the Administrator

Administrators can

- ensure that teachers have the required resources, including technology resources
- supervise the assignment of students to ensure an equitable distribution among staff
- encourage staff and members of the school community to provide documentation of student accomplishments suitable for inclusion in the e-portfolios
- ensure that time is allocated for e-portfolio activities
- initiate discussion within the staff and school community to clarify and emphasize the benefits of the LifeWork Portfolio initiative