

Public and Catholic District School Board Writing Partnerships

Course Profile

Geographics: The Geographer's Toolkit

Grade 11
Workplace Preparation
CGT3E

• *for teachers by teachers*

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Course Overview

Geographics: The Geographer's Toolkit, Grade 11, Workplace Preparation, CGT3E

Course Description

This course examines the use of geotechnologies, cartography, remote sensing, surveying, and geographic information systems (GIS) in the workplace, with emphasis on applications relevant to business, government, and the local community. Students will acquire practical experience in the collection, manipulation, interpretation, and display of geographic information, with a view to developing skills in areas such as desktop mapping, graphic presentation, image interpretation, database management, and GIS analysis.

CGT3E is a geography course and not a computer course. Even though this course is driven by technology, it is the geography skills and content that are imperative. It is expected that teachers have a good working knowledge of basic computer skills, however they are not expected to be Geographic Information Systems experts. Also, there is a myriad of software programs available to create and work within a GIS platform. Although many different quality software programs are in use in classrooms across the province, all work in this document focuses on the software applications that are presently licensed for all students within the Province of Ontario.

Course Notes

The Geographics: Geographer's Toolkit course is considered an introduction to the field of Geotechnology and its role in the field of Geography. Geotechnology encompasses the skills surrounding the areas of global positioning (GPS), remote imagery, and geographic information systems (GIS) and is one of the fastest growing skill sets within the field of information technology. Students in many areas of information technology, both within geography and in other areas, benefit from the tools within a geographer's toolkit.

Geotechnology is not an end in itself, but is in fact a tool that allows students to improve their spatial skills throughout the workplace. For many years GIS was a specialized field composed of professionals whose sole job was to build geographic databases, perform geographic analysis, and create maps. While many professionals specialize in GIS and other technology, many more use GIS as just one of the tools in their job, like a word processor or an electronic spreadsheet. This course is designed for students to learn the technology and to gain a stronger appreciation of the world around them. The expectations have been clustered into units to allow for specific geographical focuses that include a range from global to local and from physical to human geography. Students also gain an environmental awareness and garner a strong stewardship for their local area.

It is expected that students who enrol in CGT3E will graduate with an introductory workplace skill set of Geotechnology, which would be a relevant addendum for work within business, government, or the local community. Students acquire practical hands-on experience in such technological areas as data collection, manipulation, interpretation, and display, all in a geographical and spatial context. It must be stressed again that this is not a computer course, but a geography course making use of the geotechnology that is presently used with the workforce.

As this is a course based on information technology, it is important that it be as up to date as possible. The technology is based on current industry-standard software.

At present, the Ministry of Education licenses two professional software programs that are currently in use within industry throughout Ontario. These programs are uniquely different and have specific functions in the classroom as in private industry. *MFTeach*, a raster-based program, is best suited for local and small area studies (see Units 1 and 4), whereas *Arcview* is a vector-based program and is used with studies of a regional, national, and global focus (see Units 1, 2, and 4).

It must be noted that other GIS software packages are used throughout the province by specific Boards, schools, and programs. All of the activities throughout this profile could be easily adapted. It must be noted, however, that as this is a workplace destination course; therefore, it is important that teachers use software that is used in industry.

The teacher in a GIS classroom is in a unique position. Because of the ever-changing world of computer software, it is difficult for the teacher to remain current, it must be stressed that the teacher is there to guide students through the geographical and spatial skills inherent in any GIS. With respect to the Geotechnical software, the teacher is positioned as facilitator, guide, and co-learner. One of the greatest resources the teacher accesses is interaction with students.

While regular access to a computer lab, which runs a GIS program and provides Internet access, is strongly recommended, accommodations can be made throughout the course so that many of the activities can be completed without the use of a full lab of computers. However, it should be noted that GIS is a major component of several of the units and is particularly dominant throughout Unit 2. For those teachers offering this course without regular access to a computer lab, arrangements should be made, well in advance, for the use of a lab during the teaching of Unit 2 and other units that utilize GIS and/or require access to geotechnical data and/or the Internet.

A major focus of this course is the culminating unit, which allows students to partner with the business community, both public and private, and work with the geotechnical skills to identify, categorize, analyse, and present geographic data in the context of the real world. Students are also expected to keep a professional portfolio of their accomplishments that would enhance their entry into the job market.

How This Course Supports the Ontario Catholic School Graduate Expectations

A consistent theme found in the teachings of the Catholic Church concerns protecting and cherishing all life and creation. The Catholic Church teachings of Stewardship, Social Justice, and the principle of Common Good are imbedded in the critical analysis of problems faced by cultures around the world. In understanding the physical and human systems of our world, students reflect on the implications of human actions on natural systems and adopt a personal ethic as stewards of Creation. More specifically, the use of geotechnologies in global and local community studies reinforces the role of technology in promoting concepts of stewardship and sustainable resource use. The skills acquired in this course increase students' awareness of local and global events. These skills provide them with the opportunity to make informed decisions and foster the development of a citizen based on the Catholic teachings of social responsibility.

Units: Titles and Times

Unit 1	GIS Fundamentals/Geographic Essentials	15 hours
* Unit 2	Geotechnology in a Changing World	25 hours
* Unit 3	Human Interactions in the Physical World	25 hours
Unit 4	Business Geographics in the Community	35 hours
Unit 5	Workplace Portfolio	10 hours

* These units are fully developed in this Course Profile.

Unit Organization

Unit 1: GIS Fundamentals/Geographic Essentials

Time: 15 hours

Unit Description

This introductory unit examines the way geotechnology has reshaped our workplace environment. Students examine the historical context and development of geotechnologies. Students understand the importance of how changes in computer-aided mapping have facilitated interaction and communication within both the private and public sectors. The teacher introduces the technical skills and mapping elements that form a fundamental base for working in geotechnologies. Students use standard cartographic principles to demonstrate various mapping conventions. Students apply GIS tools and supporting computer technologies (*MFTeach* and *Arcview*) to demonstrate computer-aided cartographic principals, which are used to develop student awareness and subsequently enhance the quality of life on this planet.

Ontario Catholic School Graduate Expectations: 2a, 2b, 2d, 2e, 3e, 3f, 4f, 5a, 5g, 7b.

Strand(s): Geographic Foundations: Space and Systems, Global Connections, Understanding and Managing Change, Methods of Geographic Inquiry

Overall Expectations: GCV.03, GIV.04.

Specific Expectations: SS1.01, SS1.02, SS1.03, SS1.04, SS1.06, SS1.10, UC1.03, UC1.04, UC1.05, UC2.02, GI1.02, GI1.03, GI1.04, GI1.09, GI1.10, GI2.07, GI2.08, GI2.13.

Unit 1 Overview Chart

Activity	Expectations	Assessment	Focus
1	SS1.04, GCV.03, GI1.02 CGE 2a, 2c	Knowledge/ Understanding	Geographics Introduction What can GIS and geotechnology do? Where do we find the information in a GIS?
2	GI1.03, SS1.03, SS1.04, GI1.03, GI2.13, GI2.03, GIV.04, GI2.13, GI2.08 CGE 3e, 5g	Knowledge/ Understanding Application	Mapping Conventions Type and uses with associated data (title, legend, scale, direction, border, layout)
3	UCV.02, UC1.03, UC1.04, UC1.07, SS1.10, UC1.05, GI1.09, SS1.06 CGE 2a 2e, 3f	Inquiry Communication	Evolution of GIS Canadian influence and use in everyday life (uses and examples of GIS, GPS, and remote sensing)
4	UC2.02, GIV.04, GI1.10, GI2.07 CGE 2e, 5a	Knowledge/ Understanding Inquiry Application	Introduction to Geographic Information System software
5	SS1.02, GI1.03, SS1.01, GI1.04 CGE 2b, 2e, 3f, 4f, 5g, 7b	Knowledge/ Understanding Inquiry Application Communication	Culminating Activity World map

Unit 2: Geotechnology in a Changing World

Time: 25 hours

Unit Description

In this unit, students learn how to use a geographic information system (*Arcview*, GIS platform) to gather and interpret information about various world issues. More specifically, students demonstrate an understanding of how different geotechnological tools can be used to analyse these issues and offer potential solutions to global problems. Students work with a variety of topics including both physical and human concerns. Finally, students, as part of their culminating activity, make use of a GIS, the Internet, and other applicable software to gather data and perform simple analytical operations to study a particular global issue. Using acquired data, students construct map layouts that demonstrate good cartographic design. Through this interpretation and manipulation of information, students develop a strong sense of respect and stewardship towards our changing world.

Ontario Catholic School Graduate Expectations: 2a, 2b, 2c, 2e, 3b, 3e, 3f, 4f, 5a, 5d, 7f, 7i.

Strand(s): Geographic Foundations: Space and Systems, Human-Environment Interactions, Global Connections, Methods of Geographic Inquiry

Overall Expectations: SSV.01, GCV.01, GCV.02, GIV.01, GIV.03.

Specific Expectations: SS2.01, SS2.02, GC1.01, GC1.02, GC2.01, GC2.02, GC2.04, GC3.01, GI1.05, GI1.06, GI1.07, GI2.06, GI2.09, GI2.11.

Unit 2 Overview Chart

Activity	Expectations	Assessment	Focus
1	GC1.01, GIV.01, GCV.01, GCV.02, GC2.04 CGE 2a, 2b, 2c, 3e, 5a, 7f	Knowledge/ Understanding Application	Use of Geotechnologies in Addressing Matters of Global Concern
2	SSV.01, UCV.01, GC2.01, GIV.01, GI1.05, GI1.06, GI2.06, GC2.04 CGE 2a, 2b, 2c, 3f, 7i	Knowledge/ Understanding Application	Geotechnology and the Spheres: The Atmosphere, Lithosphere, Hydrosphere, and Biosphere. (preparation of thematic mapping reports)
3	GCV.02, GC1.01, SS2.01, SS2.02, GI2.09, GI2.05, GI1.06, GIV.03 CGE 2a, 2e, 3f, 7f	Knowledge/ Understanding Thinking/Inquiry Application	World Demographic Comparisons: Population, Food, Nutrition, and Their Impact on Quality of Life
4	GC2.02, GC2.04, GIV.03, GC3.01, GI2.14, GI2.06, GI1.02, GI1.04 CGE 2a, 2b, 2c, 4f, 5a, 5d, 7i	Knowledge/ Understanding Thinking/Inquiry Communication Application	Industrialization and Quality of Life: solutions to a scenario using a GIS (unit culminating activity)

Unit 3: Human Interactions in the Physical World

Time: 25 hours

Unit Description

In this unit, students apply geotechnologies to explore their responsibilities towards the human and physical environment. By identifying and describing various applications of geotechnologies, they are able to understand the earth's systems and the human interactions within these systems. The topics covered focus on the responsible use and management of resources, environmental problems and protection, human and natural disasters, and Native land issues. They could use a raster-based program for study of a local issue (*MFTeach*) and a vector-based program for their global focus. The world is constantly changing, therefore use of geotechnology, such as GIS, enables students to appreciate the earth's features and how they are continually being monitored. Their work reinforces the role of technology in promoting concepts of stewardship and sustainable resource use.

Ontario Catholic School Graduate Expectations: 1d, 1e, 2a, 2b, 2c, 2d, 2e, 3c, 3d, 3e, 3f, 4c, 4f, 5a, 5e, 5f, 5g, 7f, 7i.

Strand(s): Geographic Foundations: Space and Systems, Human-Environment Interactions, Global Connections, Understanding and Managing Change

Overall Expectations: SSV.03, UCV.01, HEV.01, HEV.02.

Specific Expectations: SS1.09, HE1.01, HE1.02, HE1.03, HE2.01, HE3.01, HE3.02, HE3.03, UC1.01, UC1.02, GI1.08, GI1.07, GI2.10, GI2.02, GI2.11, GI2.14, GC2.03.

Unit 3 Overview Chart

Activity	Expectations	Assessment	Focus
1	UC1.01, SSV.03, SS1.09, HE1.01, GI1.07, GI1.08, GI2.11, GC2.03 CGE1d, 1e, 2a, 2b, 2d, 2e, 3c, 3d, 4f, 7i	Knowledge/ Understanding Thinking/Inquiry Communication Application	Resource Issues Satellite image interpretation, analysing characteristics of resources, etc.
2	UC1.02, UCV.01, HE1.03, GI2.14, GI2.02 CGE1d, 1e, 2a, 2b, 2d, 2e, 3d, 7i	Knowledge/ Understanding Communication Application	Natural Disasters Role of geotechnology in studying and tracking, early warning, etc.
3	UC1.01, GI2.02, HEV.01, UCV.01, HE3.03 CGE1d, 1e, 2a, 2b, 2d, 2e, 3d, 7i	Knowledge/ Understanding Communication Application	Human Disasters Mapping extent, characteristics, monitoring, and averting at both a local and global level using appropriate software
4	HEV.01, HE2.01, HE3.01, HE3.02, GI2.02, GI2.14, GI2.10 CGE1d, 1e, 2a, 2b, 2c, 2d, 2e, 3c, 4c, 4f, 5a, 5e, 5f, 5g, 7f	Knowledge/ Understanding Thinking/Inquiry	Human Settlement and Indigenous People Map analysis, spatial distribution, remote settlements, use of geotechnology by Native peoples using <i>MFTeach</i> and <i>Arcview</i>
5	SS1.09, HEV.01, HEV.02, HE1.02, GI2.02, GI2.14 CGE1d, 1e, 2a, 2b, 2d, 2e, 3c, 3d, 4c, 4f, 5a, 5e, 5f, 5g	Knowledge/ Understanding Thinking/Inquiry Communication Application	Environmental Degradation Geotechnology and uses for locating, effects, solutions, and future implications

Unit 4: Business Geographics in the Community

Time: 35 hours

Unit Description

The focus of this unit is the creation of a culminating activity based on an issue in the local community. The teacher introduces the concept of Business Geographics and works students through an exemplar activity to show how geotechnologies can be used for a wide range of local government and business-related purposes. Students then work in small groups to evaluate one local issue, which is assessed and analysed using geotechnologies, including a Geographic Information System (*Arcview* and *MFTeach* professional spatial software). Examples include: planning issues related to industrial, commercial, and residential site location; environmental issues; recreation; agriculture; marketing; politics; or resource management. Through the use of the Internet, local media, government sources, and personal experiences, students perform background research for their topic. Further, groups collect and/or create data suitable for their mapping project using maps, charts, aerial photographs, and other suitable information sources. Students produce a set of written plans, maps, and graphs that relate to the issue and use GIS and related geotechnologies (GPS and Remote Sensing) to formulate a solution to problems. Solutions are based on concepts of the common good and the development of a just and compassionate society. Finally, students present their solution in a professional manner using communication and organization skills suitable for the workplace.

Ontario Catholic School Graduate Expectations: 2a, 2b, 2c, 2d, 2e, 3c, 3d, 3e, 3f, 4e, 4f, 5g, 5h.

Strand(s): Geographic Foundations: Space and Systems, Methods of Geographic Inquiry

Overall Expectations: SSV.04, SSV.02, GIV.01, GIV.02, GIV.03, GIV.05.

Specific Expectations: SS1.05, SS1.06, SS1.07, SS1.08, SS3.01, SS3.02, SS3.03, SS3.04, GI1.01, GI2.01, GI2.02, GI2.03, GI2.04, GI2.05, GI2.06, GI2.12, GI2.15, GI2.17, GI3.01, GI3.02, UC2.01, HE3.04.

Unit 4 Overview Chart

Activity	Expectations	Assessment	Focus
1	GIV.01, GCV.01, GIV.03, SSV.02, SS1.05, SS1.06, SS3.01, SS3.02, SS3.04, GI1.01, GI2.01, GI2.02, GI2.12, GI2.16, GI3.01 CGE2a, 2e, 3c	Knowledge/Understanding Thinking/Inquiry Communication Application	Introduction to Local Study Project Evaluation and selection of possible topics
2	SSV.04, SS1.07, SS1.08, GI2.03, GI2.12, GI3.02, UC2.01, HE3.04 CGE2a, 3c, 3d, 3f	Knowledge/Understanding Thinking/Inquiry Communication Application	Exemplar Scenario Activity
3	GIV.05, GI1.01, GI2.01, GI2.02, GI2.03, GI2.04, GI3.01 CGE3c, 3d, 3f	Knowledge/Understanding Thinking/Inquiry Application	Project Planning and Data Collection
4	GIV.01, GIV.03, SS3.01, SS3.02, SS3.03, GI2.01, GI2.05, GI2.06, GI2.15 CGE2c, 2d, 3b, 3c, 3f	Knowledge/Understanding Thinking/Inquiry Communication Application	Data Evaluation, Graphing and Mapping Use of GIS software (<i>Arcview</i> and <i>MFTeach</i>)
5	GIV.02, GIV.05, GI2.16, GI2.17, GI3.03 CGE2c, 2d	Knowledge/Understanding Thinking/Inquiry Communication Application	Preparation and submission of written report/group presentation

Unit 5: Workplace Portfolio – Culminating Unit

Time: 10 hours

Unit Description

This unit engages students in the creation of a personal work portfolio. While all components could occur at the end of the course, various aspects may be used in conjunction with the other units. Investigation of career opportunities is undertaken by students in order to evaluate a variety of career paths. Students are provided with the opportunity to create a portfolio that is indicative of their best work (e.g., charts, maps, diagrams, reports, analysis, images, and digital files). This portfolio would be suitable to present at an interview or for attachment to a work-related proposal. Further, students construct a revised resume, which highlights the geotechnical skills gained from this course. To facilitate this process, students present their portfolios to their peers, simulating application to a potential job in the workplace.

Throughout this worktask, students and their peers develop positive attitudes and act to promote social responsibility and the common good.

Ontario Catholic School Graduate Expectations: 1d, 1e, 2a, 2b, 2c, 2d, 2e, 3e, 3f, 4b, 4c, 4e, 4f, 4g, 5a, 5b, 5c, 5e, 5f, 5g, 5h.

Strand(s): Understanding and Managing Change, Methods of Geographic Inquiry

Overall Expectations: GIV.02, GIV.05, GI2.16, GI2.17, UCV.02.

Specific Expectations: UC1.06, UC1.07, UC3.01, GI1.03.

Unit 5 Overview Chart

Activity	Expectations	Assessment	Focus
1	GIV.02 CGE 1d, 2a, 2b, 5b	Knowledge Application	Skills needed for workplace. Interview tools and skills
2	GIV.02, UC3.01 CGE 1e, 3f, 4b, 4c, 5h	Knowledge Application	Portfolio, Demonstration and Presentation of completed course work in professional manner
3	GIV.05, UC1.07, UCV.02 CGE 4e, 4f, 4g, 5f	Inquiry Communication	Workplace Communication, preparing for interview, GIS industry jobs
4	GI2.16, UC1.06 CGE 1e, 2b, 2c, 2d, 2e, 5a, 5e, 5g	Knowledge Inquiry Application	Presentation of GIS careers, show product
5	GI2.17, GI3.03 CGE 1d, 2d, 3e, 4b, 4c, 4e, 4f, 5c, 5h	Knowledge Inquiry Application Communication	Culminating Activity: the Interview

Teaching/Learning Strategies

This course lends itself to a variety of teaching and learning styles. These strategies encourage students to think critically, work cooperatively, and conduct research that has a practical value in their lives. Students should be given opportunities to investigate topics associated with current issues recognizing the varying perspectives and career choices that could be made by individuals. Students should be encouraged to seek additional information to make informed choices for several career paths available to them.

- Learning Strategies: The teacher is encouraged to develop learning strategies that meet the needs of students with a wide variety of learning styles. Suggestions include: research and data collection, guided Internet searches, structured tutorial style lessons, simulations of real-life situations, collaborative learning, brainstorming, mind mapping, independent study, and personal reflection.

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- **Teaching Strategies:** The teacher should employ a number of teaching strategies which include Socratic lessons, self-directed lessons, arranging for guest speakers, informed discussion, and presentations.
 - **Demonstration:** Students are asked to demonstrate a synthesis of their learning as they advance towards the culminating unit. During the culminating unit, students should be able to draw upon their previous experiences in the class, assimilate new information, and work towards a final summative performance.
 - **Technical Skills:** Students develop fundamental computer skills. They examine the historical development of geotechnologies and begin to understand the importance of these powerful tools. They develop their note-taking skills, demonstrate an understanding of various mapping conventions, and apply rudimentary computer-aided cartographic principles.
 - **Geotechnical Skills:** Students begin learning the major components and functional features of a GIS. They work with the GIS to map a variety of world concerns. Further, students explore a variety of geographic concepts and gain skill in manipulating maps using industry-standard map-making software.
 - **Application of Skills Globally:** Students are introduced to additional data sets and image manipulation. Students are guided through the ways geotechnologies can be employed to solve a variety of geographic problems. Central to this course is the investigation of how humans interact with their environment. Topics should allow for the development and extension of skills learned in Unit 2 while exploring new concepts and patterns in the natural environment.
 - **Application of Skills Locally:** Students explore a nearby area and choose a task of significance to them. This involves the selection of an appropriate local study topic and the gathering and analysis of data to support the topic chosen. Students utilize both newly gained skills and those acquired in previous units to consolidate learning and develop business-like cartographic and presentation skills. Further, students should be able to use many of the skills learned in the previous three units to attempt a solution to the proposed topic.
 - **Career Focus:** This focus allows students to evaluate their acquired skills and knowledge. They are given the opportunity to enhance their professional resume and engage in a simulation exercise relating to a job application by means of a short presentation.

The subject of Geography and its associated geotechnologies use language in unique way. This is especially relevant in the use of new language associated with computers and geotechnology. In order to help all students, especially ESL/ELD students, the teaching and learning strategies should give attention to the following aspects of language in written and oral forms:

- specialized vocabulary;
- wide range of tense usage;
- words and phrases which indicate:
 - sequences or chronology;
 - cause and effect relationships;
 - contrast/comparison/superlatives;
 - statement of opinion, interpretation, and inference;
 - statements of speculation, hypothesis, and prediction;
 - statements of belief persuasion, evaluation, and definition;
- formation of questions and problems for formal and informal circumstances;
- active listening skills;
- requests for repetition, clarification, and restatement;
- note taking and summarization.
- Activities such as reading/listening need a specific and concrete product expected of students. Non-verbal communication skills are of particular importance to presentation tasks.

Language development and the expression of concepts taught are greatly facilitated if graphic products are reinforced with written or oral tasks and vice versa. All learners benefit greatly if their teachers initially provide models or structures for oral, written, and graphic communication.

Assessment & Evaluation of Student Achievement

Assessment and evaluation of student performance are based on the clusters of expectations for each of the focus activities in the unit overview charts. Assessment and evaluation strategies employed in the course address a variety of student learning strategies, meet the expectations outlined in the policy document, are appropriate for assigned activities, and provide opportunity for students to assess and improve their own learning. Teachers make use of information provided from the assessment and evaluation process to critically evaluate whether the teaching strategies and overall program are effectively meeting the expectations of the course and individual student learning needs. Activities in the sample units suggest both formative and summative evaluation strategies, as well as tools that teachers may employ in the classroom. Sample rubrics are provided for unit culminating activities.

Throughout this course a variety of assessment methods, techniques, and instruments are employed:

- **Observation:** This method is used to monitor and assess the intellectual, social, emotional, and spiritual growth and development not otherwise easily measured. Strategies may include anecdotal notes, student observation, formal and informal teacher observation, and rubrics.
- **Reflection:** This method is used to determine how and why students learn to assess various dimensions of their learning not easily observed or measured through activities or tasks. Through student reflection, student understanding of personal growth and emotional development are assessed. Strategies include self-assessment and peer evaluation.
- **Conferencing:** Evidence of student learning through listening, questioning, responding, and explaining is assessed through student/teacher conferences as well as through parent/teacher conferences. Conferencing allows the teacher to assess communication and thinking skills and to monitor personal growth and emotional development.
- **Paper-and-Pencil Tests:** Paper-and-pencil tests are administered throughout each unit. Teachers are able to assess student achievement of necessary knowledge and skills that meet specific expectations for the Geographer's Toolkit course.
- **Performance Assessment:** Students' ability to effectively apply and communicate their knowledge and skills is assessed. Student achievement of specific expectations is also assessed. This method can be used to evaluate and provide opportunities for student improvement. Application and communication of knowledge and skills can be achieved through report writing, projects, use of geotechnologies (to collect, organize, and map data), presentations, demonstrations, graphic organizers, and portfolios. Tools used include rubrics, checklists, anecdotal notes, peer assessment, and exemplars.
- **Peer and Self-Editing:** Provides opportunities for students to improve by using formative assessment tools, i.e. checklists and rubrics.
- **Student Performance:** Adaptations to a variety of learning styles and special needs are incorporated into the activities so that they may improve student performance and ensure that each student is given clear directions for improvement (e.g., communication skills; attention span; purpose and outcome of the activity; changing time requirements for completing assignments or assessment tasks; changing the format of assessment materials; providing a quiet environment in which assessment may take place; simplifying test instruction and the language of questions; providing for the use of scribes, as well as allowing for oral responses; providing alternative homework assignments; and basing classroom assessment on a full range of students work.
- **Communication:** Assessment and evaluation must be communicated clearly to students and parents at the beginning of the course and at other appropriate points throughout the course.

As a workplace preparation course, communication and application criteria may be evaluated more heavily. The evaluation chart below reflects the percentage allocation for each type of evaluation.

The final summative assessment for this course is broken into two parts. Unit 4 is a culminating activity based on a specific rich performance task (see Unit 4 Description), which brings together many of the expectations in a local context. Unit 5 is also a summative and culminating unit, as it brings together the student's body of work in a workplace portfolio. In this unit, students also inventory their skills in the form of a resume and simulated job interview. As this course is based on hands-on application and thinking and inquiry skills, the practical demands of Unit 4 could take the place of a final exam.

Evaluation of Student Achievement

Seventy per cent of the grade will be based on assessments and evaluations conducted throughout the course. Thirty per cent of the grade will be based on a final evaluation in the form of an examination, performance, essay, and/or other method of evaluation.

Accommodations

Teachers should be aware of students who require modifications to the mandated expectations for this course. *Ontario Secondary Schools* (p. 24) allows teachers to modify the learning expectations for exceptional students in order to support the contents of the student's IEP. This applies also to students who have not been identified as exceptional but are receiving Special Education programs and services.

- **Computers:** While regular access to a computer lab, which runs a GIS program and provides Internet access is strongly recommended, accommodations can be made throughout the course so that the activities can be completed without the use of computers. However, it should be noted that GIS is a major component of several of the units in this course and is particularly dominant throughout Unit 2. For those teachers offering this course without regular access to a computer lab, arrangements should be made, well in advance, for the use of a lab during the teaching of Unit 2 and other units that utilize GIS and need access to geotechnical data and/or the Internet.
- **Students with Exceptional Needs:** Every effort is made to assist all students in achieving success in their courses. Specific adaptations and accommodations are recommended with each activity. Individual Education Plans for exceptional students provide teachers with specific learning strategies that work best with individual students. As well, the proficiency levels outlined in *The Ontario Curriculum, Grades 9-12, English as a Second Language and English Literacy Development* provide teachers and school administrators with a guide to receiving and accommodating these learners in the regular classroom..
- There are a variety of strategies that can be used for students with special needs. Teachers are encouraged to work with the Special Education teacher to review students' IEPs (Individual Education Plans) to decide the best course of action to assist them in meeting the expectations of the Geographics course. An additional resource for teachers is the *Curriculum Planner Special Education Accompaniment*.
- **Enrichment:** There are numerous opportunities throughout the course for the enrichment of students.

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- All students have different learning styles; therefore a wide variety of teaching/learning strategies and assessment/evaluation techniques should be used. Many assessment tools for ESL/ELD students are formative, both in the assessment of understanding of concepts and the acquisition and practice of the specifically identified language forms necessary to express those concepts. The ESL/ELD learners' self esteem and motivation to learn benefit greatly when courses allow expression of their individual skills, interests, and varied life experiences in their family, communities, and countries of origin. Sensitivity to the diversity of cultural, ethnic, religious beliefs and the customs, socio-economic levels, and family structures of students entails accommodations to the structuring of learning experiences and resources. The subject should be introduced and presented in ways that focus on its relevance to ESL/ELD students' needs, be they communicative, such as language, day-to-day survival, social, physical, emotional, or cognitive.

Resources

Note: The URLs for the websites have been verified by the writer prior to publication. Given the frequency with which these designations change, teachers should always verify the websites prior to assigning them for student use.

Software

ESRI Canada. *Arcview 3.X*. Obtainable through Board OESS rep.

MF Teach. Thinkspace Inc. Obtainable through Board OESS rep.

Software Support Websites

ESRI CANADA K to 12 program. – www.esricanada.com/k-12/gis/capabilities.html

MF Teach – www.MFTEACH.com

Video

ESRI. *Data for Decision*. Can Roger Tomlinson, 1968. 20 min.

ESRI. *Geography Matters*. ESRI Can, 1998. 5 min.

Data CD and Web-based

Canada Soils and Agriculture – <http://sis.agr.ca/CANIS/>

Canadian Data and Images – www.nrcan.gc.ca

Canadian Space Agency – www.space.gc.ca/csa

Canadian Statistics – <http://www.statcan.ca/english/Estat/licence.htm>

ESRI Canada. *ArcCanada v.2*. Obtainable through Board OESS rep.

GeoKit CD. OAGEE, 1999. Obtainable through OAGEE regional rep.

Geogratis free national data site – <http://geogratis.cgdi.gc.ca>

Geography network, free world data – www.geographynetwork.com

Images of Canada and the World: Canadian Centre for Remote Sensing – www.ccrs.nrcan.gc.ca

NASA Data and Images – www.jpl.nasa.gov

Federal (FEMA) Emergency Management Agency US Natural Hazards – www.gismaps.fema.gov

Print and Reference

Arcview GIS ESRI Canada Manual.

Audet, Richard and Gail Ludwig. *GIS in Schools*. ESRI Press, 2000. ISBN 1-879102-85-4

Clark, Bruce and John Wallace. *Making Connections*. Scarborough, Ontario: Prentice Hall Ginn Canada, 1999. ISBN 0130126357

Davis, Bruce E. *GIS - A Visual Approach*. Onword Press. ISBN 1-56690-098-0
Davis, David E. *GIS for Everyone*. ESRI Press, 1999. ISBN 1-879102-49-8
Getting to Know ArcView GIS, 3rd ed. ESRI Press. ISBN 1879102-46-3
Getting to Know Desktop GIS. ESRI Press. ISBN 1-879102-42-0
Haddad, A. and C. *Teach Yourself PowerPoint 97*. Sams Pub. ISBN0-672 31117-8
Hohl, Pat and Brad Mayo. *ArcView GIS Exercise Book*, 2nd ed. Onword Press. ISBN I-56690-124-3
Hutchinson, Scott and Larry Daniel. *Inside ARCVIEW GIS*, 2nd ed. Onword Press. ISBN1-56690-116-2
Nicolucci, J. and Rex Taylor. *ArcView GIS Workbook & Teachers Guide*. Crescent School, ON, phone 416 449 2556. ext 239.

Websites and CDs

Canadian Schools Atlas Project: Info by and for Canadian students – <http://cgdi.gc.ca/ccatlas>
Information and surveys of world Issues – www.planetproject.ca
Ministry of Natural Resources, ON. *CD of selected Ontario Base Maps and Layered Data*. ESRI Canada, Spring 2001.
Ontario Ministry of Education. *Canadian Geographic Explorer CD*. Special Edition Irwin Publishing, Canada, 2000.
Portal to GIS info – www.gis.com
DMTI local street files 10 km block around school – ESRI Canada
Geomatics Industry – <http://www.geomatics.org>
National Geographic – www.nationalgeographic.com
The Royal Canadian Geographic Society – www.rcgs.org
Canadian Council on Geographic Education – www.ccge.org
Ontario Association for Geographic and Environmental Education magazine Monograph – www.oagee.org

OSS Considerations

This profile is designed to assist teachers in developing and delivering Geographics: The Geographer's Toolkit, Grade 11, Workplace Preparation, based on *The Ontario Curriculum, Grades 11 and 12, Canadian and World Studies*, pp. 55-61. With reference to the requirements for the Ontario Secondary School Diploma, students can use this course as an additional compulsory credit or as one of the twelve optional credits identified in *Ontario Secondary Schools, Grades 9-12, Program and Diploma Requirements, 1999*. Expectations for accommodations and modifications are outlined in section 7.12 (pp. 56-58) and appendix 6 (pp.74-75). The basis for assessment, evaluation, and reporting practices is outlined on pp. 13-16 of *The Ontario Curriculum, Grades 9-12, Program Planning and Assessment*. Career exploration is a component of the course and is aligned with *Choices Into Action: Guidance and Career Education Policy for Elementary and Secondary Schools, 1999*.

As this is a workplace course with a strong skills component, students who successfully complete the required elements of this course are in an advantageous position to make full use of cooperative education placements. As these students use professional software and skills necessary for the implementation of Geotechnology within the workplace, it is anticipated that there will be a significant demand for co-op placements.

Coded Expectations, Geographics: The Geographer's Toolkit, Grade 11, Workplace Preparation, CGT3E

Geographic Foundations: Space and Systems

Overall Expectations

- SSV.01 · demonstrate an understanding of basic spatial concepts;
- SSV.02 · explain the use of geotechnologies in support of business and local government activities;
- SSV.03 · describe how geotechnologies are used in environmental protection, resource management, and other areas;
- SSV.04 · use geotechnologies effectively to carry out geographic studies, with emphasis on the local community.

Specific Expectations

Understanding Concepts

- SS1.01 – define meridians and parallels and explain geographic coordinates (latitude and longitude) and rectangular coordinates (x, y);
- SS1.02 – identify important map projections and describe their main properties;
- SS1.03 – demonstrate an understanding of the concept of scale and the distinctions between large and small scale and between data scale and display scale;
- SS1.04 – differentiate between spatial and non-spatial data; point, line, and area data; and qualitative and quantitative data;
- SS1.05 – define the term *business geographics* and outline the range of techniques it encompasses;
- SS1.06 – describe the use of geotechnologies, especially GIS, for such business-related purposes as marketing and advertising, vehicle routing, site selection, and redistricting;
- SS1.07 – identify local government departments that make significant use of geotechnologies and spatial data (e.g., engineering, planning, health, utilities, police, environment);
- SS1.08 – describe the use of geotechnologies for such government-related purposes as land use planning, land registration, facilities management, and property assessment;
- SS1.09 – identify applications of geotechnologies relating to resources and the environment (e.g., species mapping, weather forecasting, forest management, precision farming);
- SS1.10 – identify applications of geotechnologies in other areas (e.g., navigation, recreation, criminology, warfare, emergency response).

Developing and Practising Skills

- SS2.01 – express location correctly by a variety of methods (e.g., latitude and longitude, street address, postal code);
- SS2.02 – express scale correctly in numerical and graphical form.

Learning Through Application

- SS3.01 – produce well-designed maps, charts, and graphs, using data illustrating local geographic themes;
- SS3.02 – interpret the geography of the local region, using maps or aerial photographs;
- SS3.03 – analyse selected aspects of physical and human geography, preferably of the local area, using GIS;
- SS3.04 – conduct a structured study involving the actual or potential use of geotechnologies by a local business or agency (e.g., GIS use in local businesses and government departments, resource mapping by conservation authorities).

Human-Environment Interactions

Overall Expectations

HEV.01 · explain the use of geotechnologies in studying human-environment interactions;

HEV.02 · evaluate the effectiveness of geotechnologies in identifying environmental problems and finding solutions.

Specific Expectations

Understanding Concepts

HE1.01 – describe the role of geotechnologies in facilitating the efficient and responsible use of resources (e.g., forests, minerals, fisheries);

HE1.02 – describe the role of geotechnologies in addressing environmental problems resulting from human action (e.g., pollution, deforestation, species extinction);

HE1.03 – describe the role of geotechnologies in addressing human problems resulting from environmental forces (e.g., hurricanes, floods, avalanches).

Developing and Practising Skills

HE2.01 – relate patterns of physical geography (e.g., relief, drainage) to patterns of human geography (e.g., settlements, land subdivision) on maps and images.

Learning Through Application

HE3.01 – explain the role of geotechnologies in addressing Native issues (e.g., reserve management, resource inventories);

HE3.02 – evaluate the benefits and effectiveness of using geotechnologies in sparsely populated areas (e.g., use of GPS in search-and-rescue operations, satellite monitoring of environmental impacts of military activities, radar imaging of forests);

HE3.03 – assess how modern geotechnologies could have been used to avert famous disasters such as the sinking of the Titanic;

HE3.04 – plan a hypothetical local development (e.g., park, plaza) with the aid of geotechnologies, and describe the environmental impact it would have.

Global Connections

Overall Expectations

GCV.01 · explain the use of geotechnologies in addressing matters of global concern;

GCV.02 · explain the role of geotechnologies in understanding peoples and places around the world;

GCV.03 · explain the role of geotechnologies in facilitating interaction, cooperation, and communication between peoples.

Specific Expectations

Understanding Concepts

GC1.01 – describe the role of geotechnologies in addressing issues affecting the world as a whole (e.g., global warming, desertification, overpopulation);

GC1.02 – explain how satellites support such global activities as communication, navigation, surveying, imaging, and mapping.

Developing and Practising Skills

GC2.01 – interpret maps and images to learn about areas that cannot be experienced at first hand;

GC2.02 – compare images of different places with a view to identifying similarities and contrasts;

GC2.03 – interpret satellite images to obtain a synoptic view of major world features (e.g., mountain systems, vegetation belts, oceans);

GC2.04 – make systematic use of the Internet to acquire information about different parts of the world.

Learning Through Application

GC3.01 – assess the impacts of geotechnologies on various aspects of international affairs (e.g., use of GIS in disaster relief, GPS in warfare, satellite monitoring in controlling nuclear proliferation).

Understanding and Managing Change

Overall Expectations

UCV.01 · explain the use of geotechnologies in monitoring and predicting change in the physical and human environment;

UCV.02 · assess the nature and speed of geotechnological change and its impact on the user.

Specific Expectations

Understanding Concepts

UC1.01 – describe the role of geotechnologies, especially satellite imaging, in monitoring changing features and phenomena (e.g., sea ice, forests, oil spills);

UC1.02 – describe the role of geotechnologies, especially GIS, in predicting processes and events (e.g., urban sprawl, earthquakes, coastal erosion);

UC1.03 – identify the main geotechnological advances of the late twentieth century and describe current trends;

UC1.04 – identify key Canadian contributions to geotechnology (e.g., Radarsat);

UC1.05 – describe the extension of geotechnological applications into new domains (e.g., vehicle navigation, criminology, marketing);

UC1.06 – identify present and future career opportunities in GIS, remote sensing, cartography, and surveying;

UC1.07 – describe the impact of continuous change on the user of geotechnologies (e.g., personal stress, increased cost, need for retraining).

Developing and Practising Skills

UC2.01 – describe changes in the local landscape through time by interpreting a temporal sequence of maps and aerial photographs;

UC2.02 – identify technological changes that occur frequently (e.g., hardware and software upgrades) and explain how to deal with them.

Learning Through Application

UC3.01 – prepare a comprehensive summary of their personal geotechnological skill set and compare it with their corresponding skill set two years earlier.

Methods of Geographic Inquiry

Overall Expectations

- GIV.01** · demonstrate an ability to acquire relevant data and materials and to evaluate their quality;
- GIV.02** · represent information appropriately, using a range of graphic and cartographic methods;
- GIV.03** · interpret and analyse data, maps, and images effectively;
- GIV.04** · demonstrate an understanding of basic computer concepts and a familiarity with a variety of computer applications;
- GIV.05** · demonstrate communication and organizational skills required in the workplace.

Specific Expectations

Understanding Concepts

- G11.01** – describe methods of acquiring raw data (e.g., direct measurement, questionnaire survey, field observation);
- G11.02** – identify sources of data, maps, images, and other geographic products (e.g., governments, private companies, the Internet);
- G11.03** – describe a range of techniques, from hand drawing with coloured pencils to the use of mapping software, that can be used to produce maps and graphics;
- G11.04** – identify the conceptual and design factors that make for a well-designed map or graphic (e.g., good generalization, symbol contrast, balanced layout);
- G11.05** – demonstrate an understanding of basic graphing and charting methods (e.g., scatter graphs, line graphs, bar charts, pie charts, population pyramids);
- G11.06** – demonstrate an understanding of basic thematic mapping methods (e.g., choropleth, dot, proportional symbol);
- G11.07** – identify the main types of remote sensing images (e.g. aerial photographs, thermograms, radar images);
- G11.08** – explain the principles of image interpretation, with particular reference to aerial photographs;
- G11.09** – identify the basic components of a computer and define key terms (e.g., operating system, applications software, random access memory, database);
- G11.10** – describe the basic components, operations, and capabilities of a GIS.

Developing and Practising Skills

- G12.01** – assess the quality of data, especially data acquired through the Internet, in terms of factors such as completeness, currency, accuracy, and cost;
- G12.02** – research websites relating to geography, GIS, and other geotechnologies and use search engines to locate sites of interest;
- G12.03** – execute basic survey operations, including the measurement of locations and elevations, using a GPS receiver;
- G12.04** – use electronic atlases to locate addresses and acquire information;
- G12.05** – use mapping software to generate a variety of well-designed maps, including thematic maps based on statistical data;
- G12.06** – use graphics software to produce a range of well-designed graphs, charts, and diagrams;
- G12.07** – classify maps according to type (e.g., topographic, thematic, navigational);
- G12.08** – perform basic operations correctly on topographic maps (e.g., specify location by six-figure reference; measure distances, using scales; read elevations from contours; identify symbols, using the legend);

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- GI2.09** – use GIS software appropriately to perform simple analytical operations (e.g., spatial querying, buffering, overlaying);
- GI2.10** – use a variety of visual representation techniques (e.g., relief models, computer displays) to depict the earth’s surface in novel ways;
- GI2.11** – perform basic operations correctly on aerial photographs (e.g., determine scale by measurement; identify features by interpretation; view the landscape in 3D, using a stereoscope);
- GI2.12** – orient a map or aerial photograph in the field and relate the features shown to the surrounding landscape;
- GI2.13** – master basic computer operating-system functions (e.g., manipulating windows, copying and saving files, running programs);
- GI2.14** – enter data into the computer by a variety of methods (e.g., keyboarding, downloading files, scanning);
- GI2.15** – create a small computer database relating to their local area, perform maintenance operations, and execute simple queries;
- GI2.16** – demonstrate the organizational and teamwork skills required in the workplace;
- GI2.17** – use written, oral, and visual communication skills effectively.

Learning Through Application

- GI3.01** – collect raw data, using appropriate observational methods (e.g., personal interview, questionnaire survey, direct measurement);
- GI3.02** – execute a systematic field survey in their local area and plot the results as a map;
- GI3.03** – prepare a formal report suitable for the workplace, containing a selection of charts, graphs, and maps.

Ontario Catholic School Graduate Expectations

The graduate is expected to be:

A Discerning Believer Formed in the Catholic Faith Community who

- CGE1a** -illustrates a basic understanding of the **saving story** of our Christian faith;
- CGE1b** -participates in the **sacramental life** of the church and demonstrates an understanding of the centrality of the Eucharist to our Catholic story;
- CGE1c** -actively reflects on **God’s Word** as communicated through the Hebrew and Christian scriptures;
- CGE1d** -develops attitudes and values founded on Catholic **social teaching** and acts to promote social responsibility, human solidarity and the common good;
- CGE1e** -speaks the **language of life**... “recognizing that life is an unearned gift and that a person entrusted with life does not own it but that one is called to protect and cherish it.” (Witnesses to Faith)
- CGE1f** -seeks intimacy with God and celebrates **communion** with God, others and creation through prayer and worship;
- CGE1g** -understands that one’s purpose or **call in life** comes from God and strives to discern and live out this call throughout life’s journey;
- CGE1h** -respects the **faith traditions**, world religions and the life-journeys of **all people of good will**;
- CGE1i** -integrates faith with life;
- CGE1j** -recognizes that “sin, human weakness, conflict and forgiveness are part of the human journey” and that the cross, the ultimate sign of forgiveness is at the heart of **redemption**. (Witnesses to Faith)

An Effective Communicator who

- CGE2a** -listens actively and critically to understand and learn in light of gospel values;
- CGE2b** -reads, understands and uses written materials effectively;
- CGE2c** -presents information and ideas clearly and honestly and with sensitivity to others;
- CGE2d** -writes and speaks fluently one or both of Canada’s official languages;
- CGE2e** -uses and integrates the Catholic faith tradition, in the critical analysis of the arts, media, technology and information systems to enhance the quality of life.

A Reflective and Creative Thinker who

- CGE3a** -recognizes there is more grace in our world than sin and that hope is essential in facing all challenges;
- CGE3b** -creates, adapts, evaluates new ideas in light of the common good;
- CGE3c** -thinks reflectively and creatively to evaluate situations and solve problems;
- CGE3d** -makes decisions in light of gospel values with an informed moral conscience;
- CGE3e** -adopts a holistic approach to life by integrating learning from various subject areas and experience;
- CGE3f** -examines, evaluates and applies knowledge of interdependent systems (physical, political, ethical, socio-economic and ecological) for the development of a just and compassionate society.

A Self-Directed, Responsible, Life Long Learner who

- CGE4a** -demonstrates a confident and positive sense of self and respect for the dignity and welfare of others;
- CGE4b** -demonstrates flexibility and adaptability;
- CGE4c** -takes initiative and demonstrates Christian leadership;
- CGE4d** -responds to, manages and constructively influences change in a discerning manner;
- CGE4e** -sets appropriate goals and priorities in school, work and personal life;
- CGE4f** -applies effective communication, decision-making, problem-solving, time and resource management skills;
- CGE4g** -examines and reflects on one's personal values, abilities and aspirations influencing life's choices and opportunities;
- CGE4h** -participates in leisure and fitness activities for a balanced and healthy lifestyle.

A Collaborative Contributor who

- CGE5a** -works effectively as an interdependent team member;
- CGE5b** -thinks critically about the meaning and purpose of work;
- CGE5c** -develops one's God-given potential and makes a meaningful contribution to society;
- CGE5d** -finds meaning, dignity, fulfillment and vocation in work which contributes to the common good;
- CGE5e** -respects the rights, responsibilities and contributions of self and others;
- CGE5f** -exercises Christian leadership in the achievement of individual and group goals;
- CGE5g** -achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others;
- CGE5h** -applies skills for employability, self-employment and entrepreneurship relative to Christian vocation.

A Caring Family Member who

- CGE6a** -relates to family members in a loving, compassionate and respectful manner;
- CGE6b** -recognizes human intimacy and sexuality as God given gifts, to be used as the creator intended;
- CGE6c** -values and honours the important role of the family in society;
- CGE6d** -values and nurtures opportunities for family prayer;
- CGE6e** -ministers to the family, school, parish, and wider community through service.

A Responsible Citizen who

- CGE7a** -acts morally and legally as a person formed in Catholic traditions;
- CGE7b** -accepts accountability for one's own actions;
- CGE7c** -seeks and grants forgiveness;
- CGE7d** -promotes the sacredness of life;
- CGE7e** -witnesses Catholic social teaching by promoting equality, democracy, and solidarity for a just, peaceful and compassionate society;
- CGE7f** -respects and affirms the diversity and interdependence of the world's peoples and cultures;
- CGE7g** -respects and understands the history, cultural heritage and pluralism of today's contemporary society;
- CGE7h** -exercises the rights and responsibilities of Canadian citizenship;
- CGE7i** -respects the environment and uses resources wisely;
- CGE7j** -contributes to the common good.

Unit 2: Geotechnology in a Changing World

Time: 25 hours

Unit Description

In this unit, students learn how to use a geographic information system (*Arcview*, GIS platform) to gather and interpret information about various world issues. More specifically, students demonstrate an understanding of how different geotechnology tools can be used to analyse these issues and offer potential solutions to global problems. Students work with a variety of topics including both physical and human concerns. Finally, students, as part of their culminating activity, make use of a GIS, the Internet, and other applicable software to gather data and perform simple analytical operations to study a particular global issue. Using acquired data, students construct map layouts that demonstrate good cartographic design.

Unit Synopsis Chart

Activity	Time	Expectations	Assessment	Tasks
2.1: Use of Geotechnologies in Addressing Matters of Global Concern	1.5 hours	GC1.01, GIV.01, GCV.01, GCV.02, GC2.04	Thinking/ Inquiry Knowledge Application Communication	Teacher-directed electronic slide show presentation re: Geography and Technology Brainstorming: Global issues Using the Internet, students discover data on global demographic concerns and compare with their own situation.
2.2: Geotechnology and the Spheres: Atmosphere, Lithosphere, Hydrosphere, and Biosphere	9.5 hours	SSV.01, UCV.01, GC2.01, GIV.01, GI1.05, GI1.06, GI2.06, GC2.04	Thinking/ Inquiry Knowledge Application Communication	Students research the different spheres and come up with general descriptions of each. Student groups develop a worksheet to reflect research. Groups use <i>Arcview</i> to produce thematic maps that represent the spheres as discussed. The teacher instructs students on how to use different functions of a GIS platform. Students join tables of data to make comparisons and predictions about a sphere. Students use GIS to measure anomalies within the sphere. Groups present their findings to the rest of the class.

<p>2.3: World Demographic Comparisons: Population, Food, Nutrition, and Their Impact on Quality of Life</p>	<p>7 hours</p>	<p>GCV.02, GC1.01, SS2.01, SS2.02, GI2.09, GI2.05, GI1.06, GIV.03</p>	<p>Knowledge Application Thinking/ Inquiry Communication</p>	<p>Students read an article on World Population Growth and brainstorm population problem regions. Students use a GIS to map crude population data. The teacher outlines major thematic mapping classification methods. Students join demographic tables to base maps and export. Students create a new project and construct maps showing Quality of Life. Students use word processors to import maps and provide summaries. The teacher discusses evaluation criteria with class and provides evaluation rubric. Students work in assigned pairs to evaluate one another's project.</p>
<p>2.4: Industrialization and Quality of Life Solutions to a scenario using a GIS (unit culminating activity)</p>	<p>7 hours</p>	<p>GC2.02, GC2.04, GIV.03, GC3.01, GI2.14, GI2.06, GI1.02, GI1.04</p>	<p>Thinking/ Inquiry Knowledge Application Communication</p>	<p>The teacher directs discussion relating to industrial development and guides learning of spreadsheets. Students enter data from text material. Students create a new project and build a map showing urban development and labour force. Students create a series of maps as a culminating activity.</p>

Activity 2.1: Use of Geotechnologies in Addressing Matters of Global Concern

Time: 1.5 hours

Strand(s) & Learning Expectations

Strand(s): Methods of Geographic Inquiry, Global Connections

Overall Expectations

- GCV.01 - explain the use of geotechnologies in addressing matters of global concern;
- GCV.02 - explain the role of geotechnologies in understanding peoples and places around the world;
- GIV.01 - demonstrate an ability to acquire relevant data and materials and to evaluate their quality.

Specific Expectations

- GC1.01 - describe the role of geotechnologies in addressing issues affecting the world as a whole (e.g., global warming, desertification, overpopulation);
- GC2.04 - make systematic use of the Internet to acquire information about different parts of the world.

Prior Knowledge & Skills

- basic understanding of how a GIS works and its relevance to everyday life
- experience in working with small groups
- basic understanding of navigating the Internet
- the ability to synthesize information from the Internet and present same in a coherent, well constructed paragraph

Planning Notes

- Ensure students have a copy of the electronic slide show presentation subsequent to the presentation for discussion and review.
- As there are many acronyms throughout the material, provide students with a chart where they can identify the entire terms.
- Review the questions identified by student groups to make sure they are appropriate for classroom instruction.
- If this is the first time in the course that students have used the Internet, review school and board policy.
- Develop assessment strategies.

Teaching/Learning Strategies

2.1.1/ As a class...

The teacher directs a short electronic slide show presentation and discussion on the role of Geography and Technology (15 min). This presentation can be found on the OAGEE *Geokit* CD or can be downloaded by the teacher from the ESRI Canada website (<http://www.esricanada.com/k-12>).

2.1.2/ Individually...

Students brainstorm a global problem that the use of geotechnology would help to solve. They demonstrate their conclusions in the form of a one-paragraph summary. This paragraph includes both a description of the global problem and the types of information/data needed to identify issues within the problem.

2.1.3/ As a small group...

Students navigate to the Internet site www.planetproject.ca and focus on the “Our World Core Questionnaire” section. After reading through each set of questions, students choose one question to discuss and compare their own results. They also choose a group spokesperson to relate the information to the class. They then discuss how using geotechnology would help in analysing issues related to the chosen question. Examples might include the use of maps and graphs to help communicate the results or an increased understanding of the socio-economic background of the student participants.

Assessment & Evaluation of Student Achievement

T/L Strategy	Task/Product	Tool	Purpose	Achievement
2.1.1 (class)	Whole-class discussion	Teacher-generated checklist	Formative	Knowledge Thinking/Inquiry Communication
2.1.2 (individually)	Creation of paragraph	Paragraph Rubric	Summative	Thinking/Inquiry Application Communication
2.1.3 (group)	Student-generated verbal group report	Peer assessment checklist	Formative	Thinking/Inquiry Application Communication

Accommodations

- Technical – electronic slide show presentation could be downloaded and turned into overheads.
- Technical – Internet site could be downloaded or printed out to speed up access or work with classes that do not have fast network availability.
- Remedial – A review on paragraph structure may be necessary to bring specific students up to speed. An exemplar paragraph would also be beneficial at this juncture.
- Enrichment - Students could graph the results of the Planet Project’s specific questions.

Resources

Print

Audet, Richard and Gail Ludwig. *GIS in Schools*. ESRI Press, 2000. ISBN 1-879102-85-4

Davis, Bruce E. *GIS A Visual Approach*. Onword Press. ISBN 1-56690-098-0

Davis, David E. *GIS for Everyone*. ESRI Press, 1999. ISBN 1-879102-49-8

Getting to Know Desktop GIS. ESRI Press. ISBN 1-879102-42-0

Data

ESRI Canada. *ArcCanada v.2.0* CD. Toronto: ESRI Canada Schools and Libraries Program, 1999.

Data GeoGratis – <http://geogratis.cgdi.gc.ca/frames.html>

GeoKit CD. OAGEE, 1999. Obtainable through OAGEE regional rep.

Geography Network: free world data – www.geographynetwork.com

Websites

NASA (Jet Propulsion Lab) - <http://www.jpl.nasa.gov/radar/sircxsar/ecologyagriculture.html>

www.planetproject.ca

www.esricanada.com/k-12/gis/capabilities.html

Software

ESRI. *Arcview 3.X*. ESRI, Canada. Obtainable through Board OESS rep.

Activity 2.2: Geotechnology and the Spheres: Atmosphere, Lithosphere, Hydrosphere, and Biosphere

Time: 570 minutes

Description

Students are engaged in an “inquiry teaching/problem-solving strategy”. Using this strategy, the learners are actively engaged in determining answers to questions or resolving problems. The teacher does not provide the answers; students find the solutions themselves. There are four main areas that students are involved in: problem definition, hypothesis formation, research and data collection, and conclusion formation.

Students use various GIS skills such as querying, buffering, merging, intersection, charting, table joining, shapefile creating, layout creation, labelling, and text notation. In the end, students are able to produce thematic maps to demonstrate their findings.

Strand(s) & Learning Expectations

Strand(s): Geographic Foundations: Space and Systems, Global Connections, Methods of Geographic Inquiry

Overall Expectations

SSV.01 - demonstrate an understanding of basic spatial concepts;

GIV.01 - demonstrate an ability to acquire relevant data and materials and to evaluate their quality;

UCV.01 - explain the use of geotechnologies in monitoring and predicting change in the physical and human environment.

Specific Expectations

GC2.01 - interpret maps and images to learn about areas that cannot be experienced at first hand;

GII.05 - demonstrate an understanding of basic graphing and charting methods (e.g., scatter graphs, line graphs, bar charts, pie charts, population pyramids);

GII.06 - demonstrate an understanding of basic thematic mapping methods (e.g., choropleth, dot, proportional symbol);

GI2.06 - use graphics software to produce a range of well-designed graphs, charts, and diagrams;

GC2.04 - make systematic use of the Internet to acquire information about different parts of the world.

UC1.02 - describe the role of geotechnologies, especially GIS, in predicting processes and events (e.g., urban sprawl, earthquakes, coastal erosion).

Prior Knowledge & Skills

- skills learned in Unit 1
- basic understanding of thematic mapping procedures
- experience with working in small groups
- basic understanding of file-management procedures
- the ability to collect and synthesize information and present it in a coherent well-constructed paragraph

Teaching/Learning Strategies

2.2.1/ As a class...

The teacher guides students on an Internet tour of certain sites that contain information on the four spheres: Lithosphere, Hydrosphere, Biosphere, and Atmosphere.

In small groups (three to four students)...

With the research completed, students produce a worksheet to describe their chosen sphere as well as produce questions to be answered by other students. Other students complete the worksheets.

2.2.2/ Individually...

The research should lead students to recognize various activities and processes within a specific sphere (e.g., they might identify tides within the hydrosphere or basic global wind patterns within the atmosphere). They also identify data, which allows for monitoring and forecast change within the chosen sphere, using a GIS. Students produce maps showing the different spheres and the activities (or outcomes of activities) that take place within the sphere.

Examples of monitored activities are:

- Earthquakes for Lithosphere;
- Tides for Hydrosphere;
- Logging within the Biosphere;
- Carbon Dioxide within the Atmosphere.

Information can come from *ArcCanada* and *ArcVoyager* (ministry licensed).

Possible data themes:

1. Hydrosphere themes include: lakes, rivers, and drainage.
2. Lithosphere themes include: world volcanoes, world cities, global geology, continents (N.A., Europe, Australia, Africa), minerals, and faults.
3. Biosphere themes include: ecoregions, rivers, drainage, vegetation, ecozones, and agriculture.

4. Atmosphere themes include: ecozones, drainage, snowfall, temperature, and rainfall.

(Note: These are only examples. Based on availability, others can be used.)

Students complete several GIS skills, including querying, distance calculation, charting, table joining, shapefile creation, labelling, and text notation, and produce high quality layouts that are used to interpret, forecast and monitor processes taking place within their sphere.

2.2.3/ As a group...

Each group generates a report and compiles the findings in a project folder, including map layouts, charts, and tables. Layouts are then imported into electronic slides to be presented to the rest of the class. After all groups have presented, the entire class should be able to come to a consensus on the characteristics and processes of each of the spheres.

Assessment & Evaluation of Student Achievement

The focus of this activity is a summative task. It builds on previous GIS skills learned and practised by students in Unit 1. This task manifests in a group GIS project/research portfolio that is demonstrated as an electronic presentation (students use presentation software) to the class.

T/L Strategy	Task/Product	Tool	Purpose	Achievement
2.2.1.1 (class)	Teacher-guided Internet research	Teacher-generated guide sheet	Formative	Knowledge Thinking/Inquiry
2.2.1.2 (group with individual input)	Create worksheets	Self-check from teacher notes	Formative	Thinking/Inquiry Application Communication
2.2.1.3 (group with individual input)	Answer worksheet	Peer assessment checklist	Formative	Thinking/Inquiry Application Communication
2.2.2.1 (Individually)	Student-produced maps Identified spheres	Map component checklist	Formative	Thinking/Inquiry Application
2.2.3.1 (group)	GIS presentation portfolio and demonstration to the class	GIS rubric and presentation rubric Appendix 2.4.3.1	Summative	Knowledge Thinking/Inquiry Application Communication

Accommodations

- Oral and written (overhead) instructions for brainstorming maybe helpful for ESL and Special Education students.
- A graphic organizer for the creation of factors within worksheets may help ESL and Special Education students.
- Check IEPs for accommodations required for exceptional students, especially when involved in group work.
- Pre-select the group assignment and assign specific tasks to students before they enter a group.
- Provide individual support in GIS project.
- Extend the use of GIS for students who require enrichment.
- The teacher must be sensitive to an appropriate balance of work so that all students contribute when working in groups.
- If access to computers or LCD-type projectors is limited, presentation could be done as overhead.

- A review of presentation software structure may be necessary for some students. An exemplar presentation or template may be beneficial.
- ESL students and students with special needs may require specific help with key terms and concepts found in the articles.
- Provide extended time on the computer to finish work and allow students to work in partners.

Resources

Websites

NASA (Jet Propulsion Lab) – <http://www.jpl.nasa.gov/radar/sircxsar/ecologyagriculture.html>

Canadian Soil Information System – <http://sis.agr.ca/CANSIS/>

Software

ESRI. *Arcview 3.X*. ESRI, Canada. Obtainable through Board OESS rep.

Print

Hutchinson, Scott and Larry Daniel. *Inside ARCVIEW GIS, 2nd ed.* Onword Press. ISBN1-56690-116-2

Davis, Bruce E. *GIS A Visual Approach*. Onword Press. ISBN 1-56690-098-0

Davis, David E. *GIS for Everyone*. ESRI Press, 1999. ISBN 1-879102-49-8

Getting to Know Desktop GIS. ESRI Press. ISBN 1-879102-42-0

Data

ESRI Canada. *ArcCanada v.2.0* CD. Toronto: ESRI Canada Schools and Libraries Program, 1999.

GeoGratis – <http://geogratis.cgdi.gc.ca/frames.html>

GeoKit CD. OAGEE, 1999. Obtainable through OAGEE regional rep.

Geography Network: free world data – www.geographynetwork.com

Activity 2.3: World Demographic Comparisons: Population, Food, Nutrition, and Their Impact on Quality of Life

Time: 420 minutes

Description

Students learn the basic geography of world population. Further to this, students gain insight and reinforcement with several tasks that are fundamental to understanding, manipulating, and processing geographic information encountered with a GIS. The thematic mapping capabilities of GIS along with data classification methods are highlighted.

Strand(s) & Learning Expectations

Strand(s): Geographic Foundations: Space and Systems, Methods of Geographic Inquiry, Global Connections

Overall Expectations

GCV.01 - explain the use of geotechnologies in addressing matters of global concern;

GCV.02 - explain the role of geotechnologies in understanding peoples and places around the world.

Specific Expectations

SS2.01 - express location correctly by a variety of methods (e.g., latitude and longitude, street address, postal code);

SS2.02 - express scale correctly in numerical and graphical form;

GI2.09 - use GIS software appropriately to perform simple analytical operations (e.g., spatial querying, buffering, overlaying);

GI2.05 - use mapping software to generate a variety of well-designed maps including thematic maps based on statistical data;

GI1.06 - demonstrate an understanding of basic thematic mapping methods (e.g., chloropleth, dot, proportional symbol);

GIV.03 - interpret and analyse data, maps, and images effectively.

Prior Knowledge & Skills

- skills learned in Units 1 and 2
- basic understanding of thematic mapping procedures
- experience working in small groups
- basic understanding of file-management procedures
- the ability to collect and synthesize information and present it in a coherent well-constructed paragraph

Planning Notes

- Locate the necessary data and test/examine the data for suitability and usability before use. Installation on some networks may be confusing for students initially.
- Locate an appropriate article about world population growth. Many magazines have published articles about the subject and there is information to be found on the Internet.

Teaching/Learning Strategies

2.3.1 Introduction to World Population Patterns

2.3.1.1/ As a class...

Students read an article on world population growth or world population patterns. The teacher should develop series of questions that relate to the article. Further, the questions should encourage students to make predictions about where these countries are located, which other countries might be nearing a problem with their population numbers and also address some of the factors that account for a growing population. Students may suggest regions of the world where overpopulation is a problem.

2.3.1.2/ Individually...

Once they are comfortable with basic population terminology and issues, students use a GIS to map crude population data. The teacher should direct the learning initially so that students learn the basic techniques of adding data to a GIS and navigating around the map using a variety of zooming and panning techniques. Students begin to use the label and find functions in order to locate and identify the countries under study.

Students are then directed to add several layers of data in order to better understand the concept of organizing layers in a GIS. Further, students should be instructed about the correct techniques for saving their work and should practise saving and retrieving their work before the end of class.

Finally, students evaluate their initial assumptions about world population patterns based on the maps they have generated in a GIS.

Activity 2.3.2 Major Data Classification Methods

2.3.2.1/ As a class...

The teacher directs a lesson to outline the major data classification methods available in a GIS. The teacher should show how changing the number of category divisions and applying different classification methods can produce radically different maps from the same set of data. The teacher should develop a simple worksheet, which illustrates the major differences that occur on maps by changing the number of classes and shows a small number of data occurrences over a small range.

2.3.2.2/ Individually...

Students work on analysing the effects of using a Quantile distribution, Equal Interval distribution, and Standard Deviation distribution on data. This can be done either through a worksheet and/or as a teacher-directed lesson on overhead. The teacher should avoid a GIS until mathematical concepts are understood as misuse of mathematical concepts can lead to gross errors in mapping.

Activity 2.3.3 Major Data Classification Methods Using a GIS

2.3.3.1/ Individually...

The teacher directs students to work on the GIS, once they are comfortable with the mathematics behind the classification techniques. Students construct four separate maps on a GIS at one time and arrange them in views so that they can be seen simultaneously. Students select the first world map and add a theme containing data at a global level showing the countries of the world. Students should set the number of classes to three and observe the pattern created on the map.

2.3.3.2/ As a Class...

Teacher-directed discussion should follow about the perceptions of world population distribution.

2.3.3.3/ Individually...

Students select the first world map and add a theme containing data at a global level, and showing the countries of the world. They set the number of intervals to five.

2.3.3.4/ As a Class...

- Teacher-directed discussion should follow about how increasing the number of intervals might change the viewer's perceptions of world population distribution. This pattern should be continued for the next two maps, further increasing the number of intervals to seven and then nine.
- The focus at the end of this series of maps should be about choosing the most effective number of classes to make the map most effective for a high school audience. Discussion could also focus on the importance of identifying the viewing audience for the map.
- The teacher should use a short checklist to ensure that the basic cartographic elements of the maps are complete and correct. They can refer to their cartographic rubric (Unit 1).
- The second part of this lesson involves another series of four maps.

2.3.3.5/ Individually...

Students (with teacher-led instruction) produce four maps with the same or similar numbers of classes. However, the classification method should be changed.

- Map One should use the Natural Breaks method.
- Map Two should use the Quantile distribution method.
- Map Three should use the Equal Interval method.
- Map Four should use the Standard Deviation method.

Again the focus should be on how the choice of classification types alters the appearance of the map.

2.3.3.6/ Individually...

Students make their own map choosing the number of intervals and the classification method. They label the top five to ten most populated countries as shown by their map. Using the capabilities of a GIS, they identify the location of the capital cities of those countries and label the locations using the text and label tools.

Activity 2.3.4 Introduction to World Population Growth Indicators

Students practise previously learned skills with similar data sets and learn how to export the maps from a GIS for use in other programs.

2.3.4.1/ As a class...

The teacher gives students a brief outline of some common file types and their associated usage. This should include the common ones associated with a GIS as well as file types associated with graphics programs, word processors, spreadsheets, and databases. The teacher also notes that all file types need not be covered at this point. Students construct a world map showing population density using a GIS. Students are then instructed as to the methods of exporting map views or layouts and the choices to be made when doing so. The teacher may direct students to the File Management System to examine the changes in image file sizes based on export file choices.

2.3.4.2/ As a class...

Students are directed to start a word-processing program and instructed on importing graphics. They type a brief description about world population density patterns. Students should be encouraged to use effective geographic terminology.

2.3.4.3/ Individually...

Students are given the remainder of the assignment. Students construct three additional maps in a GIS relating to birth rates, death rates, and fertility rate. They export the maps from a GIS and import them into the word-processing document already started. They provide a brief analysis of how each of these patterns compares to the population density map. The teacher uses the rubric (Appendix 2.4.3.1) to assess the maps and the analysis. Care should be taken to ensure that in the weighting of the rubric, the analysis section is given a significant portion of the grade.

Activity 2.3.5 Mapping World Quality of Life Patterns

2.3.5.1/ Individually...

Students produce a series of maps using world data. The teacher prepares a scenario that places students in a hypothetical but realistic situation for solving a problem using a GIS. Students should be given adequate direction and pointed to data suitable for the project. They save the project for peer evaluation.

Activity 2.3.6 Evaluating Quality of Life Maps

2.3.6.1/ As a small group...

- Students, with direction by the teacher, attempt to grade the efforts of their peers. Using a pre-constructed checklist and in pre-assigned small groups, students examine the four maps, assign appropriate levels (1,2,3,4) to each one, and average the four map evaluations.
- The teacher should use a demonstration model map (of excellent quality) and point out the various components that comprise a good map. This could be compared to a pre-constructed (but very poor quality) map, which is lacking many key components. The teacher then instructs students to use the checklist provided and evaluate their peer's work, referring to the sample maps when necessary.

Assessment & Evaluation of Student Achievement

Assessment of students should focus on the development of critical thinking skills. These initial lessons will require reinforcement and guided learning. Repetition of the skill occurs throughout the course and teachers should be aware that it takes some students longer than others to become proficient. Students need to have some time to evaluate what their peers have accomplished. There is a tendency to evaluate the first map with very high marks, as it can appear very professional. However, care should be taken to ensure that all map elements are present and that the student has made good use of the techniques reviewed in Unit 1. Having peers evaluate this first product should help to reinforce positive efforts and ensure that examples of both good and poor quality maps are viewed. The goal is to have students create better maps overall.

The teacher should carefully direct the peer evaluation. This requires the development of a very specific rubric, which allows only a moderate amount of interpretation on the part of the student. Eventually, this could serve as a checklist for the basics of map production.

T/L Strategy	Task/Product	Tool	Purpose	Achievement
2.3.1.1 (class)	Reading to generate whole-class discussion	Teacher-generated checklist	Formative	Knowledge
2.3.1.2 (individually)	Map raw data in GIS	View component checklist	Formative	Knowledge
2.3.2.1 (class)	Teacher-led Socratic lesson	Discussion	Formative	Thinking/Inquiry
2.3.2.2 (individually)	Answer teacher-generated worksheet	Teacher-generated checklist	Formative	Knowledge
2.3.3.1 (individually)	Map construction of four individual products	View component checklist	Formative	Application
2.3.3.2 (class)	Whole-class discussion	Worksheet	Formative	Thinking/Inquiry
2.3.3.3 (individually)	Map construction	Worksheet	Formative	Application
2.3.3.4 (class)	Whole-class discussion	Discussion	Formative	Thinking/Inquiry
2.3.3.5 (individually)	Map raw data in GIS	View component checklist	Formative	Knowledge
2.3.3.6 (individually)	Map raw data in GIS	View component checklist	Formative	Application
2.3.4.1 (class)	File Types note making	Teacher-generated Overheads	Formative	Knowledge
2.3.4.2 (class)	Import graphics	Teacher-led Instruction	Formative	Knowledge
2.3.4.3 (individually)	Map construction	Worksheet	Formative	Application
2.3.5.1 (individually)	Map raw data in GIS	Worksheet	Formative	Application
2.3.6.1 (group)	Evaluate maps	Checklist	Summative	Thinking/Inquiry

Accommodations

- A review of basic arithmetic classifying may be needed with some students.
- Some accommodation may be made for learners encountering difficulty. This may be done through allowing increased time for the completion of the maps.
- Oral and written (overhead) instructions maybe helpful for ESL and Special Education students.
- A graphic organizer for the creation of factors within worksheets helps ESL and Special Education students.

- Check IEPs for accommodations required for exceptional students, especially when involved in group work.
- Pre-select the group assignment for students and assign specific tasks before they enter a group.
- Provide individual support in GIS project.
- Extend the use of GIS for students who require enrichment.
- The teacher must be sensitive to an appropriate balance of work so that all students contribute when working in groups.
- If access to computers or LCD type projectors is limited, presentation could be done as overheads.
- A review of presentation software structure may be necessary to assist ESL student and students with writing difficulty. An exemplar presentation or template may be beneficial.
- ESL students and students with special needs may require specific help with key terms and concepts found in the articles.
- Provide extended time on the computer to finish work and allow students to work in partners.

Resources

Websites

NASA (Jet Propulsion Lab) – <http://www.jpl.nasa.gov/radar/sircxsar/ecologyagriculture.html>

www.planetproject.ca

www.esricanada.com/k-12/gis/capabilities.html

Software

ESRI. *Arcview 3.X*. ESRI Canada. Obtainable through Board OESS rep.

Print

Audet, Richard and Gail Ludwig. *GIS in Schools*. ESRI Press, 2000. ISBN 1-879102-85-4

Davis, Bruce E. *GIS A Visual Approach*. Onword Press. ISBN 1-56690-098-0

Davis, David E. *GIS for Everyone*. ESRI Press, 1999. ISBN 1-879102-49-8

Getting to Know Desktop GIS. ESRI Press ISBN 1-879102-42-0

Data

ESRI Canada. *ArcCanada v.2.0* CD. Toronto: ESRI Canada Schools and Libraries Program, 1999.

GeoGratis – <http://geogratis.cgdi.gc.ca/frames.html>

GeoKit CD. OAGEE, 1999. Obtainable through OAGEE regional rep.

Geography Network: free world data – www.geographynetwork.com

Activity 2.4: Industrialization and Quality of Life

Time: 420 minutes

Description

This series of lessons instructs students about the basic geography of global industrialization. Students gain insight into additional fundamental tasks encountered when working in a GIS. Adding tabular data, creating charts, joining tables, and multitasking with other suite-type software programs are highlighted.

Strand(s) & Learning Expectations

Strand(s): Global Connections, Methods of Geographic Inquiry

Overall Expectations

GIV.03 - interpret and analyse data, maps, and images effectively.

Specific Expectations

GC2.02 - compare images of different places with a view to identifying similarities and contrasts;
GC2.04 - make systematic use of the Internet to acquire information about different parts of the world;
GC3.01 - assess the impacts of geotechnologies on various aspects of international affairs (e.g., use of GIS in disaster relief, GPS in warfare, satellite monitoring in controlling nuclear proliferation);
GI2.14 - enter data into the computer by a variety of methods (e.g., keyboarding, downloading files, scanning);
GI2.06 - use graphics software to produce a range of well-designed graphs, charts, and diagrams;
GI1.02 - identify sources of data, maps, images, and other geographic products (e.g., governments, private companies, the Internet);
GI1.04 - identify the conceptual and design factors that make for a well-designed map or graphic (e.g., good generalization, symbol contrast, balanced layout).

Prior Knowledge & Skills

The skills learned in Strategy 2.1.2 are utilized throughout the remainder of the unit and the course. Care should be taken to encourage students to revisit and build proficiency in these basic map manipulation techniques. Mapping skills in the following series of lessons rely on the student's understanding of the basic classification techniques learned so far.

Planning Notes

- Locate the data and test the data before use. Installation on some networks may not allow write access for editing purposes. The teacher should investigate and make arrangements to move the data to unprotected areas where write access is granted.
- Locate an appropriate article or website about global industrial growth and patterns. Many magazines have published articles about the subject and there is information to be found on the Internet.

Teaching/Learning Strategies

Activity 2.4.1 Introduction to Global Industrialization Patterns

2.4.1.1/ As a class...

Students research and read an article on global industrialization or world economic globalization patterns from the Internet. The teacher should encourage students to develop a series of questions that relate to the article. The questions should encourage students to make predictions about where the most highly industrialized countries are located, which countries may be developing, and which are underdeveloped. The teacher encourages the use of geographic reference terms such as Western Europe and South East Asia. Students should be encouraged to suggest countries within regions where industrial development might not fit the established pattern.

2.4.1.2/ Individually...

Once students are comfortable with basic terminology and issues, they use a GIS to map industrialization data using Equal Interval and Standard Deviation techniques.

The teacher directs the learning initially so that students have practice using the basic skills learned in previous lessons regarding adding data to a GIS. A brief review of zooming and panning techniques, as well as additional labelling techniques, is appropriate. Students begin to use the join table feature so that non-spatial data can be attached to existing spatial data inside a GIS. Finally, students confirm, positively or negatively, their initial assumptions about global industrialization patterns based on the maps that they have generated in a GIS.

Activity 2.4.2 Creating New Data Using a Spreadsheet

This teacher-directed lesson's major goal is to teach how to enter data into a spreadsheet and then export it as a DBF file for use in a GIS. The teacher shows students how to save the file and join it to existing spatial data inside a GIS.

2.4.2.1/ As a team...

- The teacher could develop a simple worksheet that shows a small number of data occurrences so that students are not inputting data for all the countries of the world. The teacher may also choose to use data from a text or atlas that would be suitable for use in another course (e.g., World Issues).
- Students work in pairs to input the data into the spreadsheet (e.g., one student reads the data and the other enters it into the spreadsheet, taking turns at the halfway point).
- Students save their data as a spreadsheet file and then export it as a dbase IV file. Students join the file to existing spatial data and classify their new data set.

Activity 2.4.3 Factors Affecting Industrial Development

2.4.3.1/ Individually...

Students construct a map that shows the industrial development levels of countries. They extract the data from *ArcCanada* world files and demonstrate these themes and tables on their maps.

2.4.3.2/ As a group...

The teacher then directs students to join necessary tables and create graphs using the classification method CHARTS. The information for these charts and graphs comes from the attribute table of the identified themes.

2.4.3.3/ Individually...

In a layout, students compare countries from at least four different continents. This exercise also may be done using a worksheet style approach.

Activity 2.4.4 Industrialization and Quality of Life

Students use problem-solving skills and compile maps to resolve a given scenario.

2.4.4.1/ As a group...

The teacher develops a scenario that mimics a real-world issue or problem to show students how geotechnology can be used to investigate international affairs.

The teacher gives students a brief outline of the problem and provides hints indicating the kind of information, included with the GIS, that can be brought to bear on the subject

2.4.4.2/ Individually...

Students choose the data to be mapped, layout the data in a suitable fashion, and provide a rudimentary interpretation of the information as to how industrial development is an indicator of the quality of life in various countries. They export the maps (layouts) and then import them into to a word-processing document or print them directly and submit as a paper. Students are encouraged to use effective geographic terminology.

Activity 2.4.5 Evaluating Quality of Life Maps

2.4.5.1/ As a team...

With direction by the teacher, students attempt to grade their classmates' projects. Using a pre-constructed rubric, students examine the maps, assign appropriate levels to each one, and determine a grade. The teacher, using the same rubric, grades the map/project for critical feedback to the student.

Assessment & Evaluation of Student Achievement

Assessment of the students should focus on the development of critical skills. These initial lessons require reinforcement and guided learning. Repetition of the skills occurs throughout the course and teachers should be aware that it takes some students longer than others to become proficient. Also students need to have some feedback as to what they have accomplished. There is a tendency to evaluate the first maps with very high marks, as it can appear very professional. However, care should be taken to ensure that all map elements are present and that the student has made good use of geographic terminology and of the techniques learned so far. Having both a self-evaluation and a teacher evaluation should help to reinforce positive efforts and ensure that maps are viewed in a critical fashion. The goal is to have students create better overall maps.

The teacher should carefully direct the self-evaluation. This requires the development of a very specific rubric, which allows only a moderate amount of interpretation on the part of the student. Eventually, this could serve as a checklist for the basics of map production.

T/L Strategy	Task/Product	Tool	Purpose	Achievement
2.31.1 (class)	Library Resource/Centre and Internet research Whole-class discussion	Student-generated question sheet	Formative	Knowledge
2.3.1.2 (individually)	Map raw data in GIS	Map basic data	Formative	Knowledge
2.3.2.1 (as a team)	Teacher-directed lesson	Worksheet	Formative	Knowledge
2.3.3.1 (individually)	Mapping data	Teacher-generated checklist	Formative	Knowledge
2.3.3.2 (as a group)	Teacher-directed lesson on constructing graphs on maps	Checklist	Formative	Application
2.3.3.3 (individually)	Constructing layouts	Worksheet	Formative	Knowledge Application
2.3.4.1 (as a group)	Scenario	Worksheet	Formative	Application Thinking/Inquiry
2.3.4.2 (individually)	Mapping data	Checklist	Formative	Thinking/Inquiry Application
2.3.5.1 (as a team)	Evaluating maps	Rubric/Checklist	Summative	Thinking/Inquiry

Accommodations

- Allowing increased time for the completion of the maps.
- Oral and written (overhead) instructions for brainstorming maybe helpful for ESL and Special Education students.
- A graphic organizer for the creation of factors within worksheets may help ESL and Special Education students.
- Check IEP for accommodations required when there are exceptional students, especially when involved in group work.

-
- Pre-select the group assignment for students and assign specific tasks before they enter a group.
 - Provide individual support in GIS project.
 - Extend the use of GIS for students who require enrichment.
 - The teacher must be sensitive to an appropriate balance of work so that all students contribute when working in groups.
 - If access to computers or LCD-type projectors is limited, presentation could be done as overheads.
 - A review of presentation software structure may be necessary for some students with writing difficulty. An exemplar presentation or template may be beneficial.
 - ESL students and students with special needs may require specific help with key terms and concepts found in the articles.
 - Provide extended time on the computer to finish work and allow students to work with partners.

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www.planetproject.ca

www.esricanada.com/k-12/gis/capabilities.html

Software

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GeoKit CD. OAGEE, 1999. Obtainable through OAGEE regional rep.

Geography Network: free world data – www.geographynetwork.com

Appendix 2.2

File Types

When working with a Geographic Information System, you often deal with several different types of files. Each of these has different uses within the system and for generating maps.

The three letters after the file name that you choose identify file type. You must know which files perform what function and which ones work together.

Below are some of the files that we will be using immediately. Others are encountered as we progress through the course.

PCX	A graphic file that is recognized almost universally by graphics programs. It only holds 16 colours. If your graphic holds more colours than that, they are converted to one of the 16 colours available. Not very good if you have to scale the graphic.
CGM	Computer Graphics Metafile: Another graphic file type that holds more colours (256).
WMF	Graphic file type: Windows Metafile (sometimes called Placeable WMF) that holds many colours and, because it is a vector file format, is fully scalable.
JPG GIF BMP	Other types of graphic files.
TXT	A text file used for storing only words with no style (bold, italics, etc.) attached to them. This is the simplest form of text storage and works with any program.
WP	Proprietary file for <i>WordPerfect</i> word-processing documents
DOC	Proprietary file for <i>MSWord</i> word-processing documents. New versions can read older files. Older version cannot read newer ones even though the extension is the same.
WP3	Proprietary file for <i>Quattro Pro</i> spreadsheets.
XLS	Proprietary file for <i>Excel</i> spreadsheets
SHW	Proprietary file for <i>WordPerfect Presentations</i> .
PPT	<i>PowerPoint</i> , the proprietary file for Microsoft office presentations.
APR	Proprietary file for an <i>ArcView project</i> . This file only contains instructions for the program and cannot be used to print maps directly.
SHP	Proprietary file for <i>ArcView</i> map files. This is the file that controls the shapes on the map. These can contain points, lines, or polygons.
SHX	Arcview Interchange file that is required for communication between the shapefile and the computer. It also allows communication between the DBF file and the shapefile.
DBF	Database file where all the attribute data is stored for use in <i>ArcView</i> .

Appendix 2 4.1

Quality of Life Exercise

Preamble

Some newspapers articles have recently been concerned with the growing disparity between rich and poor nations of the world. Some major papers have suggested that, throughout the 1900s, little progress has been made towards improving the quality of life in many countries of the world. The United Nations and the World Bank began work on a project that investigates these claims. Both of these organizations want to commit significant amounts of money towards ensuring that all people of the world have adequate access to healthcare and clean water while improving their overall quality of life.

Situation

You have been hired as a geotechnologies specialist with the UNESCO branch of the United Nations. Your project requires you to produce a series of maps that identify where money should be spent in order to improve the quality of life for the people in that region.

At press time, UNESCO would like to display a series of world maps that illustrate the following quality of life indicators:

- Industrial Capacity: Show countries that are seriously under-developed in terms of industrial capacity.
- Drinking Water: Show countries that do not have reasonable access to safe drinking water.
- Literacy: Show countries that have a below average adult literacy rate.
- Other: Examine data on the number of doctors, teachers, cars, phones, etc.

They are not able to help you much as they do not appear to understand how geotechnology can help them at all. However, they have collected considerable amounts of data on the topic and are keen to see its geographic distribution. Of course, they understand that you may have additional information available that would allow you to perform a more detailed study and enhance the content of the project.

Available Data

Data available in c:\ArcCanada\Disk2\world\cntry95.shp You should make the whole part here into a table – it would be easier to read. Example:

Field Name in Attribute Table	Description
Poppdoc	shows the population per doctor
Heal_pcap	shows the number of healthcare workers per capita
Safewater	shows the percentage of the population with access to safe drinking water
Sanitation	shows the percentage of the population with access to sanitation systems
Litrates	shows the percentage of the population with basic literacy
Studptch	shows the average number of students per teacher
GNP_cap	shows the gross national product (wealth) per capita
	There are additional fields for number of cars, phones...

Students require the directory where this data is located (e.g., c:\...\...\cntry_94.shp and associated tables).

Note: This data should be available with the standard default installation of most GIS programs.

The presentation is due to the printers in two hours. Good Luck.

Appendix 2.4.3.1

GIS Rubric

Expectation	Level 1 (50 – 59%)	Level 2 (60 – 69%)	Level 3 (70 – 79%)	Level 4 (80 – 100%)
Thinking/Inquiry Interpret and analyse data, maps, and images effectively, GIV.03	- few of the maps and images have been interpreted effectively	- some of the maps and images have been interpreted effectively	- most of the maps and images have been interpreted effectively	- all of the maps and images have been interpreted effectively
Communication Application Identify the conceptual and design factors that make for a well-designed map, GI1.04	- few of the map essentials are present in the layout	- some of the map essentials are present in the layout	- most of the map essentials are present in the layout	- all or almost all of the map essentials are present in the layout
Application Use GIS software appropriately to perform simple analytical operations, GI2.09	- few of the specific operations needed to perform an analysis are accomplished (e.g., clipping and buffering)	- some of the specific operations needed to perform an analysis are accomplished (e.g., clipping and buffering)	- most of the specific operations needed to perform an analysis are accomplished (e.g., clipping and buffering)	- all specific operations needed to perform an analysis are accomplished (e.g., clipping and buffering)
Knowledge Demonstrate an understanding of basic thematic mapping methods, GI1.06	- few of the required themes are present	- some of the required themes are present	- most of the required themes are present	- all or almost all the required themes are present
Thinking/Inquiry Demonstrate an ability to acquire relevant data and materials and to evaluate their quality, GIV.01	- minimum data has been acquired - minimally evaluates data quality	- some of the data required has been acquired - moderate evaluation of data quality	- most of the data required has been acquired - considerable evaluation of data quality	- required data has been acquired - completely evaluates data quality
Knowledge Content-Geography (criteria relates to specific geographical expectations)				

Note: A student whose achievement is below level 1 (50%) has not met the expectations for this assignment or activity.

Note: This is a culminating task rubric that can be used with any GIS project, regardless of topic or software. With slight modifications, it could be used as a summative assessment tool throughout the unit. It is important that the teacher work with students to demonstrate the specifics of the established criteria. It would also be of benefit for the teacher to show exemplars of specific projects.

Appendix 2.2.4.1

World Demographics: Population Indicators

Situation

A situation has occurred in which the principal of your school has been selected to come before the Ministry of Education to showcase what is being done with GIS in your school. While the Ministry knows that this is still a new program, they would like to see what students have been able to produce so far.

The principal has suggested that many people do not know how powerful the use of geotechnology can be when used to solve problems of a global nature. Therefore, he/she has suggested that students showcase a global problem that can be examined with different degrees of complexity. Preferably, this problem should be related to global population issues.

Task

Produce a series of maps showing data on the status of the world's population. These maps should focus on issues such as average life expectancy, population growth rates, population doubling times, and infant mortality rates.

Files available for this project can be found on Disk 2 of the *ArcCanada* CD in the World folder.

Remember to do the following:

- Include at least four views at various scales (zoom in/out to different areas).
- Change the name of the views to non-cryptic titles.
- Label map features clearly and concisely.
- Add suitable map layers to the appropriate views.
- Join non-spatial data to existing spatial data layers.
- Choose appropriate data classification methods.
- Use a background of the world in a neutral colour/shade if required. Use a background of water, for the world view.

For this exercise, no other files are allowed.

Unit 3: Human Interactions in the Physical World

Time: 25 hours

Unit Description

In this unit, students apply geotechnologies to explore their responsibilities towards the human and physical environment. By identifying and describing various applications of geotechnologies, they are able to understand the earth's systems and the human interactions within these systems. The topics covered focus on the responsible use and management of resources, environmental problems and protection, human and natural disasters, and Native land issues. They could use a raster-based program for study of a local issue (*MFTeach*) and a vector-based program for their global focus. The world is constantly changing, therefore use of geotechnology, such as GIS, enables students to appreciate the earth's features and how they are continually being monitored. Their work reinforces the role of technology in promoting concepts of stewardship and sustainable resource use.

Unit Synopsis Chart

Activity	Time	Expectations	Assessment	Tasks
3.1: Resources	5 hours	UC1.01, SSV.03, SS1.09, HE1.01, GI1.07, GI1.08, GC2.03, GI2.11 CGE1d, 1e, 2a, 2b, 2d, 2e, 3c, 3d, 4f, 7i	Knowledge/ Understanding Thinking/ Inquiry Communication Application	Analysing Resources through the Use of Satellite Images
3.2: Natural Disasters	5 hours	UC1.02, UCV.01, HE1.03, GI2.02, GI2.14 CGE1d, 1e, 2a, 2b, 2d, 2e, 3d, 7i	Knowledge/ Understanding Communication Application	The Role of Geotechnology in the Study of Natural Disasters at both a local and global level using appropriate software
3.3: Human Disasters	5 hours	UC1.01, HEV.01, UCV.01, HE3.03, GI2.02 CGE1d, 1e, 2a, 2b, 2d, 2e, 3d, 7i	Knowledge/ Understanding Communication Application	Mapping the Extent and Characteristics of Human Disasters
3.4: Human Settlement and Indigenous People	4 hours	HEV.01, HE2.01, HE3.01, HE3.02, GI2.10, GI2.02, GI2.14 CGE1d, 1e, 2a, 2b, 2c, 2d, 2e, 3c, 4c, 4f, 5a, 5e, 5f, 5g, 7f	Knowledge/ Understanding Thinking/ Inquiry	The Use of Geotechnology in Demographics and Native Issues using <i>MFTeach</i> and <i>Arcview</i>
3.5: Environmental Degradation	6 hours	SS1.09, HEV.01, HEV.02, HE1.02, GI2.02, GI2.14 CGE1d, 1e, 2a, 2b, 2d, 2e, 3c, 3d, 4f, 5a, 5e, 5f, 5g	Knowledge/ Understanding Thinking/ Inquiry Communication Application	Characteristics of an Environmental Problem: group work and GIS lab

Activity 3.1: Resources

Time: 300 minutes

Description

Students undertake a number of activities that allows them to identify applications of geotechnologies relating to natural resources in Canada and/or other parts of the world. Through the study and analysis of various sets of aerial photographs, maps, and satellite images, students describe the role of geotechnologies in facilitating the efficient and responsible development of these resources and how they allow for the monitoring of changes to resources over time. Students apply the use of GIS to the study of farmland or mineral resources to show how such geotechnologies can be used to facilitate the development and management of such resources.

Strand(s) & Learning Expectations

Strand(s): Geographic Foundations: Space and Systems, Human-Environment Interactions, Understanding and Managing Change, Methods of Geographic Inquiry

Overall Expectations

SSV.03 - describe how geotechnologies are used in environmental protection, resource management, and other areas.

Specific Expectations

SS1.09 - identify applications of geotechnologies relating to resources and the environment (e.g., species mapping, weather forecasting, forest management, precision farming);

HE1.01 - describe the role of geotechnologies in facilitating the efficient and responsible use of resources (e.g., forests, minerals, fisheries);

GC2.03 - interpret satellite images to obtain a synoptic view of major world features;

UC1.01 - describe the role of geotechnologies, especially satellite imaging, in monitoring changing features and phenomena (e.g., sea ice, forests, oil spills);

GI1.07 - identify the main types of remote sensing images (e.g., aerial photographs, thermograms, radar images);

GI1.08 - explain the principles of image interpretation, with particular reference to aerial photographs;

GI2.11 - perform basic operations correctly on aerial photographs.

Ontario Catholic School Graduate Expectations

CGE1d - develops attitudes and values founded on Catholic social teaching and acts to promote social responsibility, human solidarity, and the common good;

CGE1e - speaks the language of life... “recognizing that life is an unearned gift and that a person entrusted with life does not own it but that one is called to protect and cherish it” (Witnesses to Faith);

CGE2a - listens actively and critically to understand and learn in light of gospel values;

CGE2b - reads, understands, and uses written materials effectively;

CGE2d - writes and speaks fluently one or both of Canada’s official languages;

CGE2e - uses and integrates the Catholic faith tradition, in the critical analysis of the arts, media, technology, and information systems to enhance the quality of life;

CGE3c - thinks reflectively and creatively to evaluate situations and solve problems;

CGE4f - applies effective communication, decision-making, problem-solving, time, and resource management skills;

CGE7i - respects the environment and uses resources wisely.

Prior Knowledge & Skills

- familiarity with the use and interpretation of satellite imagery and aerial photographs
- an ability to perform basic operations correctly on aerial photographs and satellite images (e.g. determine scale, identify features through interpretation).
- knowledge of natural resources from the Grade 8 and 9 Geography programs
- the main operational skills involved in operating the *ArcView* GIS

Planning Notes

- Review the main concepts of resource development and management (including that of farmland, forestry, and mineral wealth), either from a Canadian perspective or from that of another part of the world that is suitable.
- Obtain suitable class sets of aerial photographs and corresponding satellite images (thermograms, radar images, etc.) or provide access to a computer lab where such images can be viewed from various databases, on-line (see Resources), or from GIS software. The material should show changes to a resource through time (e.g., comparisons in the extent of forest development, or changes in agricultural land use, over a period of time).
- Book a computer lab (for up to two days) for GIS projects.

Teaching/Learning Strategies

1. The teacher reviews the topic of natural resources (e.g., farmland, mineral resources, forests, and water resources) and leads the class in a discussion on the main factors affecting the distribution of these resources (e.g., climate, soils, geology, landscape and human impact/degradation).
2. The teacher outlines the kinds of problems involved with the development of each of these natural resources. The teacher may wish to guide students through some of the relevant material (e.g., over fishing, clear cutting, mineral tailings, etc.) found in *Making Connections* (see Resources).
3. The use of remote sensing in studying and monitoring natural resources, in pairs. The teacher reviews the topics of aerial photography and 3-D imaging, Remote Sensing Images, and Satellite imaging. A set of aerial photographs and corresponding Radarsat and/or Landsat images, of the same area, is given to the students. Students work in pairs to review the main characteristics of each image and identify features that they recognize on both aerial photograph and satellite image. The teacher summarizes the findings with the class and students complete a teacher-prepared organizer.
4. The class brainstorms ideas on how the use of geotechnologies can assist in the location, assessment, development, and management of these natural resources. The teacher summarizes the main ideas and expands to introduce and explain other applications. At this point, the teacher may also wish to introduce the use of Gravimeters and Magnetometers in the location of mineral deposits.
5. Students are allocated a specific natural resource and study a number of aerial photos and satellite images of areas that illustrate this type of resource (e.g., agricultural management; land cover classification and forest management; mineral exploration; monitoring water bodies, etc.). Some of the material shows changes in the resource through time. Students complete a worksheet on their resource. The teacher circulates among the groups, giving assistance and promoting discussion and ideas. The worksheet requires students to consider the following: i) the use of satellite images, etc., in assisting students' understanding of the resource; ii) changes over time and the impact they have had; iii) how satellite images, etc., can be used with GIS to assist in the management of this resource and produce guidelines for its future sustainable development.

6. Students give a 5- to 10-minute presentation of their findings to the class using a visual display.
7. The use of GIS in studying and making predictions with regards to natural resources. Individually (or in pairs if computers are limited) This activity concludes with a GIS project (see Resources). The teacher guides students through the background information and student instruction sheets. The teacher circulates through the lab, assisting students and giving guidance.
8. Students conclude their project by using the GIS to produce finished maps showing the locations that have been chosen for future development and by completing a brief written report on their findings to explain the factors that influenced their decisions.

Assessment & Evaluation of Student Achievement

T/L Strategy	Task/Product	Tool	Purpose	Achievement
5 (small group)	Image Interpretation	Worksheet	Formative	Knowledge/ Understanding Thinking/Inquiry
6 (small group)	Short group presentation	Peer assessment using teacher-generated checklist	Formative	Communication
7 (individual or pairs)	GIS-generated map	Mapping checklist (Appendix 3.5.3)	Formative	Communication Application
8 (individual or pairs)	Written report	Paragraph checklist (Appendix 3.4.1)	Summative	Knowledge/ Understanding Communication Application

Accommodations

- Check IEP for accommodations required when there are exceptional students, especially when involved in group work.
- Pre-select the group assignment for students and assign specific tasks before they enter a group.
- Provide individual support in GIS project.
- A review of paragraph structure may be necessary to assist ESL student and students with writing difficulty. An exemplar paragraph may be beneficial.
- Students with writing difficulty may require teacher and/or peer assistance in completing their written paragraphs. Students may need help with spelling, verb tense, thought sequence expressed in complete sentences, and links between sentences.
- ESL students and students with special needs may require specific help with key terms and concepts found in the articles.
- Extend the use of GIS for students who require enrichment.

Resources

Websites

Canada Centre For Remote Sensing (CCRS) – <http://www.ccrs.nrcan.gc.ca/ccrs/imgserv/imgserve.html>

A very useful site with remote sensing images, interpretations, data, and many related links.

Images of Canada – <http://www.ccrs.nrcan.gc.ca/ccrs/imgserv/tour/toure.html>

A CCRS site for aerial photographs and satellite images with detailed interpretations.

Canadian Soil Information System – <http://sis.agr.ca/CANSIS/>

A source for ecosystems and soil survey data, maps, GIS, and remote sensing images.

Applications in Action – <http://www.ccrs.nrcan.gc.ca/ccrs/tekrd/radarsat/images/imgacte.html>
A CCRS site for RADARSAT1 images with detailed interpretations.

Applications in Action – <http://www.ccrs.nrcan.gc.ca/ccrs/tekrd/radarsat/images/imgacte.html>
Maps, satellite images, publications, and other geospatial data.

GeoGratis – <http://geogratias.cgdi.gc.ca/frames.html>
A source for geospatial data, images, and related links.

NASA (Jet Propulsion Lab) – <http://www.jpl.nasa.gov/radar/sirexsar/ecologyagriculture.html>
A source of radar images for agriculture and ecology research.

Software

ESRI Canada. *ArcCanada2 CD*. Toronto: ESRI Canada k-12 project, 2000.

Ontario Ministry of Education and Training. *Canadian Geographic Explorer CD*. Special Edition Irwin Publishing, Canada, 2000.

Print

Clark, Bruce and John Wallace. *Making Connections*. Scarborough, Ontario: Prentice Hall Ginn Canada, 1999. ISBN 0130126357

Appendices

Appendix 3.4.1

Appendix 3.5.3

Activity 3.2: Natural Disasters

Time: 300 minutes

Description

The teacher introduces the topic of natural disasters and the role that geotechnologies plays in their understanding, monitoring, and prediction. Following a teacher overview of the main causes of natural disasters, students work in groups to undertake an Internet research activity involving the use of search engines to research websites relating to natural disasters, GIS, and geotechnologies. Students then use their research to explain how the use of geotechnologies can be applied to monitoring the processes involved in these natural phenomena, predicting the likely outcomes of such events, and addressing the human problems resulting from such environmental forces. Students present their findings to the class (including a visual display). Students then enter tracking data related to a hurricane and use a GIS to create a map that allows them to make predictions of likely landfalls and wind speeds.

Strand(s) & Learning Expectations

Strand(s): Human-Environment Interactions, Understanding and Managing Change, Methods of Geographic Inquiry

Overall Expectations

UCV.01 - explain the use of geotechnologies in monitoring and predicting change in the physical and human environment.

Specific Expectations

HE1.03 - describe the role of geotechnologies in addressing human problems resulting from environmental forces (e.g., hurricanes, floods, avalanches);

UC1.02 - describe the role of geotechnologies, especially GIS, in predicting processes and events (e.g., urban sprawl, earthquakes, coastal erosion);

GI2.14 - enter data into the computer by a variety of methods (e.g., keyboarding, downloading files, scanning);

GI2.02 - research websites relating to geography, GIS, and other geotechnologies and use search engines to locate sites of interest.

Ontario Catholic School Graduate Expectations

CGE1d - develops attitudes and values founded on Catholic social teaching and acts to promote social responsibility, human solidarity, and the common good;

CGE1e - speaks the language of life... “recognizing that life is an unearned gift and that a person entrusted with life does not own it but that one is called to protect and cherish it” (Witnesses to Faith);

CGE2a - listens actively and critically to understand and learn in light of gospel values;

CGE2b - reads, understands, and uses written materials effectively;

CGE2d - writes and speaks fluently one or both of Canada’s official languages;

CGE2e - uses and integrates the Catholic faith tradition, in the critical analysis of the arts, media, technology, and information systems to enhance the quality of life;

CGE3d - makes decisions in light of gospel values with an informed moral conscience;

CGE7i - respects the environment and uses resources wisely.

Prior Knowledge & Skills

- terminology and concepts involved in major natural disasters (e.g., volcanoes, earthquakes, and hurricanes)
- ability to research material from both print and Internet sources
- understanding of the main operational skills involved in operating the *ArcView* GIS

Planning Notes

- Book a computer lab for both Internet research and GIS projects (two to three days).
- Prepare printed worksheets and GIS instruction sheets in advance.
- Bookmark suitable websites for each type of natural disaster (see Resources).

Teaching/Learning Strategies

1. The teacher introduces the topic of natural disaster and brainstorms ideas on what students consider to be a ‘natural’ disaster. The teacher lists the types of disaster (i.e., earthquake, volcanic eruption, hurricane, tornado, avalanche, landslide, flood, and tsunami) and briefly summarizes the characteristics and effects of each. Students take notes. The teacher may wish to show video material on various types of natural disaster. Students record key material, as directed by the teacher.
2. The teacher then explains how geotechnologies would play a role in studying these events (e.g., tracking storms/tornadoes using Doppler Radar, monitoring volcanic areas, and mapping areas affected by landslides/floods).
3. The class is divided into groups and each researches a different natural disaster using the Internet. Students complete a worksheet that guides them in the type of information to collect. The worksheet requires students to carry out and consider: i) the types of physical conditions leading to this kind of natural disaster; ii) the geotechnologies that are used to observe and track the development of such events (e.g., aerial photographs, radar satellite images, GPS, and GIS); iii) how geotechnologies may be applied, by local governments and communities, to make predictions and plan for this kind of natural disaster; iv) the role of geotechnologies in assisting in the aftermath of a disaster (e.g., in the guiding of emergency services to victims).
4. Students also collect images (maps, photographs, satellite images) relevant to their research and use them to produce a visual display.

5. a) The teacher provides a set of Hurricane data that will allow the students to use a GPS to create a map that tracks the hurricane, through time and space and monitor the variation in the strength of winds. Students, working in pairs, are given a prepared set of data for an actual hurricane (data available from FEMA and other sites on the Internet) or one of the teacher's own invention. Latitude and Longitude co-ordinates are given for the hurricane over a period of time. The maximum wind strength (or Hurricane/Tropical Storm rating) is given for each co-ordinate.
- b) The teacher does not include the final sets of co-ordinate and wind strengths, as students are asked to make predictions about the final destination and impact of the hurricane.
6. Prayer Activity: The human tragedy of natural disasters. Perhaps petitionary prayers for victims (e.g., El Salvador, India are appropriate).

Assessment & Evaluation of Student Achievement

T/L Strategy	Task/Product	Tool	Purpose	Achievement
3 (group)	Internet research	Worksheet	Formative	Knowledge/ Understanding Thinking/Inquiry
4 (group)	Image and data collection and visual presentation	Peer evaluation using teacher observation and checklist	Formative	Communication Thinking/Inquiry
5 a) (individual or pairs)	GIS-generated map	Mapping checklist (Appendix 3.5.3)	Formative	Communication Application
5 b) (individual or pairs)	Written report	Paragraph checklist (Appendix 3.4.1)	Summative	Knowledge/ Understanding Communication Application

Accommodations

- Check IEP for accommodations required when there are special needs students, especially when involved in group work.
- Pre-select the Internet group assignment for students.
- Provide individual support in GIS and Internet projects.
- Students with writing difficulty may require teacher and/or peer assistance in completing their written paragraphs. Students may need help with spelling, verb tense, thought sequence expressed in complete sentences, and links between sentences.
- ESL students and students with special needs may require specific help with key terms and concepts found in the articles.
- If access to a computer lab is not possible, the hurricane GIS activity could be completed by providing students with appropriate base maps and getting them to complete the activity manually.
- Remote sensing images are available from many sites on the Internet (see Resources). However, if this is not possible, the teacher should be prepared to either download suitable images and print out hard copies or provide articles and images from newspapers, periodicals, etc.
- As an alternative or extension to the GIS hurricane activity, teachers may wish to use one of the *ArcView* projects, found on their website or *ArcCanada2* CD (see Resources), that relate to natural disasters (i.e., Volcanoes, Ice Storm, Earthquakes, or Seismology).
- Reflect on recent disasters and comment on how people have come together to assist in crisis situations.

Resources

Websites

Canadian Space Agency (CSA) –

http://www.space.gc.ca/csa_sectors/earth_environment/radarsat/default.asp

Information on RADARSAT1 and Disaster Management - includes many radar images.

ESRI Canada k-12 project – <http://www.esri.ca/k-12/index.html>

Provides ArcView lesson packs

FEMA (Federal Emergency Management Agency) – <http://www.fema.gov/>

Information of Hurricanes and other natural disasters in the USA.

FEMA: Remote Sensing for Storms – <http://www.gismaps.fema.gov/1999pages/rscstorms.htm>

A source for remote sensing and GIS material, provided by FEMA.

Michigan Tech. University, Volcano Watch – <http://www.ssec.wisc.edu/data/volcano.html>

An up-to-date source for remote sensing images and maps of volcanoes.

NASA, JPL Volcano Exhibit – <http://southport.jpl.nasa.gov/volcanopic.html>

An excellent source for radar images of volcanoes from around the world.

Natural Disaster Reference Database – <http://ltpwww.gsfc.nasa.gov/ndrd/>

Satellite and remote sensing data that relate to natural disasters.

NOAA (National Oceanic and Atmosphere Administration) Coastal Service Centre –

<http://www3.csc.noaa.gov/CSCweb/genericPage.asp?bin=7>

This site provides GIS and remote sensing data relating to coastal hazards.

Operation Significant Event Imagery – <http://www.osei.noaa.gov/>

A NOAA source for high-resolution and detailed imagery of significant natural disasters.

United States Geological Society (USGS) - Hurricane and Extreme Storm Impact Studies –

<http://coastal.er.usgs.gov/hurricanes/oblique.html>

Aerial photographs and video on hurricanes and tropical storms.

USGS: Geologic hazards, earthquakes & landslides – <http://geohazards.cr.usgs.gov/welcome.html>

The USGS's site for digital images and maps relating to earthquakes and landslides.

Print

Birchall and McCutcheon. *Planet Earth*. Toronto: John Wiley & Sons, 1993. ISBN 0471794864

Butler, J. *Natural Disasters*, 3rd ed. Melbourne, Australia: Heinemann Educational, 1993.

ISBN 0858595176

Christopherson, R. *Geosystems*, 3rd ed. New Jersey: Prentice Hall, 1997. ISBN 0135053145

Newson, L. *Devastation!: The World's Worst Natural Disasters*. USA: D K Publishing/Discovery Channel, 1998. ISBN 0789435187

Vogel, C.G. *Nature's Fury: Eyewitness Reports of Natural Disasters*. Scholastic, 2000.

ISBN 0590115022

Video

Discovery Channel. *Raging Planet* video set. BMG Video/Discovery Channel, 1998.

The Learning Channel. *Storm Force* video set. The Learning Channel, 1999.

National Geographic. *Cyclone!* 1996, UPC: 727994509011; *Nature's Fury* 1996, UPC: 727994519935;

Killer Wave: Power of the Tsunami 1996, UPC: 727994519041; *Storm of the Century* 1996, UPC:

727994700159; *Volcano Nature's Inferno* 1996, UPC: 727994519010.

Software

ESRI Canada. *ArcCanada2* CD. Toronto: ESRI Canada k-12 project, 2000.

Natural Resources Canada. *Radarsat Monitors Natural Disasters: The Red River Flood of 1997* CD.

Activity 3.3: Human Disasters

Time: 300 minutes

Description

Students examine various global industrial disasters such as: the Exxon Valdez oil spill, the sinking of Titanic, or airline crashes. Students use a variety of resources such as the Internet, magazine articles, and videos to gain insight into the causes of these disasters and the extent of human/environmental damage. Through the analysis of satellite images, students describe the role of geotechnology in averting famous disasters such as Titanic and the potential for monitoring environmental changes over time. Students use a GIS to map famous disasters and examine how map projections alter distances. This provides students with the opportunity to critically examine the effectiveness of geotechnology in preventing human/environmental disasters and protecting and enhancing the quality of life.

Strand(s) & Learning Expectations

Strand(s): Human-Environment Interactions, Understanding and Managing Change

Overall Expectations

HEV.01 - explain the use of geotechnologies in studying human-environment interactions;

UCV.01 - explain the use of geotechnologies in monitoring and predicting change in the physical and human environment.

Specific Expectations

HE3.03 - assess how modern geotechnologies could have been used to avert famous disasters such as the sinking of the Titanic;

UC1.01 - describe the role of geotechnologies, especially satellite imaging, in monitoring changing features and phenomena (e.g., sea ice, forests, oil spills);

GI2.02 - research websites relating to geography, GIS, and other geotechnologies and use search engines to locate sites of interest.

Ontario Catholic School Graduate Expectations

CGE1d - develops attitudes and values founded on Catholic social teaching and acts to promote social responsibility, human solidarity, and the common good;

CGE1e - speaks the language of life... “recognizing that life is an unearned gift and that a person entrusted with life does not own it but that one is called to protect and cherish it” (Witnesses to Faith);

CGE2a - listens actively and critically to understand and learn in light of gospel values;

CGE2b - reads, understands, and uses written materials effectively;

CGE2d - writes and speaks fluently one or both of Canada’s official languages;

CGE2e - uses and integrates the Catholic faith tradition, in the critical analysis of the arts, media, technology, and information systems to enhance the quality of life;

CGE7i - respects the environment and uses resources wisely.

Prior Knowledge & Skills

- analysis and interpretation of remote sensing satellite images
- basic map skills such as distance, scale, latitude and longitude, x-y coordinate systems
- use of map projections

Planning Notes

- Determine the topic selection and select articles for students.
- Prepare worksheets and questions for article and video review in advance.
- Book a computer lab for Internet use and GIS application.
- Prepare blackline masters prior to the activity, depending on topic selected.

Teaching/Learning Strategies

1. Students brainstorm various human or industrial disasters that have occurred and identify the differences between human and natural disasters. Teachers may provide students with current newspapers to help identify human/environmental disasters.
2. To begin the study of human disasters, teachers should have determined the topic they wish to cover. Topics teachers may consider include: the Exxon Valdez oil spill; the Chernobyl nuclear disaster; airline crashes; the sinking of the Titanic; the sinking of the Russian Submarine; or the Military Jet crash of a cable car in Italy. The teacher pre-teaches selected key terms and concepts to assist in student comprehension. Students review an article on the selected case study. The articles selected by the teacher should explain: the cause of the disaster; location; extent of damage both human and ecologically and finally address how various geotechnologies could have been used to avert the disaster or monitor the aftermath. Students produce an organizer to study various human disasters. They record: the name and type of disaster; date of occurrence; geographic location; cause of the disaster; extent of damage; and use of geotechnology in averting or monitoring changes to the physical landscape.
3. A map illustrating the location of the incident as well the extent of the human/ecological damage will be produced using a blackline master provided by the teacher. For example, using the Internet, students are able to examine a map illustrating the location of the Exxon Valdez oil spill in Alaska and use the data provided on the website to map the location of the spill and trace the movement of the spill along the coastline (see Resources).
4. Students use the Internet to examine and interpret satellite images of human disasters such as oil spills. Students identify features such as black swirls in major water bodies, identify the water body affected by the spill, major communities located near the site and identify how the resources, wildlife, and human populations have been affected by the disaster.
5.
 - a) Working in groups of two or three, students are provided with a newspaper article or magazine article that deals with a specific human disaster. Students complete their organizers with the information their group has collected. Along with the organizer, students produce a map showing the location and extent of damage of their human disaster.
 - b) Each group then presents their findings to the class in a 5- to 10-minute presentation. Students should be responsible for recording new information and findings to their organizer.
6. Students view a video that illustrates clearly how a human disaster such as Exxon Valdez, Titanic, or Chernobyl could have been averted or monitored with the use of geotechnologies. Teachers should provide students with questions to answer during the video, which can later be used to foster class discussion.
7. Students use *Arcview* GIS and *Esri* data to produce a map illustrating great circle routes along the North Atlantic. The purpose is to explore how map projections affect the line and distance connecting two places. This computer application allows students to explore airline flight routes and determine how this can be used to detect location of plane crashes. Students use this application to plot the route of the Titanic and position when it sank. This application reinforces the use of geotechnology in averting, locating, and monitoring human disasters.

Assessment & Evaluation of Student Achievement

T/L Strategy	Task/Product	Tool	Purpose	Achievement
2 (individual)	Case Study Review Organizer	Teacher-generated checklist	Formative	Knowledge/ Understanding
4 (pairs)	Internet use for satellite image interpretation	Checklist, anecdotal notes	Formative	Thinking/Inquiry
5 a) (small groups)	Article Review: organizer and map	Roving conference with teacher	Formative	Knowledge/Understanding
5 b) (small group)	Presentation of Topic: organizer and map	Teacher-generated checklist	Summative	Knowledge/Understanding Thinking/Inquiry Communication
6 (class)	Video Review: questions, discussion	Anecdotal notes	Informal	Knowledge/Understanding
7 (pairs)	GIS application: map	Map rubric/Map checklist (Appendix 3.5.3)	Summative	Communication Application

Accommodations

- Check IEP for accommodation required when special need students are placed in groups.
- Pre-select the group assignment for students and assign specific tasks before they enter their groups.
- Pair students for satellite image interpretation and GIS application.
- Students with reading difficulties may require individual assistance from the teacher. Articles may have to be read orally. Questions and worksheets should be read together orally.
- For students with writing difficulties, teacher or peer tutor assistance may be necessary in writing a paragraph for the oral presentation.
- ESL students and students with special needs may require specific help with key terms and concepts found in the articles.
- As an extension, students can do a film review dealing with a specific human disaster.

Resources

Websites

Applications in Action – <http://www.ccrs.nrcan.gc.ca/ccrs/tekrd/radarsat/images/imgacte.html>
 A CCRS site for RADARSAT1 images with detailed interpretations. Radarsat Images of Oil Spill Monitoring, Milford Haven, Wales, UK.

CEONet – <http://ceonet.ccrs.nrcan.gc.ca/>
 Maps, satellite images, publications, and other geospatial data.

GeoGratis – <http://geogratis.cgdi.gc.ca/frames.html>
 A large source for geospatial data, images, and related links.

ThinkQuest – <http://library.thinkquest.org>

Article: Prince William Sound. Paradise Lost? Background information, maps, and environmental changes that have occurred in the Alaskan Basin ten years after the Exxon Valdez oil spill. Includes brief history and photos.

Federal Computer Week – <http://fcw.com/pubs/fcw/1999/0301/webgondala-3-5-99.html>

Crimes and Disasters- Italian Cable Car; Indian Air Hijacking, Afghan Air Hijacking, Nuclear Accidents

Software

ESRI Canada. *ArcCanada2* CD. Toronto: ESRI Canada k-12 project, 2000.

Print

Clark, Bruce and John Wallace. *Making Connections*. Scarborough, Ontario: Prentice Hall Ginn Canada, 1999. ISBN 0130126357

Activity 3.4: Human Settlement and Indigenous Peoples

Time: 240 minutes

Description

In this activity, students relate patterns of human settlement to patterns in the physical world. Using a GIS application, students collect, input, and map data illustrating the population distribution and density of a selected country. Factors affecting settlement patterns, such as climate, topography, economic activity, resources, transportation, and access to markets, are explored. The activity concludes with a study of Indigenous peoples' and problems concerning land claims. Students explore the role of geotechnologies in sparsely populated areas and how they can be used to address Native issues. The case study fosters a respect for and affirmation of the diversity and interdependence of the world's people.

Strand(s) & Learning Expectations

Strand(s): Human-Environment Interactions, Methods of Geographic Inquiry

Overall Expectations

HEV.01 - explain the use of geotechnologies in studying human-environment interactions.

Specific Expectations

HE2.01 - relate patterns of physical geography (e.g., relief, drainage) to patterns of human geography (e.g., settlements, land subdivision) on maps and images;

HE3.01 - explain the role of geotechnologies in addressing Native issues (e.g., reserve management, resource inventories);

HE3.02 - evaluate the benefits and effectiveness of using geotechnologies in sparsely populated areas (e.g., use of GPS in search-and-rescue operations, satellite monitoring of environmental impacts of military activities, radar imaging of forests);

GI2.02 - research websites relating to geography, GIS, and other geotechnologies and use search engines to locate sites of interest;

GI2.10 - use a variety of visual representation techniques (e.g., relief models, computer displays) to depict the earth's surface in novel ways;

GI2.14 - enter data into the computer by a variety of methods (e.g., keyboarding, downloading files, scanning).

Ontario Catholic School Graduate Expectations

CGE1d - develops attitudes and values founded on Catholic social teaching and acts to promote social responsibility, human solidarity, and the common good;

CGE1e - speaks the language of life... "recognizing that life is an unearned gift and that a person entrusted with life does not own it but that one is called to protect and cherish it" (Witnesses to Faith);

CGE2a - listens actively and critically to understand and learn in light of gospel values;
CGE2b - reads, understands, and uses written materials effectively;
CGE2c - presents information and ideas clearly and honestly and with sensitivity to others;
CGE2d - writes and speaks fluently one or both of Canada's official languages;
CGE2e - uses and integrates the Catholic faith tradition, in the critical analysis of the arts, media, technology, and information systems to enhance the quality of life;
CGE3c - thinks reflectively and creatively to evaluate situations and solve problems;
CGE4c - takes initiative and demonstrates Christian leadership;
CGE4f - applies effective communication, decision-making, problem-solving, time, and resource management skills;
CGE5a - works effectively as an interdependent team member;
CGE5e - respects the rights, responsibilities, and contributions of self and others;
CGE5f - exercises Christian leadership in the achievement of individual and group goals;
CGE5g - achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others;
CGE7f - respects and affirms the diversity and interdependence of the world's peoples and cultures.

Prior Knowledge & Skills

- familiarity with terms such as settlement patterns, population distribution, and population density from the Grade 9 course
- ability to input data into a computer and use a GIS
- thematic map interpretation

Planning Notes

- Collect population data and provide it to students.
- Book a computer lab for GIS application.
- Prepare instructions for the GIS application.

Teaching/Learning Strategies

1. The teacher defines settlement patterns, population distribution, and population density. Diagrams and/or maps to illustrate the key terms may be helpful. Students are responsible for recording the information in a note form.
2. The teacher provides students with selected population data for a country of their choice. Students use the population data to produce a map illustrating the population distribution and population density of the selected country. Students use a GIS to input the population data, join tables, and produce a map. Teachers may consider using the Mexico, USA, Canada, or World shapefiles provided by Esri data. Students complete a worksheet, examining which areas of their country are most populated; where the population is distributed; and areas with the highest and lowest population density.
3. Students use an atlas to examine thematic maps such as physical, vegetation, and soil maps for their selected country. Climate graphs and maps illustrating major resources used in industrial activity are also useful. Students relate patterns of human settlement to patterns in physical geography. Criteria teachers may consider for the organizer include: topography, climate, resources, economic activity of the region, transportation routes, and access to markets.

4. Students review an article that examines Indigenous peoples around the world and some of the issues concerning land use changes, economic development, and clash of interests. Students record information in a note. Students view a map with the teacher illustrating the location of various Indigenous peoples under threat. The teacher may consider a specific group they would like to study further. Some suggestions include Canada's Inuit or Haida, Brazil's Yanomami or Apinaye Indians, Maya Indians in Mexico, or the Manobo people of the Philippines.
5. The teacher shows a video that examines some of the issues and threats to Indigenous People around the world. Depending on the country and people selected, the concerns differ. Using a worksheet, students describe the people's way of life; identify resources present in their region; describe how the resources are used by Indigenous people in a sustainable manner; explain some of the issues threatening the livelihood and culture of the Indigenous people; and evaluate the effectiveness of geotechnologies in assisting Indigenous people in remote areas while protecting the resources central to the continuation of their way of life. Students complete a paragraph summarizing their findings.

Assessment & Evaluation of Student Achievement

T/L Strategy	Task/Product	Tool	Purpose	Achievement
2 (pairs)	Population map GIS application	Map checklist, rubric	Summative	Communication Application
3 (small group)	Atlas activity Settlement organizer	Teacher observation and checklist	Informal	Thinking/Inquiry Communication Application
5 (individual)	Paragraph writing	Paragraph checklist	Formative	Knowledge/ Understanding Communication

Accommodations

- A review of paragraph structure may be necessary to assist ESL students and students with writing difficulty. An exemplar paragraph may be beneficial.
- Students with writing difficulty may require teacher and/or peer assistance in completing their written paragraphs. Students may need help with spelling, verb tense, thought sequence expressed in complete sentences, and links between sentences.
- Provide individual support in GIS projects, particularly in inputting data and joining tables.
- If access to a computer lab for the GIS application is not possible, teachers may use blackline masters and provide students with data to create population distribution and population density maps.
- Students may conduct a study of a current land claim considering environment and physical landscape, economic and cultural implications.

Resources

Websites

University of Alberta – <http://www.ualberta.ca/~esimpson/claims/claims.htm>

Examines Native Land Claims in Canada.

Statistics Canada – <http://www.statcan.ca>

Population Statistics available.

Native American Indian Resources – <http://www.kstrom.net/isk/maps/mapmenu.htm>

Contains maps, GIS windows on native lands, current places, and history in North America.

Software

ESRI Canada. *ArcCanada2* CD. Toronto: ESRI Canada k-12 project, 2000.

Print

Clark, Bruce and John Wallace. *Making Connections*. Scarborough, Ontario: Prentice Hall Ginn Canada, 1999. ISBN 0130126357

Lean, G., D. Hinrichsen, and A. Markham. *Atlas of the Environment*. New York: Prentice Hall Press, 1990. ISBN 0130504696

Bray, Matt and Ashley Thomson. *Temagami A Debate on Wilderness*. Toronto: Dundurn Press, 1990. ISBN 1550020862

Video

“Native Claims: Growing Frustrations.” *CBC News in Review*. October, 1995. 10 min, 30 sec.

Appendices

Appendix 3.5.3 – Generic GIS Mapping Checklist

Appendix 3.4.1 – Paragraph Checklist

Activity 3.5: Environmental Degradation

Time: 360 minutes

Description

This activity focuses on how geotechnologies may be used in exploring environmental problems. The teacher may choose from various topics, such as air quality, acid rain, species extinction, rainforest destruction, global warming, ozone depletion, and ocean pollution. A specific environmental issue is introduced using various methods such as articles, videos, Internet searches, satellite images, etc. The activity reinforces skills such as mapping the location and extent of the issue. The detrimental effects to both human and natural ecosystems are examined. The use of geotechnology enables students to appreciate that solutions and impending actions must be taken to ensure the future of this world.

Strand(s) & Learning Expectations

Strand(s): Geographic Foundations: Space and Systems, Human-Environment Interactions, Methods of Geographic Inquiry

Overall Expectations

HEV.01 - explain the use of geotechnologies in studying human-environment interactions;

HEV.02 - evaluate the effectiveness of geotechnologies in identifying environmental problems and finding solutions.

Specific Expectations

SS1.09 - identify applications of geotechnologies relating to resources and the environment (e.g., species mapping, weather forecasting, forest management, precision farming);

HE1.02 - describe the role of geotechnologies in addressing environmental problems resulting from human action (e.g., pollution, deforestation, species extinction);

GI2.14 - enter data into the computer by a variety of methods (e.g., keyboarding, downloading files, scanning);

GI2.02 - research websites relating to geography, GIS, and other geotechnologies and use search engines to locate sites of interest.

Ontario Catholic School Graduate Expectations

CGE1d - develops attitudes and values founded on Catholic social teaching and acts to promote social responsibility, human solidarity, and the common good;

CGE1e - speaks the language of life... “recognizing that life is an unearned gift and that a person entrusted with life does not own it but that one is called to protect and cherish it” (Witnesses to Faith);

CGE2a - listens actively and critically to understand and learn in light of gospel values;
CGE2b - reads, understands, and uses written materials effectively;
CGE2d - writes and speaks fluently one or both of Canada's official languages;
CGE2e - uses and integrates the Catholic faith tradition, in the critical analysis of the arts, media, technology, and information systems to enhance the quality of life;
CGE3c - thinks reflectively and creatively to evaluate situations and solve problems;
CGE3d - makes decisions in light of gospel values with an informed moral conscience;
CGE4f - applies effective communication, decision-making, problem-solving, time, and resource management skills;
CGE5a - works effectively as an interdependent team member;
CGE5e - respects the rights, responsibilities, and contributions of self and others;
CGE5f - exercises Christian leadership in the achievement of individual and group goals;
CGE5g - achieves excellence, originality, and integrity in one's own work and supports these qualities in the work of others.

Prior Knowledge & Skills

- use of the Internet, locating specific articles
- working knowledge of GIS
- graphing knowledge, such as producing a circle graph, bar graph, and line graph
- knowledge of a well-written paragraph

Planning Notes

- Locate appropriate articles to be used by students, either as a class or in groups; the articles may be bookmarked on a website.
- Create a worksheet so that students can read the article and extract the appropriate information.
- Research or locate the human and natural causes of the issue.
- Locate and plan for an appropriate GIS mapping activity or similar.
- Data must be located for students to input and create a graph (see Resources).

Teaching/Learning Strategies

1. a) The teacher selects a global environmental problem and locates information and an article on the issue. A great choice is a lesson on Threatened Species, which can be downloaded from the Environmental Systems Research Institute, ESRI, website (see Resources). Other choices include articles from Ducks Unlimited (see Resources), and Acid Rain (GIS Activity). The study should examine the use of geotechnologies in studying protected land resources and issues concerning species conservation or other appropriate environmental problems and solutions.
b) The teacher gives students a list of terms to be defined which categorize threatened species or other specific terms needed to understand the issue. Students research the information in the package from ESRI or look up the terms elsewhere (see Resources.) Key terms include endangered species, vulnerable species, rare species, indeterminate species, and insufficiently known species.
c) The teacher gives a note or creates a worksheet for student to complete, involving the causes of the issue, the threatened species. One important question to be addressed is: What causes a species to become threatened? Students should research this task, from a website or article located by the teacher, for examples of both human and natural causes.
2. a) The teacher may continue with the same environmental issue or choose another topic, such as air quality, rainforest destruction, global warming, ozone depletion, or acid rain. Again, the issue must be examined as to the problem and causes of it (e.g., organizer or diagrams).

- b) Students create a map of the extent of the problem or something similar. The ESRI activity on Threatened Species may now be carried out, or the teacher provides data, specific to the issue at hand, to be mapped by students. In this way, students apply their knowledge of geotechnologies while relating it to the environmental issue.
 - c) Students record the various geotechnologies that have been and that may have been used in the study of the issue. Ducks Unlimited explains the use of many geotechnologies, such as radio transmitters, satellite images, and remote sensing, which is taken and plotted by GIS Analysts to study the problems.
3. The teacher now focuses on data that students enter into the computer and graph in order to better understand one aspect of the issue. Data is collected or given to students and is entered into the computer to provide a graph of statistical information. For example, in the Threatened Species lesson, the data on proportion of extinction caused each year by human activities could be transmitted into a circle graph. Students must then respond to questions such as which activities are the main threats to species.
 4. Students now evaluate the effectiveness of the use of geotechnologies in the study of environmental issues and how they may be used in helping to find solutions. The teacher leads the class in a discussion while noting key words and ideas on the board. Students research and prepare a report as outlined by the teacher. The report must include; i) A description of the issue, using the appropriate terminology or key terms learned. ii) A chart of both human and natural causes for this environmental problem, including examples from around the globe. iii) A mapping activity showing the extent/location of the issue. iv) A graph depicting statistical information about the issue. v) A short report of the solutions, which exist and must be implemented in order to alleviate and change the path of environmental degradation. (See Resources for websites available for searches.)

Assessment & Evaluation of Student Achievement

T/L Strategy	Task/Product	Tool	Purpose	Achievement
1 b) (individual)	Definitions of key terms	Teacher-generated observation checklist (Appendix 3.5.1)	Informal	Knowledge/ Understanding
1 c) (individual)	Reading and answering questions	Worksheet	Summative	Thinking/Inquiry
2 b) (small group)	Map work	Map checklist (Appendix 3.5.3)	Formative Summative	Knowledge/ Understanding
3 (small group)	Computer-generated graph and questions	Checklist	Formative	Thinking/Inquiry
4 (as a class, individual)	Discussion and report on issue	Paragraph checklist (Appendix 3.4.1)	Summative	Knowledge/ Understanding Thinking/Inquiry Communication
4 (individual)	Full report	Report rubric (Appendix 3.5.2)	Summative	Knowledge/ Understanding Thinking/Inquiry Communication Application

Accommodations

- If computers are not available, articles may be brought to the classroom.
- Articles may be read together as a class and discussed as in a worksheet.
- If a lab is not available, maps and graphs may be produced using blackline masters.
- Maps and graphs can be produced by the teacher and then interpreted with the use of an organizer chart or worksheet.
- Paragraphs may be word processed, spell-checked, etc.
- Check IEP for accommodations required when there are exceptional students.
- A review of paragraph structure may be necessary to assist ESL student and students with writing difficulty. An exemplar paragraph may be beneficial.
- Students with writing difficulties may require teacher and/or peer assistance in completing their written paragraphs. Students may need help with spelling, verb tense, thought sequence expressed in complete sentences, and links between sentences.
- ESL students and students with special needs may require specific help with key terms and concepts found in the articles.
- The teacher may wish to select additional articles and lessons through the endangered species websites listed in Resources.

Resources

Websites

Endangered Species – <http://www.endangeredspecie.com/>

Lesson plans

Endangered Species – <http://www.nceet.snre.umich.edu/EndSpp?Endangered.html>

Lesson plans

Threatened Animals of the World – http://www.wcmc.uk/data/database/rl_anml_combo.html

Statistical information (i.e., data input for graphing).

World Wildlife Fund – <http://panda.org/livingplanet/home.shtml>

Conservation information

The Raptor Centre – <http://www.raptor.cvm.umn.edu/>

Educational projects about species of birds including satellite tracking information and migration data.

ESRI – http://www.esricanada.com/k-12/lesson/threatened_species/index.html

Lesson packs on GIS

Ducks Unlimited – www.ducks.ca/geese/index.html

Use of geotechnologies for environmental protection.

Environmental Directory – www.webdirectory.com

A directory of key terms and issues.

Statistics Canada – www.statcan.ca/start.html

Use for data to make graphs or maps.

Software

ESRI Canada. *ArcCanada2* CD. Toronto: ESRI Canada k-12 project, 2000.

Print

Molyneux, John, and Marilyn MacKenzie. *World Prospects*, 3rd ed. Scarborough: Prentice-Hall Canada Inc., 1994. Graphing statistics for data on information such as Carbon Dioxide Emissions, Remaining Wilderness area.

Stanford, Quentin H., ed. *Canadian Oxford School Atlas*, 7th ed. Toronto: Oxford University Press, 1998.

Appendix 3.4.1

Paragraph Checklist

Knowledge or Skill Exhibited	Low Degree	Mid-Degree	High Degree
The student uses appropriate content.			
The student uses a grammatically correct writing style.			
The student is able to identify the cause and extent of the problem.			
The student is able to identify the use of geotechnology in monitoring changes to the landscape.			
Suggestions for improvement:			

Appendix 3.5.1

Observation Checklist

Student Name:

Observed by:

Criteria	Dates Observed					
Work space is organized.						
Remains focused on task.						
Discussions with peers are relevant to the task.						
Has the required tools for working (books, pencils, pens, etc.).						
Follows directions.						
Asks relevant questions.						
Uses appropriate voice level.						
Starts task without prompts.						
Shows tolerance for others' ideas.						
Is alert in class.						
Participates in small-group discussions.						
Participates in large-group discussions.						
Expresses his/her ideas/opinions.						
Is polite to peers/adults.						

General Comments:

Appendix 3.5.2

Report Rubric for use with Environmental Degradation Report

Overall Level: _____ Student Name: _____

Categories/ Criteria	Level 1 (50-59%)	Level 2 (60-69%)	Level 3 (70-79%)	Level 4 (80-100%)
Knowledge/ Understanding - Understanding of concepts - Understanding of maps	- demonstrates a limited understanding of a concept - demonstrates limited ability to create a map	- demonstrates some understanding of a concept - demonstrates some ability to create a map	- demonstrates a considerable understanding of a concept - demonstrates good ability to create a map	- demonstrates a high degree of understanding of a concept - demonstrates through ability to create a map
Think/Inquiry - Use of information from graphs - Relationships between concepts	- is able to use information from the graphs with limited effectiveness - has limited ability to see the relationship between many concepts	- is able to use information from the graphs with some effectiveness - is able to make some conclusions about concepts	- is able to use information from the graphs with good ability - draws clear relationships between concepts	- is able to use information from the graphs with thorough ability - draws excellent relationships between concepts
Communication - Communication of graphic information and mapping information - Writing style	- communicates information through graphs and maps with limited clarity - writing limits expression of main ideas	- communicates information through graphs and maps with some clarity - writing allows expression of main ideas	- communicates information through graphs and maps with considerable clarity - writing clearly expresses main ideas	- communicates information through graphs and maps with extreme clarity - writing strongly expresses main ideas
Application - Application of concepts - Application of information in graphs and maps	- demonstrates limited ability in applying concepts - has limited ability applying information in graphs and maps	- demonstrates some ability to apply concepts - is able to apply information in graphs and maps	- demonstrates a clear ability in applying concepts - is able to apply information in graphs and maps very well	- demonstrates thorough ability in applying concepts - has thorough ability to apply information in graphs and maps

Note: A student whose achievement is below level 1 (50%) has not met the expectations for this assignment or activity.

Appendix 3.5.3

Generic GIS Mapping Checklist

NAME

PROJECT

Title Checklist	Accurate and present	/2
	Correct Spelling	/1
	Appropriately positioned	/1
Legend Checklist	Appropriately positioned	/1
	Correctly constructed	/2
Labels Checklist	Required labels present	/4
	Spelled accurately	/1
	Aligned correctly	/1
Layout Checklist	Required data present	4
	Appropriate font size and clarity	/3
	Appropriate use of colour/graduation	/3
	Border present	/1
	Scale bar present	/1
	North arrow present	/1
	Overall proportionality	/4
Overall Achievement Level		MARK /30
Comments:		