Public District School Board Writing Partnership

Canadian and World Studies

Course Profile

Geomatics: Geotechnologies in Action

Grade 12
University/College Preparation
CGO4M

- *for teachers by teachers*

Course Profiles are professional development materials designed to help teachers implement the new Grade 12 secondary school curriculum. These materials were created by writing partnerships of school boards and subject associations. The development of these resources was funded by the Ontario Ministry of Education. This document reflects the views of the developers and not necessarily those of the Ministry. Permission is given to reproduce these materials for any purpose except profit. Teachers are also encouraged to amend, revise, edit, cut, paste, and otherwise adapt this material for educational purposes.

Any references in this document to particular commercial resources, learning materials, equipment, or technology reflect only the opinions of the writers of this sample Course Profile, and do not reflect any official endorsement by the Ministry of Education or by the Partnership of School Boards that supported the production of the document.

Acknowledgments

Public District School Board Writing Team – Grade 12, Geomatics: Geotechnologies in Action

Lead Boards
Toronto District School Board

Project Managers
Allan Hux, Toronto District School Board
Ethel Johnston, Toronto District School Board

Course Profile Writing Team
Mark Lowry, Lead Writer, Toronto District School Board
Gerry Bell, District of Niagara School Board
Ewan Geddes, Toronto District School Board

Reviewers
Erin D'Alessandro, ESRI Canada
Susan Laskin, Department of Geography, Ryerson University, Toronto
Lorraine Linton, Toronto District School Board
Joe Maurice, Algoma District School Board
Todd Pottle, Kawartha Pineridge School Board

Associations
Ontario Association of Geographic and Environmental Education (OAGEE)
Ontario Geography Consultants Association (OGCA)

Course Overview
Geomatics: Geotechnologies in Action, CGO4M, Grade 12, University/College Preparation

Policy Document: *The Ontario Curriculum, Grades 11 and 12, Canadian and World Studies, 2000.*
Prerequisite: Any University, University/College, or College Preparation course in Canadian and World Studies, English, or Social Sciences and Humanities

Course Description

Geomatics: Geotechnologies in Action examines the approaches and techniques that geographers and other professionals use to acquire, manage, map, analyse, and communicate information about the earth's surface. Students will receive a systematic introduction to the four pillars of geomatics - surveying, remote sensing, cartography, and geographic information systems (GIS), and will learn how to apply their knowledge and skills to a variety of real world situations relating to physical and human geography. This University/College Preparation course is designed to equip students with the knowledge and skills they need to meet the expectations of a wide range of University and College level courses.

Course Notes

The Geomatics: Geotechnologies in Action course is considered an introduction to the field of Geotechnology and its role within the discipline of Geography. Geotechnology encompasses the skills surrounding those areas of global positioning (GPS), remote imagery, and geographic information systems (GIS), and is quickly becoming a basic tool on the spatial side of information technology.

> "**Geomatics** is a field of activities which, using a systemic approach, integrates all the means used to acquire and manage spatial data required as part of scientific, administrative, legal and technical operations involved in the process of the production and management of spatial information."
>
> Canadian Institute of Geomatics 1998.

Geotechnology is not an end in itself, but is a skill set and methodology that will allow students to improve their spatial skills throughout their academic and professional lives. 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 specialize in GIS and other technology, many more use GIS as just one of the tools in their studies, as a word processor or an electronic spreadsheet would be used. This course is designed so students may experience this technology and 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 will also gain an environmental awareness and a strong stewardship for their local area.

It is expected that students who enroll in CGO4M will graduate with an introductory grounding in Geotechnology and Geomatics, which would be a relevant addendum for any future studies. Students acquire experience in such technological areas as data collection, manipulation, interpretation, and display, all in a context of spatial and geographical analysis. It must be stressed that this is not a computer course but a Geography course that is making use of geotechnology.

As this is a course based on information technology, it is important that it be as up-to-date as possible. To this end, the technology will be based on current ministry-licensed standard software.

At present, the Ministry of Education, through its software-licensing program, licenses two professional software programs that are currently in use within academia and industry throughout Ontario. These programs are quite different and have specific functions in the classroom and in private industry. *MFTeach*, a raster-based program, is best suited for local and small area studies whereas *Arcview* is a vector program and will be used with studies of a regional, national, and global focus.

Specific boards, schools, and programs throughout the province may be using other GIS software packages. All of the activities throughout this profile could be easily adapted. It must be noted however, that this course is designed to prepare students for college and/or university. It is important that teachers use software that may be used in postsecondary institutions or may be found in both public and private sectors.

The use of geotechnology software is central to this course and therefore regular access to a computer lab which runs a GIS program and provides Internet access is essential. Ideally, this course should be based in a computer lab with GIS software programs such as *ArcView*, *ArcCanada*, *ArcUSA*, and *MFTeach* available. It is also possible for teachers to substitute the ministry-licenced software with other GIS and geotechnologies software where they see fit.

Due to the ever-changing world of computer software, it is difficult for the teacher in a GIS classroom to have access to the latest programs. However, it must be stressed that the teacher is there to guide the students through the geographical and spatial skills inherent in any GIS. With respect to the geotechnical software, the teacher will be positioned as a facilitator, guide, and co-learner. GIS is a major component of all the units in this course. The units are designed to provide opportunity for students to explore significant components of geomatics. Unit 1 provides students with an introduction to the fundamentals of GIS theory. Unit 2 introduces students to a variety of imagery used in geographical analysis. Unit 3 attempts to link both imagery and thematic mapping techniques together and Unit 4 provides students with an introduction to surveying skills with special emphasis on GPS and its incorporation within geographical analysis. Unit 5, the Culminating Unit, provides students with the opportunity to demonstrate their skills, knowledge, understanding, and application of geotechology.

Units: Titles and Times

Unit 1	The Fundamentals of Geomatics	20 hours
Unit 2	Geographic Concepts using Imagery	20 hours
* Unit 3	Analysing and Understanding Patterns of Information	25 hours
Unit 4	Using GPS and other Geotechnologies in the Field	25 hours
Unit 5	Culminating Unit: Analysis of an Issue Using Geomatics and Geotechnologies	20 hours

* This unit is fully developed in this Course Profile.

Unit Overviews

Unit 1: The Fundamentals of Geomatics

Time: 20 hours

Unit Description

Students explore the structure and concepts used to construct both traditional maps and maps made with a GIS. Students gain an overall understanding of the history of mapmaking and the tools and techniques used for geographic analysis. It is important to emphasize that even though students use technology in mapmaking, the basic underlying principle is that the features on maps represent the natural phenomena on earth thus reinforcing the sanctity of life. This unit should include a basic understanding of map projections and how manipulating map projections can alter our perception of the world. Students are introduced to the primary functional concepts of a GIS – mapmaking, using a variety of themes, ordering layers, using text annotations, and performing the layout of a map. Included with the understanding of a GIS are the introductions to complementary computer programs such as spreadsheets and drawing and graphic packages used in combination to produce well designed and functional maps.

Unit Overview Chart

Activity	Learning Expectations	Assessment Categories	Focus
1	SSV.01, HEV.02, GCV.01, GI2.07, GC1.01	Knowledge/ Understanding Thinking/Inquiry	Introduction to Geomatics
2	UCV.03, GC1.03, SS2.04, UC1.03, SS1.02, GC3.02, SS3.01	Knowledge/ Understanding Thinking/Inquiry	History of Mapmaking: Development of Maps and Their Influence on Events
3	GCV.03, SSV.03, SS1.07, GI1.06, SS1.03, SS1.08	Application Communication	Mapmaking With A Purpose: Constructing Maps Using Components Such As Projections to Convince Others of Your Point of View
4	GCV.02, SSV.02, GI1.12, GI1.14, GC3.03	Knowledge/ Understanding Thinking/Inquiry	Introduction to GIS: Components of GIS and Their Uses
5	GIV.03, GI2.02, SS2.01	Knowledge/ Understanding Application	Georeferencing Images For Use in a GIS
6	SSV.04, GC3.04	Application	Constructing a World Map With Layers
7	GCV.01, GI1.07, GI2.10	Application Communication	Culminating Activity: Making a World Map Layout for Other Applications

Culminating Activity

The focus of the culminating activity for Unit 1 is the creation of a world map that is used in the geographic analysis of a specific issue. Students use basic geotechnical skills to measure both attribute and spatial parameters. This may include the location of specific places using latitude/longitude or UTM coordinates and/or the analysis of the socio-demographic statistics regarding these specific places. Students present their finding using a variety of map projections and an analysis of how these projections influence the message of the map. Some possible examples might be mapping and analysing issues such as economic indicators or natural disasters identification.

Unit 2: Geographic Concepts Using Imagery

Time: 20 hours

Unit Description

Using imagery, students use a GIS to explore and analyse the patterns and relationships that exist within world regions. Working with images from a variety of origins and scales, students develop an appreciation of the unique capability of satellite imagery. In addition, students should be especially aware of how radar images differ from other types of images. Using aerial photographs, students identify and analyse the various components needed to interpret remote images and demonstrate how these images can be used to successfully monitor our resources.

Unit Overview Chart

Activity	Learning Expectations	Assessment Categories	Focus
1	GI1.13, UC2.02, UC1.01, HE1.01	Knowledge/ Understanding	Introduction to Raster-Based Analysis: Image fundamentals
2	GI1.09, GI1.08, SS1.06, GI1.10	Knowledge/ Understanding Application	Introduction to Satellite Capabilities Kinds of Images, Platforms, Classification of Data, Methods of Collection, Cloud Cover Problems
3	GC2.03, GC2.01	Application Communication	Working with Low Resolution Images World Satellite Images WorldSat and Night Image
4	GI1.15, GC3.01	Application	Combining Raster and Vector Map Components
5	UC1.02, HE3.02, GC1.02, UC1.04	Knowledge/ Understanding Thinking/ Inquiry Communication	Exploring Canada's Contribution to Satellite Imagery: Radarsat Comparison to Other Satellite Images: Image Recognition and Cloud Cover Solutions in a GIS
6	GI2.12, GI1.10, HE1.02	Knowledge/ Understanding Thinking/ Inquiry Application	Exploring High Resolution Raster Images Aerial photos: Types, Application and Analysis In a GIS
7	UC2.03, GI2.11, GI1.11, GI3.02	Thinking/ Inquiry Application	Detecting Change through Image Analysis Using a GIS
8	UCV.02, UCV.01, SSV.05, UC3.02, HE3.03, HE1.03	Thinking/ Inquiry Application Communication	Using Satellite Images and GIS to Save Lives: Predicting the Paths of Natural Hazards

Culminating Activity

The focus for the Unit 2 culminating activity is the use of GIS and imagery to assess the level of damage caused by natural disasters which could threaten human life. Students use a GIS to calculate and display information where the damage from such a disaster was greatest. Furthermore, students make predictions about the impact of the disaster on human systems. Finally, students provide an analysis based on the available data, making recommendations which could be implemented to save human life in the event of a similar natural disaster.

Unit 3: Analysing and Understanding Patterns of Information

Time: 25 hours

Unit Description

Students identify and examine patterns that emerge from physical systems, human systems, and urban systems. Using a GIS, students have opportunities to map the relationships that exist between these systems. Furthermore, by exploring methods of data classification, students also map and appreciate the spatial distribution of unique human characteristics such as ethnicity, indigenous people, and socio-economic patterns. The culminating activity of this unit focuses on urban patterns within cities. The socio-economic patterns in the city, such as crime, are mapped using the GIS.

Unit Overview Chart

Activity	Learning Expectations	Assessment Categories	Focus
1	SSV.04, HEV.01, HE1.02	Knowledge/ Understanding	Understanding the Elements of Physical Systems using GIS: Defining Physical Regions
2	SSV.04, SS1.10	Knowledge/ Understanding Application	Mapping the Elements of Human Systems with a GIS
3	HEV.01, HE2.01, HE2.02, SS3.02, SS2.05	Thinking/Inquiry Communication	Using Images to link Environmental and Human Systems in a GIS
4	GCV.02, GCV.03, GI1.03, GI2.13	Knowledge/ Understanding	Data Classification Methods and Technologies
5	GIV.01, GIV.02, UCV.01, HE3.01, SS3.03, GI2.13	Knowledge/ Understanding Application	Mapping the Distribution of Indigenous Peoples and Cultural Groups Thorough GIS Mapping Structures
6	GIV.01, GIV.02, GIV.03, GI2.13, SS3.03	Knowledge/ Understanding Application	Using Data classification Techniques to Find Patterns in Census Data
7	GIV.03, GCV.04, GC3.01	Knowledge/ Understanding Application	Applications of Street Level Data
8	GIV.03, GCV.03	Thinking/Inquiry Communication	Exploring Urban Patterns with Street Level Data
9	GCV.04, UC1.05	Communication	Culminating Activity Crime in America: Integrating State, County and Street Level Data

Culminating Activity

The purpose of this culminating activity is to acquaint students with the use of GIS and its role in law enforcement. The students examine patterns of crimes by state, by county, and at the street level. Students examine how GIS can help analyse patterns of crime in a community.

Students participate in a scenario whereby common social factors attributed to increased/decreased crime rates should be investigated. Geographic analyses like these occur every day in police departments across the USA and Canada.

Unit 4: Using GPS and other Geotechnologies in the Field

Time: 25 hours

Unit Description

This unit serves to understand and promote the use of complementary resources for a GIS, namely a Global Positioning System (GPS). During fieldwork, students use a GPS to collect data, input the data into a GIS, and then map the data in meaningful ways. Students use images overlain with vector data to explore how GPS technologies can play a role in monitoring and predicting change in physical and human systems of geography. Furthermore, students gain exposure to how these sources of information can be used to limit human problems associated with changes in the physical landscape. The geotechnical skills in this unit should focus on address geocoding, editing tables, editing vertices, merging and splitting polygons, and drawing features on maps. Students should also accomplish hotlinking images to maps.

Unit Overview Chart

Activity	Learning Expectations	Assessment Categories	Focus
1	GI1.05, SS1.04, GC3.05	Knowledge/Understanding	Understanding the Fundamentals of GPS Technology
2	GI2.05, GI2.04, GI1.04, GI1.02, SS1.05, GI2.06, GI1.01, SS1.01	Knowledge/Understanding Application	Developing Field Survey Skills Though GPS
3	GI2.09, UC2.01, SS2.03, SS2.02	Knowledge/Understanding Application	Developing Map Reading Skills with GPS, GIS and Traditional Technologies
4	UC3.01, GC2.02, GC1.04	Knowledge/Understanding Thinking/Inquiry	Using Local Images to Identify and Map Change
5	UC1.07, UC1.06, GC3.05	Thinking/Inquiry	Identifying Career Opportunities in Geomatics
6	GI3.03, GI3.01, GI2.08	Thinking/Inquiry Communication	Culminating Activity: Mapping Human Interactions in the Local Environment

Culminating Activity

The purpose of this culminating activity is to engage students in real world analysis using their local area. Using the skills developed in this and previous units and under the direction of the teacher, students conceptualize a scenario using local data and situations. Subsequently, students develop a workable framework and execute a geographic analysis of their local area using a combination of GIS/GPS/Imagery/Maps. Students present their findings either as a hard copy report or as an electronic presentation.

Unit 5: Culminating Unit: Analysis of Issue Using Geomatics and Geotechnology

Time: 20 hours

Unit Description

In this culminating unit students demonstrate their skills using various geotechnologies to make informed conclusions on a specific issue using geomatic analysis. Students, in consultation with the teacher, identify, plan, develop, and execute a study of a significant issue in the form of report. This issue may include parameters of local, regional, or global significance. Students collect data from various sources to support their findings.

The report should include:

- a series of maps and/or georeferenced images;
- a combination of student-researched data from various sources including unique data;
- an explanation of the metadata used within this report;
- a geospatial and statistical analysis of the issue;
- conclusions regarding the issue.

The report is presented using two mediums, i.e., a paper report and visual presentation.

Students choose to integrate one or more techniques from each unit of study. The study should be manageable in scope so that students can finish the report in the time allotted by the teacher.

Unit Overview Chart

Activity	Learning Expectations	Assessment Categories	Focus
1	SSV.02, GI3.01	Knowledge/Understanding Application	Developing a Scenario for a Geomatics Independent Study
2	GIV.03, GI3.03, GI12.01, GI2.03, GI1.02	Thinking/Inquiry	Gathering Information for Processing in a GIS
3	GIV.02, GI2.08, SS1.06, SS3.03, SS3.02	Application	Managing Data, Developing Maps and Providing Analysis
4	GIV.02, GI1.07, UC3.01, GI1.07	Knowledge/Understanding Application Communication	Developing Presentation Techniques
5	HEV.02, GCV.01, UCV.01, GCV.04, UCV.02, GI2.13	Communication	Presenting Solutions to Geomatics Scenarios

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 both an academic and practical value in their lives. Students investigate topics associated with current issues recognizing the varying perspectives and post secondary choices that could be made by individuals. Students are encouraged to seek additional information to make informed choices for several 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.

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 learnings 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 mapmaking 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 Units 1 and 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.

The subject of Geography and its associated geotechnologies use language in a 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 teachers initially provide models or structures for oral, written, and graphic communication.

A strong focus within a geomatics course incorporates the concepts of problem-based learning, whereby students are presented with realistic scenarios and are expected to investigate solutions through a GIS.

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. In the activities in the fully developed unit suggestions are made for both formative assessment and summative evaluation strategies, as well as tools that teachers may employ in the classroom. Sample rubrics are provided for unit culminating activities.

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.

Throughout this course a variety of assessment methods, strategies, and tools are employed:
Conferencing: Evidence of student learning through listening, questioning, responding, and explaining is assessed through student/teacher conferences. Conferencing allows the teacher to assess communication and thinking skills.

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 Geomatics 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 assessment strategy 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, rating scales and marking schemes.

Peer and Self-Assessment: Provides opportunities for students to improve by using formative assessment tools, e.g., checklists, and rubrics.

The final summative evaluation for this course is broken into two parts. Unit 5 is a culminating unit based on a specific performance task (see Unit 5 Description), which brings together many of the expectations in an issues context. A summative examination should be included in this course. It should take place in a GIS lab environment using the geotechnological skills and geomatic analysis specific to this course.

Seventy per cent of the grade will be based on evaluations conducted throughout the course. Thirty per cent of the grade will be based on a final evaluation in the form of a seminar-style performance, essay, and examination that will take place in a GIS lab environment. Through this exam, students demonstrate their geotechnical skills and geomatic analysis. Teachers are encouraged to formulate and present to the students an evaluation plan that encompasses the entire course. It is expected that this student evaluation plan will identify the combination of formative and summative tasks required. It must be noted that this is a geography course so the summative contextual analysis should be based on geographic principles and skills. Though an examination is identified as part of the culminating unit it is imperative that this exam use the skill set learned and demonstrated within the Geomatics course. Therefore this exam should take place in a computer lab environment with active GIS as an integral part of the test procedure.

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 Individual Education Plan (IEP). This applies also to students who have not been identified as exceptional but are receiving special education programs and services and have IEPs. Where such modification occurs, care must be taken to ensure that the credit may still be granted. Consultation with the principal is advised. Specific adaptations and accommodations are recommended with each activity. Individual Education Plans (IEP) for exceptional students provide teachers with specific learning strategies that work best with individual students. Teachers are encouraged to review students' IEPs to decide the best course of action to assist them in meeting the expectations of the Geomatics course. An additional resource for teachers is the *Ontario Curriculum Unit Planner* Special Education Companion.

Enrichment: There are numerous opportunities throughout the course for enrichment activities. While this course is mainly vector-based mapping, students should be encourage to explore rastor-based programs. Students should also be encouraged to investigate extensions to the basic GIS software.

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. 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. As well, the proficiency levels outlined in *The Ontario Curriculum, Grades 9-12, Eng1ish 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.

Resources

Units in this Course Profile make reference to the use of specific texts, magazines, films, videos, and websites. The teachers need to consult their board policies regarding use of any copyrighted materials. Before reproducing materials for student use from printed publications, teachers need to ensure that their board has a Cancopy licence and that this licence covers the resources they wish to use. Before screening videos/films with their students, teachers need to ensure that their board/school has obtained the appropriate public performance videocassette licence from an authorized distributor, e.g., Audio Cine Films Inc. The teachers are reminded that much of the material on the Internet is protected by copyright. The copyright is usually owned by the person or organization that created the work. Reproduction of any work or substantial part of any work from the Internet is not allowed without the permission of the owner.

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.
ESRI. *The District. Using GIS to Combat Crime*. 2001 5min

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* or 3. Obtainable through Board OESS representative.
GeoKit CD. OAGEE, 1999. Obtainable through OAGEE regional representative.
ATLAS Ontario CD 2001 obtainable through ESRI Canada
Geographer's WORKBENCH CD Obtainable through GEM Geotechnologies
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
Celebrating an Education for Justice and Peace: A Letter to the Catholic Secondary School Students of Ontario from the Catholic Bishops of Ontario. Ontario Conference of Catholic Bishops 01/96
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.

Pottle, Todd. *Geography and GIS: GIS Activities for Students.* Toronto: Irwin Publishing, 2001. ISBN0-7725-2830-6

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

Network (Shaping a New World) – www.network.org

OSS Considerations

This profile is designed to assist teachers in developing and delivering Geomatics: Geotechnologies in Action, Grade 12, University/College Preparation, based on *The Ontario Curriculum, Grades 11 and 12, Canadian and World Studies,* pp. 93-100. 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.*

Coded Expectations, Geomatics: Geotechnologies in Action, Grade 12, University/College Preparation, CGO4M

Geographic Foundations: Space and Systems

Overall Expectations

SSV.01 · explain how the earth is modelled for scientific and mapping purposes;
SSV.02 · demonstrate an understanding of basic spatial concepts;
SSV.03 · explain the process of map projection and the properties and uses of selected projections;
SSV.04 · explain the use of geotechnologies in studying physical and human systems;
SSV.05 · use geotechnologies effectively to display and analyse patterns and regions on the earth's surface.

Specific Expectations

Understanding Concepts

SS1.01 – explain how the shape of the earth relates to the earth's rotation and gravitational field;
SS1.02 – explain the concepts of reference ellipsoid, reference sphere, and datum;
SS1.03 – define great circles, small circles, meridians, and parallels and explain the concept of great circle distance;
SS1.04 – explain the concept of elevation measured from mean sea level;
SS1.05 – differentiate between true, magnetic, and grid directions;
SS1.06 – demonstrate an understanding of the concept of scale, including the distinctions between large and small scale and between data scale and display scale;
SS1.07 – differentiate between spatial and non-spatial data; point, line, and area data; and qualitative and quantitative data;
SS1.08 – explain how map projections are used to transform the curved surface of the earth into a flat map, using examples from four broad groups of projections: azimuthal, conical, cylindrical, and miscellaneous;
SS1.09 – describe applications of geotechnologies relating to physical systems (e.g., resource management, climate modelling, forest mapping);
SS1.10 – describe applications of geotechnologies relating to human systems (e.g., marketing, route planning, precision farming, land use planning).

Developing and Practising Skills

SS2.01 – express location correctly by geographic coordinates, grid coordinates, and other methods (e.g., street address, postal code);
SS2.02 – express directions correctly as bearings (quadrant method) and azimuths (whole circle method) and convert from one to another;
SS2.03 – express scale correctly in numerical, verbal, and graphical form and convert from one to another;
SS2.04 – classify map projections as azimuthal, conical, or cylindrical based on the appearance of the meridians and parallels;
SS2.05 – analyse patterns of physical geography (e.g., relief, drainage) and human geography (e.g., settlements, land subdivision) on topographic maps and images.

Learning Through Application

SS3.01 – describe the properties and uses of important map projections, especially those commonly used in Canada (e.g., the Transverse Mercator and the Lambert Conformal);

SS3.02 – produce well-designed thematic maps to display and analyse distributions of physical and human phenomena (e.g., precipitation, population density, personal income);

SS3.03 – perform appropriate GIS analyses to isolate areas that meet specific criteria (e.g., orchards on sandy soil more than one hundred metres from a highway).

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

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

HE1.03 – explain the role of geotechnologies in addressing human problems caused by environmental forces (e.g., hurricanes, floods, avalanches).

Developing and Practising Skills

HE2.01 – explain the capability of GIS to integrate physical and human factors in addressing problems that involve aspects of both;

HE2.02 – 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 – assess the role of geotechnologies in addressing issues affecting indigenous peoples (e.g., reserve management, resource inventories);

HE3.02 – evaluate the use of geotechnologies in sparsely populated areas (e.g., use of global positioning systems [GPS] in search-and-rescue operations, satellite monitoring of military activity, radar imaging of forests);

HE3.03 – assess whether modern geotechnologies could have been used to avert famous disasters (e.g., sinking of the Titanic, collapse of the Ocean Ranger drilling platform).

Global Connections

Overall Expectations

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

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

GCV.03 · analyse how perceptions of places, situations, and events are affected by maps;

GCV.04 · evaluate the role of geotechnologies in facilitating interaction, cooperation, and communication between peoples.

Specific Expectations

Understanding Concepts

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

GC1.02 – describe the use of radar in providing information about cloud-covered parts of the earth;

GC1.03 – explain how map projection distortions can misrepresent the relative areas of different parts of the world;

GC1.04 – explain how satellites support global 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 areas to identify similarities and contrasts;

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

Learning Through Application

GC3.01 – explain how maps, especially maps of unfamiliar lands, can convey a misleadingly simple view of reality;

GC3.02 – explain the implications of the Eurocentric bias that results from centring conventional world maps on the Greenwich meridian;

GC3.03 – analyse the use of maps in propaganda, both negative propaganda intended to mislead and positive propaganda intended to benefit humanity;

GC3.04 – assess the positive and negative impacts of the use of geotechnologies in international affairs (e.g., GIS in disaster relief, GPS in military operations, satellites in monitoring of nuclear sites);

GC3.05 – examine the ethical aspects of the use of GIS, GPS, and related technologies, especially the implications for individual privacy, marginalized groups, and minority cultures.

Understanding and Managing Change

Overall Expectations

UCV.01 · explain the use of geotechnologies in monitoring change in dynamic systems;

UCV.02 · explain the use of geotechnologies in modelling and predicting future change;

UCV.03 · identify key stages in the evolution of geomatics.

Specific Expectations

Understanding Concepts

UC1.01 – explain the role of geotechnologies, especially satellite imaging, in monitoring changing phenomena (e.g., crop growth, clear-cutting, oil spills);

UC1.02 – show how modern geotechnologies can be used to measure changes that were formerly undetectable (e.g., monitoring crustal movements by GPS);

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

UC1.04 – identify key Canadian contributions to geomatics (e.g., Radarsat, Canada Geographic Information System);

UC1.05 – describe the extension of geomatics applications into non-traditional domains (e.g., criminology, marketing, medicine);
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 – predict changes in the weather by correctly interpreting meteorological charts;
UC2.02 – analyse the role of geotechnologies in predicting catastrophic events (e.g., hurricanes, avalanches, earthquakes);
UC2.03 – analyse the role of geotechnologies in anticipating long-term change (e.g., desertification, urban sprawl, rise in sea level).

Learning Through Application
UC3.01 – describe changes in their local landscape through time by interpreting a temporal sequence of maps or aerial photographs;
UC3.02 – model and predict future change in a physical or human system, using GIS (e.g., determining the effects of climatic change on crop growth).

Methods of Geographic Inquiry

Overall Expectations
GIV.01 · select and apply geographic skills, methods, and technologies to gather, analyse, and synthesize ideas and information;
GIV.02 · use a variety of methods and technologies to communicate the results of geographic inquiry and analysis effectively;
GIV.03 · evaluate sources of spatial and other data.

Specific Expectations
Understanding Concepts
GI1.01 – describe methods of acquiring raw data (e.g., direct measurement, questionnaire surveys, field observation);
GI1.02 – identify sources of data, maps, images, and other geographic products (e.g., governments, private companies, the Internet);
GI1.03 – identify the areal units by which data are commonly aggregated (e.g., enumeration areas, census tracts, school districts);
GI1.04 – explain the basic principles of, and the main techniques used in, surveying (e.g., use of tapes and compasses, measurement of distances and angles, use of GPS);
GI1.05 – explain the basic principle underlying GPS and the significance of differential GPS;
GI1.06 – explain the four basic mapping transformations: reduction, projection, generalization, and symbolization;
GI1.07 – demonstrate an understanding of the conceptual and artistic factors that make for a well-designed map or graphic (e.g., good generalization, symbol contrast, balanced layout);
GI1.08 – identify the sources and explain the characteristics of different types of electromagnetic radiation and their uses in remote sensing (e.g., using different kinds of infrared emissions to measure temperature and humidity in different parts of the atmosphere);
GI1.09 – classify remote sensing methods according to technology (e.g., photography, radar) and platform (e.g., airborne, spaceborne);
GI1.10 – explain the processes of aerial photography, remote sensing, thermography, and radar;

GI1.11 – explain the principles of image interpretation, with particular reference to aerial photographs;
GI1.12 – identify the main subsystems of a GIS (i.e., data input, data management, data analysis, data output);
GI1.13 – explain the concept of layering and the difference between the raster and vector data models;
GI1.14 – describe the structure of a database and explain basic database functions, including querying;
GI1.15 – explain key analytical operations in GIS (e.g., reclassification, overlaying, buffering).

Developing and Practising Skills

GI2.01 – assess the quality of data in terms of factors such as accuracy, completeness, currency, and cost;
GI2.02 – convert analogue data to digital data for computer input (e.g., by scanning or digitizing);
GI2.03 – use the Internet effectively to access information relevant to geomatics;
GI2.04 – execute basic survey operations by pacing or with the aid of simple instruments;
GI2.05 – determine the locations and elevations of points, using a GPS receiver;
GI2.06 – orient a map or aerial photograph in the field and relate the features shown to the surrounding landscape;
GI2.07 – classify maps according to type (e.g., topographic, thematic, navigational);
GI2.08 – produce a variety of good quality maps, charts, and graphs, using computer software or other methods;
GI2.09 – 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);
GI2.10 – use a variety of visual representation techniques (e.g., graphics, relief models, computer displays) to depict the earth's surface in novel ways;
GI2.11 – interpret a variety of remote sensing images, from aerial photographs to satellite images;
GI2.12 – 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);
GI2.13 – use GIS software appropriately to perform analytical operations (e.g., overlay analysis, route determination, database querying, simple image analysis).

Learning Through Application

GI3.01 – execute a systematic field survey in their local area and plot the results as a map;
GI3.02 – critically assess the results of a GIS analysis in the light of such factors as data quality, cell size, and initial assumptions;
GI3.03 – evaluate the use of GIS and other geotechnologies in comparison with alternative approaches used by geographers (e.g., field observation, library research, scientific experimentation).

Unit 3: Analysing and Understanding Patterns of Information

Time: 25 hours

Unit Description

Students identify and examine patterns that emerge from physical systems, human systems, and urban systems. Using a GIS, students have opportunities to map the relationships that exist between these systems. Furthermore, by exploring methods of data classification, students also map and appreciate the spatial distribution of unique human characteristics such as ethnicity, indigenous people, and socio-economic patterns. The culminating activity of this unit focuses on urban patterns within cities. The socio-economic patterns such as crime in the city are mapped using the GIS.

Activity 3.1: Identifying Physical Regions in the United States

Time: 1.5 hours

Description

This activity acquaints students with the use of GIS and its role in mapping physical regions by visual comparison. Using a relief image/map of the USA students outline the different physical regions, define what is a physical region, identify what makes it a region, and indicate the specific regions that they highlighted. Students then demonstrate the differing physical regions of the USA by creating shape files directly on to a georeferenced image of the USA. Then, students use these files to create an accurate physical features map of continental America.

Strand(s) & Learning Expectations

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

Overall Expectations

SSV.04 - explain the use of geotechnologies in studying physical and human systems;
SSV.05 - use geotechnologies effectively to display and analyse patterns and regions on the earth's surface;
GCV.03 - analyse how perceptions of places, situations, and events are affected by maps.
HEV.01 - explain the use of geotechnologies in studying human-environment interactions;
HE1.02 - explain the role of geotechnologies in addressing environmental problems resulting from human action (e.g., pollution, deforestation, species extinction).

Prior Knowledge & Skills

The student should have:

- an understanding of how a GIS works and its relevance to geospatial analysis;
- an understanding of navigating the Internet;
- skill in the retrieval of geographic data from the Geography Network Internet site.

Planning Notes

- Make sure the appropriate data is available on the computers.
- Ensure students have access to the Internet for data retrieval.
- If this is the first time in the course that students have used the Internet, review school and board policies.
- Develop assessment strategies.

Teaching/Learning Strategies

3.1.1 – The purpose of this lesson is to acquaint students with the use of GIS and its role in mapping physical regions by visual comparison. Using a relief image/map of the USA students outline the different physical regions, define what is a physical region, identify what makes it a region, and indicate the specific regions that they highlighted.

Teachers acquaint students with some concepts and terms used to differentiate the different physical regions. Also, the teacher outlines the differences between Ecozones, as studied in Grade 9, and physical regions.

During the classroom discussion the teacher describes what characteristics define regions such as economical, political, cultural, and physical characteristics.

3.1.2 – Individually the students show the different physical regions of the USA using a relief image US_48big.tif found on the ESRI Schools and Library CD-ROM to do so. Students produce polygons to indicate where the different physical regions, e.g., Rocky Mountains, Appalachian Mountains, the Prairies, Coastal Lowlands, and River basins, are located. They produce a theme table to add information to the theme. The type of information that could be placed in the table includes: Name, Classification, Basic Elevation (high, medium, low), and Precipitation (which can be found on the Internet).

(It is felt that students at the senior level will have had a strong Canadian focus up to this point and therefore a wider North American context will have definite benefits. This activity could be accomplished using georeferenced images for Canada or any other political entity that has both political and physical regions.)

Assessment & Evaluation of Student Achievement

The focus of this activity is for students to identify the different physical features of the United States. The students produce a relief map to show the different regions. A mapping checklist can be used to evaluate each map. This assessment can either be done by students or by the teacher.

T/L Strategy	Task/Product	Tool	Purpose	Achievement Category
3.1.1 (class)	Whole-class discussion	Teacher-generated rating scale	Formative	Knowledge/Understanding Thinking/Inquiry Communication
3.1.2 (individual)	Creation of a relief map	Map component checklist	Formative	Thinking/Inquiry Application

Accommodations

Enrichment – students can identify smaller regions and place more detailed information in the theme table.

Resources

Print

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

OAGEE. *Monograph* Fall, 2001

Jonell, Alvi. *Extending ArcView GIS*. ESRI Press, 1999. ISBN 1-879102-05-6

Data

US_48big.tif, ESRI Schools and Library CD-ROM.

Websites

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

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

Activity 3.2: Identifying Settlement Patterns in the United States

Time: 1.5 hours

Description

This activity acquaints students with the use of GIS and its role in mapping human settlement and systems. The teacher initiates a class discussion on some of the reasons for urban settlement, e.g., water accessibility, resource base, physical impediments, climate, etc.

Once students have accomplished this task they should be able to see areas around the USA that have a higher concentration than others. Where there is a high concentration, students use polygons to produce a new theme: Megalopolis (these should be seen around New York City, L.A. Miami for example). A number of cities within each of these physical regions can be analysed using attribute queries. It is also suggested that a simple statistical analysis be done for the cities in each area using the calculator tool for such activities as total population of selected cities and rural urban differences.

Strand(s) & Learning Expectations

Strand(s): Geographic Foundations: Space and Systems

Overall Expectations
SSV.04 - explain the use of geotechnologies in studying physical and human systems.

Specific Expectations
SS1.10 - describe applications of geotechnologies relating to human systems (e.g., marketing, route planning, precision farming, land use planning).

Prior Knowledge & Skills

Students should have:
- an understanding of how a GIS works and its relevance to geospatial analysis
- an understanding of navigating the Internet
- an idea of what characteristics make up Physical Regions
- skills in the retrieval of geographic data from the Geography Network

Planning Notes

- Make sure the appropriate data is available on the computers.
- Ensure students have access to the Internet for data retrieval.
- If this is the first time in the course that students have used the Internet, review school and board policies.
- Develop assessment strategies.

Teaching/Learning Strategies

3.2.1 – The purpose of this lesson is to acquaint students with the use of GIS and its role in mapping human settlement and systems. The teacher initiates a class discussion on some of the reasons for urban settlement, e.g., water accessibility, resource base, physical impediments, climate etc.

Using US data from ESRI Data, students first locate all the major cities in the United States. As there will be too many cities with which to work, students query out city centres that are greater than 100 000 people, for example.

The teacher may want to direct students to view The Geography Network to locate, or reinforce their decision.

3.2.2 – Once students have accomplished this task they are able to see areas around the US that have a higher concentration than others. Where there is a high concentration, students will then use polygons to produce a new theme, Megalopolis (these should be seen around New York City, Los Angeles, Miami, for example). A number of cities within each of these physical regions can be analysed using attribute queries. It is also suggested that a simple statistical analysis be done for the cities in each area using the calculators tool for such activities as total population of selected cities and rural urban differences.

Assessment & Evaluation of Student Achievement

This assessment can either be done by students or by the teacher.

T/L Strategy	Task/Product	Tool	Purpose	Achievement
3.2.1 (class)	Whole-class discussion	Teacher-generated check list	Formative	Knowledge Thinking/Inquiry Communication
3.2.2 (individual)	Creation of a settlement distribution map	Map component checklist	Formative	Thinking/Inquiry Application

Resources

Print

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

OAGEE. *Monograph* Summer, 2001.

Jonell, Alvi. *Extending ArcView GIS*. ESRI Press, 1999. ISBN 1-879102-05-6

Data

The Geography Network – www.geographynetwork.com
ArcView ESRIdata US cities
Davis, David E. *GIS for Everyone.* ESRI Press, 1999. ISBN 1-879102-49-8

Websites

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

Software

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

Activity 3.3: Exploring the Influence that Physical Regions have on Urban Settlement

Time: 1.5 hours

Description

This activity acquaints students with the use of GIS and its role in mapping and utilising national level data. Students examine the pattern of settlement in the USA as the physical regions have influenced it. Students examine how GIS can help to determine where new settlement may need to occur and where it cannot. Students accomplish this using examples of human settlements, i.e., transportation. The presentation is demonstrated in the form of a written paper with supporting maps to be presented to the entire class.

Strand(s) & Learning Expectations

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

Overall Expectations

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

Specific Expectations

HE2.01 - explain the capability of GIS to integrate physical and human factors in addressing problems that involve aspects of both;
HE2.02 - relate patterns of physical geography (e.g., relief, drainage) to patterns of human geography (e.g., settlements, land subdivisions) on maps and images;
SS3.02 - produce well-designed thematic maps to display and analyse distribution of physical and human phenomena (e.g., precipitation, population density, personal income);
SS2.05 - analyse patterns of physical geography (e.g., relief, drainage) and human geography (e.g., settlements, land subdivisions) on topographical maps and images.

Prior Knowledge & Skills

The student should have:

- an understanding of how a GIS works and its relevance to geospatial analysis;
- experience working with small groups;
- an understanding of navigating the Internet;
- the ability to retrieve their own work;
- the ability to use a slideshow presentation program;
- skills in the retrieval of geographic data from the Geography Network Internet site;
- the ability to synthesize information from the Internet as well as their own work and present it in a coherent, well constructed paragraph.

Planning Notes

- Ensure students have access to the Internet for data retrieval.
- Ensure students have access to a word processor, and a presentation package.
- Have notes on factors that influence settlement.
- Develop assessment strategies.

Teaching/Learning Strategies

3.3.1 – The purpose of this lesson is to acquaint students with the use of GIS and its role in mapping and utilising national level data. Students examine the pattern of settlement in the US as the physical regions have influenced it. Students examine how GIS can help determine where new settlement may need to occur and where it can't.

Teachers acquaint students with some concepts and terms used when discussing physical regions and settlement characteristics. To show the connection or influence, students display some transportation features such as railways, highways, and international airports.

At this point, the teacher describes each of these transportation features and explains their importance in the development and distribution of urban centres.

3.3.2 – The teacher instructs students to examine the settlement patterns in the US based on physical regions and transportation methods. Students map the major urban settlements, which they have already identified from the previous lesson. Some questions students should keep in mind are: are there any flaws in these transportation methods starting with the most historic railroads and why might they be there? do the highways follow the railroads, give an explanation. what is the significance of urban size and international airports and are there any exceptions why/why not?

3.3.3 – When students have completed their work they display their findings in presentation format with a written paper to support their maps. The presentation is done in front of the whole class.

Assessment & Evaluation of Student Achievement

Using the expectations being assessed, the teacher designs checklists to assess the class discussion and the map showing the relationship, and a rubric for the student GIS slideshow presentation.

Assessment of the final product can be by the teacher or by the students. In many instances, peer assessment is very effective as it allows students to showcase their work. So as not to be distracted by colourful images that show little geographic reasoning, the teacher should ensure that the rubric is prescriptive and detailed. Teachers who choose to have students integrate their maps into a word-processing package would be well advised to develop a checklist for their use and evaluation when grading the final product.

T/L Strategy	Task/Product	Tool	Purpose	Achievement
3.3.1 (class)	Whole-class discussion	Teacher-generated checklist	Formative	Knowledge Thinking/Inquiry Communication
3.3.2 (individual)	Creation of a map showing the relationship between settlement and relief	Map component checklist	Formative	Thinking/Inquiry Application
3.3.3 (group/class individual participation and contribution)	GIS Slideshow presentation	GIS and presentation rubric	Summative	Knowledge Thinking/Inquiry Application Communication

Accommodations

- Have available notes on the influencing factors physical regions have on settlement development
- Enrichment - Students could map how they predict the US will look in the future with population growth.

Resources

Print

Yeates, Maurice, *The North American City.* ISBN 0-321-01364-6

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

Jonell, Alvi. *Extending ArcView GIS.* ESRI Press, 1999. ISBN 1-879102-05-6

Data

The Geography Network (www.geographynetwork.com) has a good selection of New York City data *ArcView* ESRIdata

Websites

– www.esricanada.com/k-12/gis/capabilities.html
– www.census.gov (US Census Bureau)

Software

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

Activity 3.4: Data Classification – Changing American Ethnography

Time: 1.5 hours

Description

This activity focuses on a teacher-directed slide show of specific geo-statistical data classification methods that focuses on the diversity of ethnic, racial, or cultural groups of a specific region. Students identify various GIS methods for establishing and mapping patterns of human diversity within a defined region.

Strand(s) & Learning Expectations

Strand(s): Human-Environment Interactions, Global Connections

Overall Expectations

GCV.02 - explain the role of geotechnologies in understanding peoples and places around the world;
GCV.03 - analyse how perceptions of places, situations, and events are affected by maps.

Specific Expectations

GI1.03 - identify the areal units by which data are commonly aggregated (e.g., enumeration areas, census tracts, school districts);
GI2.13 - Use GIS software appropriately to perform analytical operations.

Prior Knowledge & Skills

The student should have

- Basic understanding of how a GIS works and its use in geostatistical operations
- Experience in working in small groups
- Basic understanding of working in an Internet environment
- Basic understanding of summary and note taking

Planning Notes

- The teacher will build a slide show on basic classification methods (see *Geographer's Workbench* Gem Geotechnologies 2001) with a requisite worksheet.
- Acquire either an LCD projector or method of overheads to show the slide show.

Teaching & Learning strategies

3.4.1 – Students participate in a teacher-directed slide show on specific methods of data classification (chloropleth mapping) and fill in the accompanying worksheet.
Students then read an article on the changing American demographic with the objective of identifying where ethnic, racial, or racial groups live in the USA.
e.g., – http://seattlepi.nwsource.com/local/race261.shtml

OR

– http://www.umac.org/ocp/population/demographics.htm

3.4.2 – Students use a summary sheet in order to make point-form notes on the distribution of African Americans and/or Aboriginal peoples throughout the USA. The teacher instructs them to look for patterns as they relate to rural/urban influences and other geographic parameters.

Assessment & Evaluation of Student Achievement

T/L Strategy	Task/Product	Tool	Purpose	Achievement
3.4.1 (class)	Teacher-centred learning	Checklist in the form of a self-assessment question sheet	Formative Through the use of self-assessment question sheet	Knowledge/ Understanding Thinking/Inquiry
3.4.2 (individually)	Summary sheet of minority issues in the United states with emphasis on rural and urban differences	Checklist	Formative	Thinking/Inquiry Application

Accommodations

- Teacher may demonstrate the methods needed to write a summary to a specific document, when necessary.

Resources

Print and CD

Knox, Paul and Steven Pinch. *Urban Social Geography: An Introduction.* ISBN 0-5823-8119-3

Yeates, Maurice. *The North American City.* ISBN 0-321-01364-6

Mitchell, Andy. *The ESRI Guide to GIS Analysis Volume 1: Patterns & Relationships.* ESRI Press. ISBN 1-879102-06-4

Bell, Gerry, E. Geddes, and M. Lowry. *The Geographer's Workbench.* GEM Geotechnologies, Burlington, 2001. A CD of activities and data for The Geographer's Toolkit, Grade 11 Workplace Preparation course

Websites

– http://seattlepi.nwsource.com/local/race261.shtml
or
– http://www.umac.org/ocp/population/demographics.htm

Activity 3.5: Mapping the Distribution of Indigenous Peoples and Cultural Minorities Through GIS Mapping Structures

Time: 6.5 hours

Description

Students map and analyse First Nations land claims. They create a thematic map to establish specific patterns and discuss the results of these patterns. Students then apply different classification techniques to the geo-statistical data to make comments and conclusions.

Strand(s) & Learning Expectations

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

Overall Expectations

GIV.01 - select and apply geographic skills, methods, and technologies to gather, analyse, and synthesize ideas and information;
GIV.02 - use a variety of methods and technologies to communicate the results of geographic inquiry and analysis effectively;
UCV.01 - explain the use of geotechnologies in monitoring change in dynamic systems.

Specific Expectations

HE3.01 - assess the role of geotechnologies in addressing issues affecting indigenous peoples (e.g., reserve management, resource inventories);
SS3.03 - perform appropriate GIS analyses to isolate areas that meet specific criteria;
GI2.13 - use GIS software appropriately to perform analytical operations.

Prior Knowledge & Skills

The student should have:

- an understanding of how a GIS works and its relevance to geospatial analysis;
- experience in working with small groups;
- an understanding of navigating the Internet;
- a basic understanding of basic one and two variable statistics (i.e., mean, media, mode);
- skills in the retrieval of geographic data from the Geography Network Internet site.

Planning Notes

- Ensure students have access to the Internet for data retrieval.
- Ensure students have access to a word processor and a presentation package.
- Obtain the geographic files from the appropriate website (www.geographynetwork.com) and copy the files to the student use directory on the computers.
- Ensure students have access to generalized data on USA by county, First Nations/Indigenous peoples Land Claims, and US Cities. Files to use Generalized USA which can be found on either the Geographynetwork.com or ESRI Maps and data.
- The file for Federal lands-Native American Reservations can also be found on the Geographynetwork.com.

Teaching/Learning Strategies

The purpose of this lesson is to acquaint students with the attribute data inherent in any GIS vector shapefile and the methods of classifying this data. Students examine specific polygon shape files of the USA and through the use of both isolation and classification begin to make specific socio/demographic conclusions, and isolate specific variables.

3.5.1 – First Nations/Indigenous Peoples Land Claims - Students download and unzip a specific file from the geography network or Ministry-licenced *ArcCanada* CD (included with *ArcView* software). They then, using the legend editor, create a thematic map over the previously created contiguous 48-state file. They modify the legend to show only the First Nations reservations. This is accomplished using the colour transparency fill feature in the legend editor to isolate only those polygons of Indigenous Lands. Students then make informed classroom comments as to the patterns and location of the lands within the USA.

3.5.2 – Students now add to the Contiguous 48-states theme a theme of the US counties with fields of population 90 and 97. This theme should also include data on numbers of African Americans per county in the USA. This information can be found either on the geography network or data sources like ESRI Maps and Data or Ministry-licenced *ArcCanada* CD (included with *ArcView* software). Students, either individually or in pairs, create a map of the various counties throughout the USA. They classify this data by number of African Americans per county using a standard classification technique, i.e., natural breaks and a default number of classes (5). Referring to their notes from Activity 3.4 students make four other maps using different classification methods. They put these four classification types in differing views. A class discussion can then take place as to the relative patterns that show up with these various views and given the information they have on classification methods students are able to make informed decisions on which ones are most appropriate for this data presentation.

3.5.3 – Students, with the teacher's guidance, amalgamate into larger groups of three or four students per group. Students then choose four or five adjacent states that they clip out of the original states file. In order that a representative sample of the US is identified, the teacher needs to be involved in this process. Areas of the USA to be covered should include:

- Northeast
- Southeast
- Southern states
- West coast
- Midwest
- Great Lakes

Students repeat the classification process on their chosen state grouping. They normalize their data by the county population in 1990. As a group they make decisions as to which classification method best represents the information that they collected from the summary reading in Activity 3.4. To demonstrate the rural urban variance student groups then identify the appropriate cities file (this will need to be clipped from the cities file to their state grouping). Students decide on an appropriate urban community size and query out those cities. These cities may be mapped as proportional symbols. This exercise is then repeated for the 1997 census. The student groups present their findings through a seminar process to the rest of the class in a series of presentation slides that can be collated into a classroom presentation on density and patterns of African Americans in America.

Note: We have used the correct terminology for African Americans. Some data files however may refer to "Blacks." Teacher will need to be sensitive to the language describing groups in the population.

Assessment & Evaluation of Student Achievement

Teachers should devise a rubric for the culminating exercise that encourages students to combine the information they have generated.

T/L Strategy	Task/Product	Tool	Purpose	Achievement
3.5.1 (individual)	Cull out federal First Nations reservations and develop a thematic map	Checklist	Formative	Knowledge/ Understanding Thinking/Inquiry
3.5.2 (individually or pairs)	Using US county data create chroropleth map to show patterns of African American concentration	Checklist	Formative	Thinking/Inquiry Application

T/L Strategy	Task/Product	Tool	Purpose	Achievement
3.5.3 (small groups or pairs) Individual Contribution	Using a clipped group of states students make conclusions on population patterns Presentation showing comparison and conclusions of population patterns	Rubric	Summative	Application Communication

Accommodations

- An introduction to social area analysis theory may be necessary for some students. An exemplar on Geographic Analysis would also be beneficial at this juncture.
- Enrichment – Students could map other groupings for comparison.

Resources

Print and CD

Knox, Paul and Steven Pinch. *Urban Social Geography: An Introduction.* ISBN 0-5823-8119-3

Yeates, Maurice. *The North American City.* ISBN 0-321-01364-6

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

OAGEE. *Monograph.* Fall, 2001.

Jonell, Alvi. *Extending ArcView GIS.* ESRI Press, 1999. ISBN 1-879102-05-6

Mitchell, Andy. *The ESRI Guide to GIS Analysis Volume 1*: *Patterns & Relationships.* ESRI Press. ISBN 1-879102-06-4

Bell, Gerry, E. Geddes, and M. Lowry. *The Geographer's WorkBench.* GEM Geotechnologies, Burlington, 2001. A CD of activities and data for The Geographer's Toolkit, Grade 11 Workplace Preparation course

Data

The Geography Network (www.geographynetwork.com) has a good selection of New York City data

ESRI Data and Maps has maps and Data for the USA.

Websites

– http://gis.esri.com/industries/k-12/arclessons/ (address matching tutorial)

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

– www.census.gov (USA Census Bureau)

Software

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

Activity 3.6: Using Data Classification Techniques to Find Patterns in Census Data

Time: 1.5 hours

Description

In this activity, students rely on the geo-statistical methods of classification established in the previous activity to work with a number of demographic variables. After students have classified and mapped their specific variables, they then present their findings to the class.

Strand(s) & Learning Expectations

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

Overall Expectations

GIV.01 - select and apply geographic skills, methods, and technologies to gather, analyse, and synthesize ideas and information;
GIV.02 - use a variety of methods and technologies to communicate the results of geographic inquiry and analysis effectively.

Specific Expectations

GIV.03 - evaluate sources of spatial and other data;
SS3.03 - perform appropriate GIS analyses to isolate areas that meet specific criteria;
GI2.13 - use GIS software appropriately to perform analytical operations.

Prior Knowledge & Skills

The student should have:

- an understanding of how a GIS works and its relevance to geospatial analysis;
- experience working with small groups;
- an understanding of the pitfalls of working with culturally biased data;
- an understanding of navigating the Internet;
- skill in the retrieval of geographic data from the Geography Network Internet site;
- the ability to synthesize information from the Internet and present it in a coherent, well constructed paragraph.

Planning Notes

- Ensure students have access to the Internet for data retrieval.
- Ensure students have access to a word processor and a presentation package.
- Obtain the geographic files from the appropriate website (www.geographynetwork.com) and copy the files to the student use directory on the computers. Generalized USA data is also available from ESRI Maps and Data or Ministry-licenced *ArcCanada* CD (included with *ArcView* software).
- It is imperative that the teacher encourages students to the sensitivity of working with culturally biased data. It must be noted that in many cases the circumstances have created the data and not the other way around. If a class discussion is needed to discuss where students' impressions have come from then it is very important that the teacher take time to do this.
- The teacher should direct students to accumulate data on Generalized USA county demographic data. If the Internet connections are inadequate, the teacher should search for and download the information ahead of time and place it for access by students in an appropriate directory.
- If this is the first time in the course that students have used the Internet, review school and board policies.
- Develop assessment tools and strategies.

Teaching/Learning Strategies

3.6.1 – Student groups, determined in the previous activity, continue to work with their four adjacent state groups. They are instructed (teacher-directed) to choose four other demographic variables. It is imperative that the teacher be aware of cultural and economic sensitivity as the students choose their variables. After students choose the specific fields they are to write a one-sentence hypothesis that they try to prove using various classification techniques and groupings. It must be stressed to students that this co-relation or comparison can be manipulated by the classification numbers and break methodologies that they use. It is suggested that the teacher manipulate the choice of variables in such a way that there is one that will not co-relate. An example of this could be housing units. It is important for students to realise that many of their suppositions will be wrong and that this can be a good thing.

Students in groups create layouts of their four variables around the central map with a layout for each of the chosen variables. The layout should include information as to the supposition, the classification method they used along with the normalizing variable if they used one (population 1997), and one or two points of conclusion. It must be noted that this is strictly a visual co-relation of distinguishing patterns and distribution. Student groups conclude by putting their layouts into a presentation format. They may find it more expedient to add comments at this stage instead of at the layout stage.

3.6.2 – Student groups present their findings to the class. In their discussion they should include the supposition and their findings. Included in this discussion is the classification method they used and why, and any differences they noted if they used a different classification method. Comments should also be made as to the number of data groupings and if the data was normalized.

Assessment & Evaluation of Student Achievement

T/L Strategy	Task/Product	Tool	Purpose	Achievement
3.6.1 (group)	Groups map four demographic variables	Teacher-generated check list	Formative	Knowledge/ Understanding Thinking/Inquiry Communication
3.6.2 (group and class)	Compare the variables to the distribution and add comment to presentation slides	Slide presentation checklist	Formative	Thinking/Inquiry Application

Accommodations

- Remedial – An introduction to social area analysis theory may be necessary for some students. An exemplar on Geographic Analysis would also be beneficial at this juncture.
- Enrichment – Students could map local data as a comparator for known neighbourhood identification.

Resources

Print and CD

Knox, Paul and Steven Pinch. *Urban Social Geography: An Introduction.* ISBN 0-5823-8119-3

Yeates, Maurice. *The North American City.* ISBN 0-321-01364-6

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

OAGEE. *Monograph.* Fall, 2001

Jonell, Alvi. *Extending ArcView GIS.* ESRI Press, 1999. ISBN 1-879102-05-6

Bell, Gerry, E. Geddes, and M. Lowry. *The Geographer's WorkBench.* GEM Geotechnologies, Burlington, 2001. A CD of activities and data for The Geographer's Toolkit, Grade 11 Workplace Preparation course

Data
The Geography Network (www.geographynetwork.com) has a good selection of New York City data. ESRI Data and Maps has maps and data for the USA.

Websites
– http://gis.esri.com/industries/k-12/arclessons/ (address matching tutorial)
– www.esricanada.com/k-12/gis/capabilities.html
– www.census.gov (US Census Bureau)

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

Activity 3.7: Exploring Urban Patterns with Census Tract Data

Time: 4.0 hours

Description

The purpose of this activity is to acquaint students with the use of GIS and its role in mapping and utilizing street level (census tract) data. Students examine the pattern of neighbourhoods in a major city. Students examine how GIS can help develop information related to the development of neighbourhoods. Geographic analyses like these occur in planning departments across the United States and Canada.

Strand(s) & Learning Expectations

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

Overall Expectations
GCV.04 - evaluate the role of geotechnologies in facilitating interaction, cooperation, and communication between peoples;
GIV.03 - evaluate sources of spatial and other data;
GC3.01 - explain how maps, especially maps of unfamiliar lands, can convey a misleadingly simple view of reality.

Prior Knowledge & Skills

The student should have:
- an understanding of how a GIS works and its relevance to geospatial analysis;
- experience working with small groups;
- an understanding of navigating the Internet;
- skill in the retrieval of geographic data from the Geography Network Internet site;
- the ability to synthesize information from the Internet and present it in a coherent, well-constructed paragraph;
- an understanding of census data structures including Census tracts.

Planning Notes

- Ensure students have access to the Internet for data retrieval.
- Ensure students have access to a word processor and a presentation package.
- Obtain the geographic files from the appropriate website (www.geographynetwork.com) and copy the files to the student use directory on the computers. Street file data is also available from the book and accompanying CD by Davis, David E. *GIS for Everyone* or Ministry-licenced *ArcCanada* CD (included with *ArcView* software).
  The teacher should direct the students to accumulate data on New York City demographics. If the Internet connections are inadequate, the teacher should search for and download the information ahead of time and place it for access by students in an appropriate directory.

- If this is the first time in the course that students have used the Internet, review school and board policies.
- Develop assessment strategies.

Teaching/Learning Strategies

3.7.1 – The purpose of this lesson is to acquaint students with the use of GIS and its role in mapping and utilizing street level (census tract) data. Students examine the pattern of neighbourhoods in Manhattan and greater New York City. Students examine how GIS can help develop information related to the development of neighbourhoods. Geographic analyses like these occur in planning departments across the United States and Canada.

Teachers need to acquaint students with some concepts and terms used when discussing census tract level information. Terms and concepts related to urban geography and social area analysis as well as GIS should be reviewed before starting the lesson.

3.7.2 – The teacher instructs students to examine the demographic patterns in Manhattan by census tract.

Students map the major ethnic, racial, or cultural groups from the United States Census. Students should use a standard deviation classification method that allows for more than six divisions. Students are to identify those areas which have a higher than normal concentration of each major ethnic, racial, or cultural grouping. Areas with above average concentrations can be considered to be statistically significant major ethnic, racial, or cultural neighbourhoods. Students should note the differences that occur from the patterns of several minority groups on the island of Manhattan. Other areas can be accommodated if desired.

As an alternative approach, teachers can instruct student in the use of the calculator functions embedded in the GIS. Students can calculate the major ethnic, racial, or cultural percentage of the total population for that tract. This would be done for each major ethnic, racial, or cultural group being studied (e.g., Hispanic, African American, Asian). The end result will produce a different viewpoint as to the level of concentration which establishes a neighbourhood.

3.7.3 – Students create "neighbourhoods" by drawing polygons over the areas of highest concentration. Students create a street file of New York City and use the street names to define the social areas of the map. Using a city-guide directory, students compare their polygons to the traditionally defined neighbourhoods and note similarities and differences. They account for any discrepancies between the two maps.

Students retrieve an image of Manhattan to use as a backdrop. Placing their neighbourhoods over the backdrop image allows students to view the types of structures present in the neighbourhood. Students record relevant observations to include in their final output. Additional maps of median value or median rent value would be useful as economic comparitors.

Students develop an electronic presentation which illuminates the three social areas of Manhattan identified. Students create several summary pages, which incorporate maps, text, and images to show the minority neighbourhoods of Manhattan, New York.

Assessment & Evaluation of Student Achievement

Teachers should devise a rubric for the culminating exercise that encourages students to combine the information they have generated.

Assessment of the final product can be by the teacher or by the students. In many instances, peer assessment is very effective as it allows students to showcase their work. So as not to be distracted by colourful images that show little geographic reasoning, the teacher should ensure that the rubric is prescriptive and detailed. Teachers who choose to have students integrate their maps into a word-processing package would be well advised to develop a checklist for their use and evaluation when grading the final product.

T/L Strategy	Task/Product	Tool	Purpose	Achievement
3.7.1 (class)	Whole-class discussion about social area analysis concepts	Rating scale	Formative	Knowledge/ Understanding Thinking/Inquiry
3.7.2 (individually or pairs)	Exercise constructing neighbourhoods based on population concentration of minority groups	Checklist	Formative	Thinking/Inquiry Application
3.7.3 (individually)	Comparative analysis of constructed maps with accepted social areas in a community	Rubric	Summative	Application Communication

Accommodations

- Enrichment - Students could map local data as a comparitor for known neighbourhood identification.

Resources

Print

Knox, Paul and Steven Pinch. *Urban Social Geography: An Introduction.* ISBN 0-5823-8119-3

Yeates, Maurice. *The North American City*. ISBN 0-321-01364-6

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

OAGEE. *Monograph.* Fall, 2001

Jonell, Alvi. *Extending ArcView GIS.* ESRI Press, 1999. ISBN 1-879102-05-6

Data

The Geography Network (www.geographynetwork.com) has a good selection of New York City data *ArcView StreetMap* has street level data for all major US urban centres.

Websites

– http://gis.esri.com/industries/k-12/arclessons/ (address matching tutorial)
– www.esricanada.com/k-12/gis/capabilities.html
– www.census.gov (US Census Bureau)

Software

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

Activity 3.8: Applications of Street level Data

Time: 4.0 hours

Description

This activity (a continuation from Activity 3.7) acquaints students with the use of GIS and its role in mapping and utilizing street level data. Students examine the pattern of streets in a major North American city. Students examine the way the logistics industry attempts to schedule and route deliveries based on a variety of criteria. Further, students examine how GIS can help develop information for tourists in a community. Geographic analyses like these occur every day in planning departments and delivery services across the United States and Canada.

Strand(s) & Learning Expectations

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

Overall Expectations

GCV.04 - evaluate the role of geotechnologies in facilitating interaction, cooperation, and communication between peoples;
GIV.03 - evaluate sources of spatial and other data;
GC3.01 - explain how maps, especially maps of unfamiliar lands, can convey a misleadingly simple view of reality.

Prior Knowledge & Skills

Students should have:

- an understanding of how a GIS works and its relevance to everyday life;
- some experience working with small groups;
- an understanding of navigating the Internet;
- skills in the retrieval of geographic data from the Geography Network Internet site;
- the ability to synthesize information from the Internet and present it in a coherent, well constructed paragraph.

Planning Notes

- Ensure students have access to the Internet for data retrieval.
- Ensure students have access to a word processor and a presentation package.
- Obtain the geographic files from the appropriate website (www.geographynetwork.com) and copy the files to the student use directory on the computers.
- The teacher should direct the students to accumulate data on New York City landmarks. If the Internet connections are inadequate, the teacher should download the information ahead of time and place it for access by students in an appropriate directory.
- If this is the first time in the course that students have used the Internet, review school and board policies.
- Develop assessment strategies.

Teaching/Learning Strategies

3.8.1 – The purpose of this lesson is to acquaint students with the use of GIS and its role in mapping and utilising street level data. Students examine the pattern of streets in Manhattan and greater New York City. Students examine how the logistics industry attempts to schedule and route deliveries based on a variety of criteria. Students then examine how GIS can help develop information for tourists in a community. Geographic analyses like these occur every day in planning departments and delivery services across the United States and Canada.

Teachers acquaint students with some concepts and terms used when discussing street level information. Terms and concepts related to urban geography as well as Geographic Information Systems should be reviewed before starting the lesson. Teachers should obtain background information about the logistics and the logistics industry prior to the presentation of this lesson.

3.8.2 – The teacher instructs students to examine the street patterns in Manhattan. They should note the differences that occur from the layout of streets in older and newer parts of the island.

The teacher instructs students to locate a variety of street addresses in the Manhattan area using the GIS. Using the GIS, students map and measure the shortest route to each of the identified places and to a return destination.

Noting that delivery services (logistics) work with this type of data each day, students construct a table which adds the type of delivery being requested at the address. This table will be geocoded to the street map of New York City. Each address should be classed as receiving one of perishable goods, small package goods, or heavy furniture items. Students reclassify the delivery points based on a predetermined classification system. This allows the students to construct multiple maps which direct various sizes of trucks to deliver goods to various destinations in a specified order.

Finally, students are given a list of landmarks in the Manhattan area. Students use the Internet to locate the addresses of the landmark. They will also obtain graphic images of the landmark to be used as either a hotlinked image or as a graphic element in the brochure.

Students develop a table which is suitable for geocoding. Students geocode the data and construct a map showing all the landmark sites including small images of the landmark.

3.8.3 – Students develop a brochure (single or multiple pages) which directs visitors on a walking tour through the Manhattan area to the various landmarks. This could be done as a booklet style brochure where students export the maps they have generated and add the information to form a graphic rich text document. They should include information about each landmark such as opening/closing times, entry fees, and distance from the previous location as well as directions from one landmark site to another.

Alternatively, teachers can have students generate an electronic presentation using the maps they have generated and the supporting text material together.

Assessment & Evaluation of Student Achievement

Teachers should devise a rubric for the culminating exercise that encourages students to combine the information they have generated.

Assessment of the final product should be by the teacher. In many instances, peer assessment is very effective as it allows students to showcase their work. However, in this instance, the teacher will have the students prepare a written "tour guide" booklet which integrates the maps, charts and text material. So as not to be distracted by colourful images that show little geographic reasoning, the teacher would be the best evaluator. Teachers who choose to have students integrate their maps into a computer presentation using presentation software such as *PowerPoint* or *Corel Presentations* would be well advised to develop a checklist for student use and evaluation during the class presentation.

T/L Strategy	Task/Product	Tool	Purpose	Achievement
3.8.1 (class)	Whole-class discussion about urban geography concepts and/or logistics	Rating scale	Formative	Knowledge/ Understanding Thinking/Inquiry
3.8.2 (individually or pairs)	Completion of exercise looking at street level data	Checklist	Formative	Thinking/Inquiry Application
3.8.3 (individually or pairs)	Construction of "Tour Guide" booklet with detailed maps and commentary	Rubric	Summative	Application Communication

Accommodations

- A review on paragraph structure may be necessary for some students. An exemplar on Geographic Analysis would also be beneficial at this juncture.
- Enrichment – Students could add charts, graphs and significant retail establishments, etc. to the walking tour maps.

Resources

Print

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

OAGEE. *Monograph.* Summer, 2001.

Jonell, Alvi. *Extending ArcView GIS.* ESRI Press, 1999. ISBN 1-879102-05-6

Data

The Geography Network (www.geographynetwork.com) has a good selection of New York City data.

ArcView StreetMap has street level data for all major US urban centres.

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

Websites

– http://www.logisticsworld.com/logistics/ (depository of logistics information)

– http://www.purchasedparts.com/logistics.htm (short overview on logistics)

– http://gis.esri.com/industries/k-12/arclessons/(address matching tutorial)

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

Software

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

Activity 3.9: Culminating Activity: Crime in America

Time: 3.0 hours

Description

This Culminating Activity demonstrates the use of GIS and its role in law enforcement. Students examine patterns of crimes by region, by county and at the street level. Students examine how GIS can help analyse patterns of crime in a community. Geographic analyses like these occur every day in police departments throughout North America.

Strand(s) & Learning Expectations

Strand(s): Understanding Change, Global Connections

Overall Expectations

GCV.04 - evaluate the role of geotechnologies in facilitating interaction, cooperation, and communication between peoples.

Specific Expectations

UC1.05 - describe the extension of geomatics applications into non-traditional domains (e.g., criminology, marketing, medicine).

Prior Knowledge & Skills

The student should have:

- a basic understanding of how a GIS works and its relevance to geospatial analysis;
- some experience working with small groups;
- a good understanding of navigating the Internet to obtain geospatial information;
- the ability to synthesize information from the Internet and present it in a coherent, well constructed paragraph.

Planning Notes

- Ensure students have access to a copy of the electronic video presentation regarding crime management through GIS for discussion and review (www.esri.com\the district).
- Ensure students have access to a word processor, a presentation package, and the Internet.
- Obtain the ArcLesson: Crime Analysis from the appropriate website (www.esri.com\k-12) and copy the files to the student use directory on the computers.
- Unzip the Arclesson: Crime Analysis as noted in the teaching/learning strategies section
- Print the following documents:

Exercises

- ❑ CP1-Exercise 1 – Crime Analysis in America.doc
- ❑ CP2-Exercise 2 – Crime Analysis by County.doc
- ❑ CP3-Exercise 3 – Crime Analysis in Washington.doc
- ❑ CP4-Exercise 3 – Crime Analysis in Washington-TEACHER MASTER.doc
- ❑ (additional notes, answers, etc. are provided in the TEACHER MASTER version)

Handouts to be completed by the students, used as overheads, or used as reference material

- ❑ CP5-Factors That Influence Crime-TEMPLATE.doc
- ❑ CP6-Factors That Deter Crime-TEMPLATE.doc
- ❑ CP7-Classifying Your Data-REFERENCE.doc

- As there are some acronyms and terms related to crime presented in the material, provide students with a fill-out chart where they can identify the entire terms.
- Review the worksheet materials that will be completed by student groups to make sure they will have the appropriate depth of knowledge required.
- 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

3.9.1 – The purpose of this lesson is to acquaint students with the use of GIS and its role in law enforcement. The students examine patterns of crimes by state, by county and at the street level. Students examine how GIS can help analyse patterns of crime in a community. Geographic analyses like these occur every day in police departments across the nation.

The geographic analysis in part three of this exercise has been portrayed on the CBS network's crime drama, *The District.* For more details on CBS's *The District*, refer to www.esri.com/thedistrict. The "pawn shop" analysis was portrayed on Episode 15 – "A Southern Town" (from the web site, click on the number 15 to read more about this episode).

Note: This activity could also be created using public data supplied by your local police force. Every major municipality within Canada now has a GIS division whose responsibility it is to disseminate spatial information and show its relationship to crime. They usually have individuals that will come to your class to give a hands-on demonstration.

3.9.2 – Download the lesson from the web site www.esri.com/k-12 (look under "For Schools" and "ArcLessons") or Ministry-licenced *ArcCanada* CD (included with Ministry-licenced *ArcView* software) and unzip the file so that all data files, project files, and supporting documentation are located in the directory "C:\ Crime_Patterns". You will want to unzip this file to your local disk drive. You want to end up with a directory on your local computer called "Crime_Patterns."

Notes

- You can install this directory in any location on your computer.
- If you copy the data from a CD-ROM, make sure the file permissions on the following are read-write:
  - Crime_Patterns\tmp
  - Crime_Patterns\projects
  - Crime_Patterns\projects\crime_analysis.apr (this is only necessary to repair the path names once)
- You should end up with a directory structure that looks like the following:
  - \docs – documentation and lesson information
  - \docs_images – supporting documentation bitmaps (not required)
  - \projects – ArcView 3.2 project files
  - \shapes_county – county data for eastern U.S.
  - \shapes_dc – Washington, D.C. data
  - \shapes_state – state data for the U.S.
  - \tables – tabular data (pawnshop locations for D.C.)
  - readme.txt – instructions
  - start.apr – ArcView 3.2 launch and repair project (calls \projects\crime_analysis.apr)
- Start ArcView and open the project file C:\Crime_Patterns\start.apr. (If the Crime_Patterns directory is located somewhere other than C:\, use the correct path).
  - **Note:** opening the start.apr will automatically repair any path errors in the file C:\Crime_Patterns\projects\crime_analysis.apr which is actually the project you will be using. Assuming you install the data in a directory called "Crime_Patterns" located on any drive and in any other folder, then the start.apr project will repair the paths in the project and open the crime_analysis.apr project file. If you choose, you can open the crime_analysis.apr file directly. Start.apr will only work if the crime_analysis.apr project file is read-write.
  - If the project opens correctly without any missing data, then you should be all set to proceed. Go ahead and quit and then follow the exercises by opening the CrimePatterns\projects\crime_analysis.apr directly (once the paths have been corrected by running start.apr once).

Depending upon what you want the students to complete and turn in, you may find it helpful to have access to the Internet, a word processing program, and a presentation program. However, these are not required to complete the ArcView analyses.

Teachers need to acquaint students with some concepts and terms used when discussing crime. See the "Analysis of the Maps" question and answer section at the end of CP4 (teacher master), which has an explanation of some crime terms.

Furthermore, teachers need to ensure that students have a grasp of what the standard deviation method of classifying data shows and signifies. The student reference material in CP7-Classifying Your Data is a quick outline and may be helpful.

Teachers should use the overhead/template on CP5-Factors that Influence Crime-TEMPLATE.doc to start students' thinking about this issue. The open bubbles are not meant to solicit correct answers. In fact, impressions of related factors which are wrong can be used as a strong teaching point and should not be neglected. Teachers should also consider that Exercise 3 uses the location of pawnshops and proximity to roads as two factors which influence the crime of burglary. Teachers may wish to introduce this concept at this point or add it later.

Following brainstorming the factors that influence crime, the teacher can address the factors that deter crime, by using CP6-Factors that Deter Crime-TEMPLATE.doc. Alternatively, this can be saved for the conclusion of the exercises.

After the preparation of students, students must complete three exercises and their associated worksheets.

Exercise #1 begins with general patterns of crime in the USA by state. Students map burglary statistics over a three-year period looking specifically at where the number of burglaries has increased and decreased. Teachers may also wish to access information about their local area prior to this exercise.

Exercise #2 has the students working with county level data. Here students use the classifications of "Serious Crime" and "Violent Crime." However, other choices can be substituted. Definitions of these terms are provided in the final exercise #3 analysis (see the teacher master). The goal of this part of the exercise is to analyse the pattern of crime within states. Also, using charts and maps together, students begin to understand that the various factors attributed to crime may not be valid at all levels of data aggregation. Part of this exercise is designed to direct students to the Washington D.C. region, as this is the basis of exercise #3.

Exercise #3 shows students the crime related factors at the local or street level. It attempts to relate policing strategies to criminal behaviour and to some of the geographic factors that relate to the crime of burglary. Students complete the worksheet on "Factors that Deter Crime" as a whole class.

3.9.3 – The teacher encourages students to work through the ArcView exercises in one of two ways. The teacher can work with the students directing the manipulation of the software and stopping to speak about patterns seen in the crime data. The teacher can also choose to allow students to work at their own pace. In this case, the teacher should ensure that students complete the question sheets fully before proceeding with the next scenario exercise.

Assessment & Evaluation of Student Achievement

The focus of the assignment should be an analysis of the factors that contribute to crime at the local level and the factors that deter crime at the local level.

This should be done in either report style where students export the maps they have generated and add the analysis to form a graphic rich text document. Alternatively, teachers can have students generate an electronic presentation using the maps generated and supporting analytical text.

Evaluation of the final product should be by the teacher. However it is important for students to have a chance to showcase their work. If teachers have students prepare written reports which integrate the maps, charts, and text material, the teacher would be the best evaluator. Teachers who choose to have students integrate their maps into a computer presentation using presentation software such as *PowerPoint* or *Corel Presentations* would be well advised to develop a checklist for student use and evaluation during the class presentation.

T/L Strategy	Task/Product	Tool	Purpose	Achievement
3.9.1 (class)	Whole-class discussion about factors that influence and deter crimes terminology associate with crime		Formative	Knowledge/ Understanding Thinking/Inquiry
3.9.2 (individually or small group)	Completion of crime analysis exercises parts 1,2, and 3.	Checklist	Formative	Thinking/Inquiry Application
3.9.3 (Small group or individually)	Student-generated written report or electronic presentation	Assessment Rubric (see Appendix 1)	Summative	Application Communication

Accommodations

- A review on paragraph structure and geospatial analysis may be helpful to some students. An exemplar on Geographic Analysis would also be beneficial at this juncture.
- Enrichment – Students could examine local crime statistics to use for comparison purposes.

Resources

Print

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

Data

Crime Pattern Analysis lesson-pak from (http://gis.esri.com/industries/k-12/arclessons/) or Ministry-licenced *ArcCanada* CD (included with *ArcView* software).
Video clip from *The District* television program (available at www.esri.com/thedistrict) or Ministry-licenced *ArcCanada* CD (included with *ArcView* software).

Websites

– http://gis.esri.com/industries/k-12/arclessons/ (Crime Pattern Analysis) or Ministry-licenced *ArcCanada* CD (included with *ArcView* software)
– www.esricanada.com/k-12/gis/capabilities.html

Software

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

Appendix 1 – GIS Rubric for Culminating Unit

Note: This is a culminating task Rubric that can be used with any GIS project `regardless of topic or software. It is important that the teacher work with the students to demonstrate the specifics of the established criteria. It would also be beneficial for the teacher to show exemplars of the specific projects.

Criteria/ 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	- the maps and images have been interpreted with limited effectiveness for the specific project	- the maps and images have been interpreted with some effectiveness for the specific project	- the maps and images have been interpreted with considerable effectiveness for the specific project	- all of the maps and images have been interpreted effectively for the specific project
Communication Application Identify the conceptual and design factors that make for a well-designed map GI1.04	- the map essentials are present in the layout to a limited degree	- the map essentials are present in the layout to some degree	- the map essentials are present in the layout to a considerable degree	- all the map essentials are present in the layout
Application Use GIS software appropriately to perform simple analytical operations GI2.09	- the specific operations needed to perform an analysis have been accomplished to a limited degree	- the specific operations needed to perform an analysis have been accomplished to some degree	- most of the specific operations needed to perform an analysis have been accomplished to a considerable degree	- all of the specific operations needed to perform an analysis have been accomplished to a high degree
Knowledge/ Understanding Demonstrate an understanding of basic thematic mapping methods GI1.06	- the required themes are present to a limited degree	- the required themes are present to some degree	- the required themes are present to a considerable degree	- the required themes are present to a high degree
Thinking/ Inquiry Demonstrate an ability to acquire relevant data and materials and to evaluate their quality GIV.01	- a limited amount of the data required has been acquired - limited complete evaluation of the data quality has been demonstrated	- some of the data required has been acquired - some evaluation of the data quality has been demonstrated	- most of the data required has been acquired - an evaluation of the data quality has been demonstrated	- all the data required has been acquired - a complete evaluation of the data quality has been demonstrated

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