

Asking and Answering Questions about the World: Geographic Skills

The Importance of Geographic Skills

Geographic skills provide the necessary tools and techniques for us to think geographically. They are central to geography’s distinctive approach to understanding Earth’s physical and human patterns and processes. Geographic skills are used in making decisions important to everyday life—where to buy or rent a home; where to get a job; how to get to work or to a friend’s house; and where to shop, vacation, or go to school. All of these decisions involve the ability to acquire, arrange, and use geographic information. Daily decisions and community activities are linked to thinking systematically and spatially about environmental and societal issues.

Community decisions relating to problems of air, water, and land pollution or locational issues, such as where to place industries, schools, and residential areas, also require the skillful use of geographic information. Business and government decisions—from the best site for a supermarket or a regional airport to issues of resource use or international trade—involve the analysis of geographic data.

Geographic skills help people make reasoned political decisions. Whether the issues involve the evaluation of foreign affairs and international economic policy or local zoning and land use, geographic skills enable people to collect and analyze information, come to an informed conclusion, and make reasoned decisions on a course of action. Geographic skills also aid in the development and presentation of effective, persuasive arguments regarding matters of public policy.

Developing Geographic Skills

It is essential that students develop skills that will enable them to observe patterns, associations, and spatial order. Many of the skills that students are expected to learn involve using tools and geospatial technologies that are part of the process of geographic inquiry. Geographic representations, such as maps and globes, as well as their digital versions, are essential tools of geography because they assist in visualizing spatial arrangements and patterns.

Other tools and geospatial technologies, including satellite-produced images, graphs, sketches, diagrams, and photographs are also integral parts of geographic analysis. The rate of growth of an urban area, for example, can be observed by comparing old and new satellite images. Large-scale land-use changes or changes in sea surface temperatures can be observed by comparing a series of satellite images. An important tool in geographic analysis is the geographic information system (GIS). Geographic information systems make the process of organizing, analyzing, and presenting geographic infor-

mation easier, thus accelerating geographic inquiry. Remotely sensed data provide both archived and real-time images that can be studied independently or as a part of a GIS analysis. Digital globes and interactive online maps can display human and physical data sets to assist in systematic analysis of spatial phenomena. A global positioning system (GPS) aids in accurately identifying the location of collected data; GPS technologies are currently used in a wide range of digital mobile devices.

Many of the capabilities that students need to develop geographic skills are termed “critical thinking skills.” Such skills are not unique to geography and involve a number of generic thinking processes, such as knowing, inferring, analyzing, judging, hypothesizing, generalizing, predicting, problem-solving, and decision-making. These skills have applications to all levels of geographic inquiry and constitute the bases on which students can build competencies in applying geographic skills to geographic inquiry.

Geographic skills develop over the entire course of students’ school years. For each of the three successive grade levels discussed, teachers and other curriculum developers must recognize that students’ mastery of geographic skills should be sequenced effectively so that students retain and build on their understanding. The skills cannot be taught or applied in isolation. They are interconnected and complementary, and together they form a process of investigation that makes the complexity of place more intelligible and more understandable.

The Rationale for Geographic Skills

The geographic skills required of a geographically informed person consists of five sets of skills adapted from the Guidelines for Geographic Education: Elementary and Secondary Schools, prepared by the Joint Committee on Geographic Education by the Association of American Geographers and the National Council for Geographic Education. The five skill sets are as follows:

1. Asking Geographic Questions
2. Acquiring Geographic Information
3. Organizing Geographic Information
4. Analyzing Geographic Information
5. Answering Geographic Questions

For each of the five skills sets, there is a discussion of the principles underlying the set of skills and then a presentation of what the student is expected to know, understand, and be able to do at grades 4, 8, and 12.

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1. Asking Geographic Questions

Geographic inquiry involves the ability and willingness to ask and answer questions about geospatial phenomena. The key geographic questions ask Where is it located? Why is it there? What is the significance of the location? As students pose additional questions, they seek responses that help to organize spatial understandings: What is this place like? With what is it associated? What are the consequences of its location and associations? As geospatial technologies advance, students will still need to be able to ask these basic questions to select and apply the appropriate technology to conduct geographical research, thereby gaining geospatial understanding.

Students should be asked to speculate about possible answers to questions. Speculation leads to the development of hypotheses that link the asking and answering stages of the process. Hypotheses guide the search for information.

Geography is distinguished by the types of questions it asks—the “where” and “why there” of an issue or problem. It is important that

students develop and practice the skills of asking such questions for themselves. Practice in asking geographic questions begins with distinguishing between geographic and nongeographic questions (e.g., space-based versus time-based inquiry). Students should then develop geographic questions related to issues. At higher grade levels, students can identify geographic problems and ways in which geographic inquiry can help solve problems, resolve issues, inform decisions, and lead to actions.

Being able to ask geographic questions enables students to engage in doing geography by posing geographic questions to guide a geographic inquiry, realizing that questions can be refined as a part of the inquiry process. Geographic questions help increase spatial reasoning skills, identify geographic issues and problems, and develop new or additional geographic research questions and hypotheses for further investigation.

4th GRADE

the student knows and understands:

Asking Geographic Questions

1. The characteristics of a geographic question

Therefore, the student:

- A. Identifies and describes differences between geographic and nongeographic questions, as exemplified by
 - ▶ Identifying examples of geographic questions from a list of both geographic and nongeographic questions (e.g., does the question ask Where is it located? Why is it there? What is the significance of the location?).
 - ▶ Identifying questions that help explain the importance of the features or location of places (e.g., Why are good harbor facilities an important part of New York City’s location? How does Chicago’s mid-continent location influence its accessibility to the rest of the United States? How does the climate of Florida’s cities affect the movement of vacationing winter visitors?).
 - ▶ Describing how geographic questions seek information about the organization of human or physical features in space (e.g., Where do most people live in the world? Why are mountain ranges located where they are?).

8th GRADE

the student knows and understands:

Asking Geographic Questions

1. The sources of geographic questions

Therefore, the student:

- A. Identifies geographic issues and constructs a question from a geographic perspective, as exemplified by
 - ▶ Identifying geographic issues and problems in news articles and constructing geographic questions that would address the issue from a geographic perspective (e.g., spatial or ecological perspectives).
 - ▶ Identifying a local environmental issue and constructing geographic questions appropriate to study the issue (e.g., What are the pros and cons of building a community water park in the desert southwest region of the United States?).
 - ▶ Identifying a global human population issue and constructing geographic questions to investigate the issue from multiple perspectives (e.g., What are some of the reasons why people move from rural areas in a developing country to its largest and most crowded city? What are some of the economic and environmental consequences of such migrations?).

12th GRADE

the student knows and understands:

Asking Geographic Questions

1. The role of developing geographic questions in a research project that answers geographic questions

Therefore, the student:

- A. Analyzes an issue and constructs geographic questions that inform a geographic investigation, as exemplified by
 - ▶ Analyzing digital and paper maps of a place or thematic topic and constructing geographic questions to investigate the issue.
 - ▶ Analyzing current trends in population and constructing geographic questions to investigate the sources and future projections of the trends.
 - ▶ Analyzing a current news report and constructing geographic questions that would provide a geographic focus to the study or resolution of the topic or issue.

2. Acquiring Geographic Information

Geographic information is any information connected to a location that includes data about physical and human characteristics or phenomena at any place on the planet. To answer geographic questions, students should start by gathering data from diverse sources in various ways to develop information that will inform their responses.

The skills involved in acquiring geographic information include activities such as locating and collecting data, observing and systematically recording information, reading and interpreting maps and other graphic representations of spaces and places, interviewing people who can provide both information and perspectives about places and issues, and using statistical methods. Students should read and interpret all kinds of maps. They should compile and use primary and secondary information to prepare quantitative and qualitative descriptions. They should collect data from interviews, fieldwork, reference material, and digital resources. Internet-based sources for geographic information are increasingly accessible but must always be evaluated for reliability and validity.

Primary sources of geographic information, especially the results of fieldwork performed by the students, are important in geographic inquiry. Fieldwork involves students conducting research in the community by distributing questionnaires, taking photographs, recording

observations, interviewing citizens, and collecting samples. Fieldwork helps arouse students' curiosity and makes the study of geography more enjoyable and relevant. Fieldwork fosters active learning by enabling students to observe, ask questions, identify problems, and hone their perceptions of physical features and human activities. Fieldwork connects students' school activities with the world in which they live. Data collected using GPS technology in the field can be mapped onto digital maps and globes or viewed and analyzed in a GIS.

Typical secondary sources of information include texts, maps, statistics, photographs or imagery, video or multimedia, databases, newspapers, telephone directories, and government publications. Digital data may be highly specialized such as real-time data, physical and human statistical data, and remotely sensed data and images. These sources aid in the acquisition of geographic information, especially from or about remote locations. Encyclopedias report information compiled from secondary sources and are important in some research situations.

Being able to acquire geographic information enables students to engage in doing geography by mastering the techniques and skills necessary to gather and record geographic information and data from primary and secondary sources.

4th GRADE

the student knows and understands:

Acquiring Geographic Information

1. The characteristics of geographic information

Therefore, the student:

- A. Describes and analyzes the characteristics of geographic information, as exemplified by
 - ▶ Describing the characteristics of a place using observed and collected data (e.g., weather, climate, elevation, population density, availability of fresh water).
 - ▶ Analyzing data examples to determine whether or not it is geographic (e.g., Does it provide information about a location or place, connections between and among places, or the spatial organization of human or physical features on Earth's surface?).
 - ▶ Identifying and describing the characteristic information required for a map to be accurate and helpful (e.g., title, orientation, date, author, legend, scale, index, grid, source).

8th GRADE

the student knows and understands:

Acquiring Geographic Information

1. The process of collecting geographic information

Therefore, the student:

- A. Explains which sources of geographic information will be needed for a geographic investigation, as exemplified by
 - ▶ Describing and explaining how observations and collected geographic information can be used in a geographic investigation.
 - ▶ Identifying and describing sources of reliable geographic data (e.g., US Census Bureau data, Population Reference Bureau data, CIA: The World Factbook).
 - ▶ Explaining how digital globes and maps can provide base map information to provide a context for additional data layers or themes (e.g., tectonic plate boundaries and the occurrence of earthquakes, identification of climate and vegetation characteristics that may contribute to increased wildfire risk, identification of human or physical features that may affect the development of an emergency situation evacuation route).

12th GRADE

the student knows and understands:

Acquiring Geographic Information

1. The criteria for evaluating the value and reliability of geographic information

Therefore, the student:

- A. Evaluates sources of geographic information for reliability, as exemplified by
 - ▶ Evaluating the metadata for geospatial database files (e.g., data that might be used in a GIS, US census data on the Census Bureau's website).
 - ▶ Evaluating the reliability of Internet-based data sources to ensure validity and accuracy (e.g., information on a blogger site versus the United Nations website or political advertisement websites versus National Institute of Health Research Bulletins).
 - ▶ Evaluating the date, sources, authors, and designs of geographic visualizations or representations for accuracy (e.g., dates for data displayed, construction of x- and y-axis values on charts displaying information, misuse of map symbols on cartograms).

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4th GRADE

the student knows and understands:

Acquiring Geographic Information

2. The sources of geographic information

Therefore, the student:

A. Identifies observations, maps, globes, and other geographic representations as sources of geographic information, as exemplified by

▶ Identifying how satellite images provide geographic information (e.g., display patterns of population growth or decline by observing images detailing land use taken at different times, portrays contrasting shorelines of lakes in images taken at normal and drought times).

▶ Identifying ZIP codes as a source of geographic information that is helpful at a larger scale but less so at the neighborhood or school and classroom scale.

▶ Identifying digital globes and maps as sources of different types of geographic information (e.g., terrain data or road and transportation data).

8th GRADE

the student knows and understands:

Acquiring Geographic Information

2. The distinction between primary and secondary sources of geographic information

Therefore, the student:

A. Explains the differences between primary and secondary sources of geographic information, as exemplified by

▶ Explaining why using digital globe and mapped projects are secondary sources of geographic information.

▶ Explaining why mapping student-observed or -collected data points on a digital globe or map is a primary source of geographic information.

▶ Explaining the difference between using a map created by someone else versus a map created by the student as secondary and primary sources of geographic information.



Image credit: Joseph Kerski

A GPS or other mobile device can be used to determine the location of data points when acquiring geographic information.

3. Organizing Geographic Information

Once collected, the geographic information should be organized and displayed in ways that assist with analysis and interpretation. Data need to be arranged systematically. Different types of data may be separated and classified in visual, graphic forms: paper and computer-generated maps, various geospatial images (e.g., photographs, aerial photos, remotely sensed images), graphs, cross sections, climographs, diagrams, tables, and cartograms. Written information from documents or interviews may be organized into pertinent quotes or tabular form. Geographic information may also be organized in a GIS. These approaches allow students a wide range of options in displaying and organizing information.

Computer-based technologies and the Internet enhance not only students' access to geographic information but also the ability to organize it. Students may need guidance in selecting appropriate applications for organizing and displaying geographic information. There is an increasing number of free, web-based, mobile device, or desktop client applications that may be used for educational projects and instruction.

There are many ways to organize geographic information. Maps play a central role in geographic inquiry, but there are other ways to translate data into visual forms, such as graphs of all kinds, tables, spreadsheets, and time lines. Such visual aids are especially useful when accompanied by clear oral or written summaries. Creativity and skill are needed to arrange geographic information effectively. Decisions about

design, color, graphics, scale, and clarity are important in developing the kinds of maps, graphs, charts, and other visualizations that best represent the data.

Geography has been called “the art of the mappable.” Making maps should be a common activity for all students. They should read (decode) maps to collect information and analyze geographic patterns and make (encode) maps to organize information. Making maps may mean using sketch maps to make a point in an essay or record field observations, using symbols to map data showing the location of world resources, or producing a county-level map of income by state using a GIS. Students may also use Internet-based mapping resources to develop their own maps.

For students, making maps should become as common and natural as writing a paragraph. They should be skilled in interpreting and creating map symbols, finding locations on maps using various reference systems, orienting maps, finding directions, and using scales to determine distance. Using these map skills helps students think critically about the purposes and uses of maps.

Being able to organize geographic information enables students to engage in doing geography by applying methods to organize geographic and geospatial information so that it can be displayed to facilitate analysis and effectively communicate geographic information.

4th GRADE

the student knows and understands:

Organizing Geographic Information

1. The different forms for displaying geographic information

Therefore, the student:

- A. Constructs digital and paper maps, graphs, tables, and charts to display geographic information, as exemplified by
 - ▶ Constructing a map using points to represent the locations of student-collected data.
 - ▶ Constructing a graph to display the changes in student enrollment at the school.
 - ▶ Constructing a data table with represented values and a map to display the values represented by colors (e.g., list of schools in the community with more than 100, 200, and 300 students; different types of businesses in the community; number of each, low-, medium-, and high-population states).

8th GRADE

the student knows and understands:

Organizing Geographic Information

1. The advantages and disadvantages of the different forms for displaying geographic information

Therefore, the student:

- A. Describes and constructs appropriate forms of visualizations to represent different types of geographic data, as exemplified by
 - ▶ Constructing a choropleth map representing demographic values and explaining why this type of map is an effective way to display this type of data.
 - ▶ Describing and explaining how isopleth lines effectively represent increasing or decreasing values between locations (e.g., rainfall amounts, elevation, growing-season zones).
 - ▶ Describing and constructing both point and polygon maps to represent different types of geographic data.

12th GRADE

the student knows and understands:

Organizing Geographic Information

1. The selection and design of appropriate forms for organizing and displaying geographic information

Therefore, the student:

- A. Evaluates the alternatives for organizing and displaying geographic information, as exemplified by
 - ▶ Constructing different types of graphs representing data that describes a place (e.g., population changes, levels of personal income per state, population pyramids).
 - ▶ Evaluating the use of a GIS to display and organize geographic information (e.g., Would additional data layers be helpful? Are there important relationships among data layers used? Is an appropriate scale selected to display the data?).
 - ▶ Evaluating the appropriateness of using a digital globe to display point data or area data (e.g., ZIP codes, counties, states).

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8th GRADE the student knows and understands:

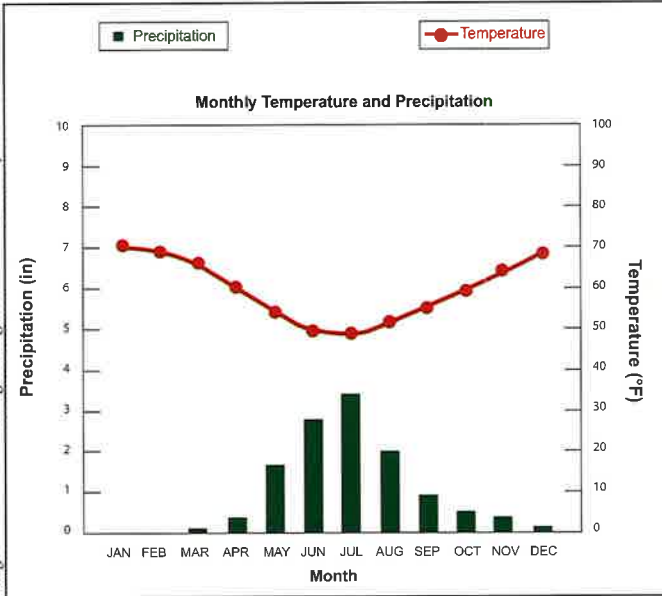
Organizing Geographic Information

1. The advantages and disadvantages of the different forms for displaying geographic information

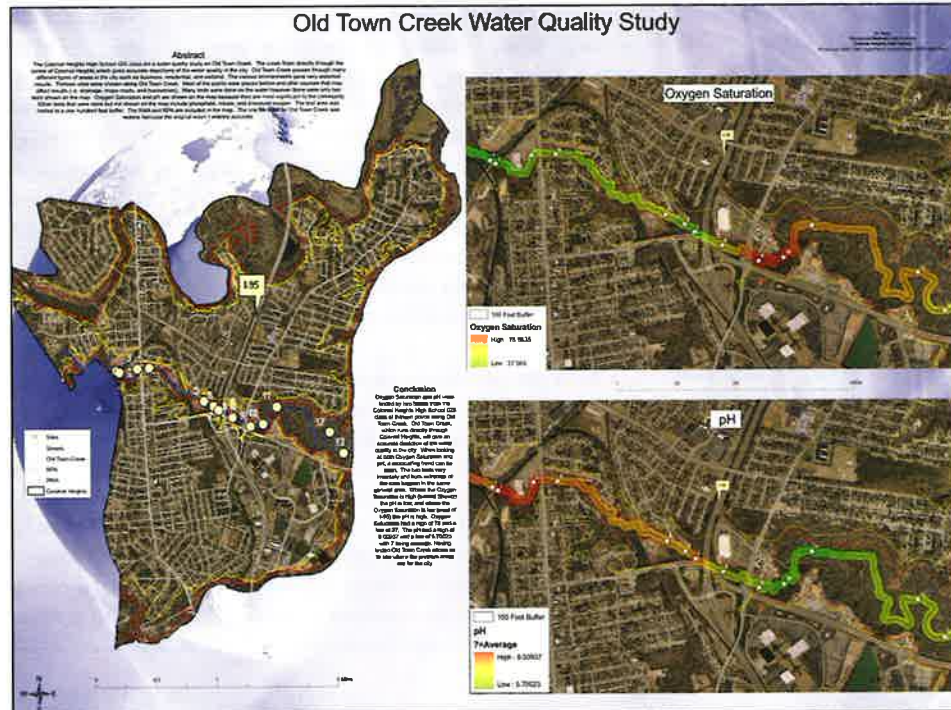
B. Explains the advantages of using different forms of geographic representations for data, as exemplified by

- ▶ Explaining why a GIS-generated map might be the best type of map to display the overlap or relational aspects of multiple data sets.
- ▶ Explaining why one map projection may be more appropriate to use than other projections (e.g., amount of distortion, degree of accuracy in represented shapes of continents, focus on a hemisphere or pole).
- ▶ Explaining the advantages of using graphs or maps for different types of data at different scales (e.g., climographs to represent climate data, population pyramids to represent population data, US national maps to represent state-level data, state maps to represent ZIP-code-level data).

Image credit: National Drought Mitigation Center, University of Nebraska-Lincoln



A climograph for Santiago, Chile displays data for the average seasonal variation in precipitation and temperature over the course of a year.



A GIS can be used to display student-collected data with other data sets and base maps.

4. Analyzing Geographic Information

Analyzing geographic information involves seeking patterns, relationships, and connections. As students analyze and interpret information, meaningful patterns or processes emerge. They can then synthesize their observations into coherent explanations. Students should note associations and similarities between areas, recognize patterns, and draw inferences from maps, graphs, diagrams, tables, and other sources. Using basic statistics, students are able to look for trends, relationships, and sequences.

Geographic analysis involves various thinking processes. It is sometimes difficult to separate the processes involved in organizing geographic information from the procedures used in analyzing it; the two processes go on simultaneously in many cases. But in other instances, analysis follows the manipulation of raw data into an easily understood and usable form. Both activities involve the use and development of students' spatial skills.

Students should scrutinize paper and digital maps to discover

and compare spatial patterns and relationships. In addition, they can study tables and graphs to determine trends and relationships between and among items; probe data through statistical methods to identify trends, sequences, correlations, and relationships; and examine texts and documents to interpret, explain, and synthesize characteristics. All students need to develop these analytical skills.

Digital tools provide additional ways to analyze spatial data. For example, a GIS spatial display can be used to analyze georeferenced data. Multiple data layers may reveal relationships or trends as a part of the analysis. These analytic processes then may lead to answers to the questions that first prompted an inquiry and to the development of geographic models and generalizations.

Being able to analyze geographic information enables students to engage in doing geography by using analytical methods to interpret and evaluate geographic information. Employing accurate analysis techniques and methodologies is essential in geographic inquiry.

4th GRADE

the student knows and understands:

Analyzing Geographic Information

1. The process of analyzing data to identify geographic relationships, patterns, and trends

Therefore, the student:

- A. Analyzes simple graphs, tables, and maps using geographic data to identify relationships, patterns, and trends, as exemplified by
 - ▶ Constructing a graph representing geographic information from a data table to identify trends (e.g., comparing social or economic indicators between two or more countries).
 - ▶ Analyzing various maps to identify relationships or similarities between countries or regions based on the data represented (e.g., variations in climate related to latitude, population densities related to climate, railway networks in relation to elevation or topographies).
 - ▶ Analyzing the relationships and patterns between political boundary lines and features on maps to describe possible trends (e.g., boundaries aligned to rivers, mountain ranges, or other physical features, boundaries aligned to lines of latitude or longitude or other mathematical formulations).

8th GRADE

the student knows and understands:

Analyzing Geographic Information

1. The process of analyzing data to describe geographic relationships, patterns, and trends

Therefore, the student:

- A. Analyzes graphs, tables, and maps using geographic data to describe relationships, patterns, and trends, as exemplified by
 - ▶ Analyzing two or more maps or satellite images to describe changes or identifying trends that may be evident based on the data (e.g., satellite images of a city or region before and after a tsunami, earthquake, or flood, satellite images of forests where logging is taking place, maps of census data showing changes in population).
 - ▶ Analyzing map legends to better understand the nature of the representation of data on the map (e.g., classification values and break points of a choropleth map, methods for determining different classification values, review the histogram of the data to see how data are represented in another form in addition to the mapped version).
 - ▶ Analyzing a GIS to describe the relationships and patterns resulting from the overlay of multiple data sets (e.g., describe the relationship of tornado occurrences with population density and state boundaries).

12th GRADE

the student knows and understands:

Analyzing Geographic Information

1. The process of analyzing data to explain geographic relationships, patterns, and trends

Therefore, the student:

- A. Analyzes and explains geographic relationships, patterns, and trends using models and theories, as exemplified by
 - ▶ Constructing a GIS model to analyze data from multiple locations and comparing the model results to identify patterns or relationships in those locations.
 - ▶ Analyzing population data as represented in the demographic transition model to explain the changes through time in populations of countries.
 - ▶ Analyzing a US city using a concentric zone model to explain the historical evolution of the commercial downtown.
- B. Analyzes data using statistics and other quantitative techniques, as exemplified by
 - ▶ Constructing a scatter plot of data to identify possible relationships or trends in the data.
 - ▶ Analyzing a histogram for data to determine the best method for displaying the values on a map.
 - ▶ Analyzing data using descriptive statistics such as average, median, mode, and range to determine the characteristics of the distribution in the data set.

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5. Answering Geographic Questions

In any academic discipline, good questions encourage good answers. Geography is no exception. The skills needed to build such answers require a structure that is both multifaceted and complex. Students must learn not only to manage data but also to assemble it so that it is clear and concise. The answers that derive from such a process can be organized in graphic form (maps, tables, graphs, and other geovisualizations) as well as oral and written narratives. Whatever the format, responses must be based on provable and relevant facts that inspire interpretation, analysis, reasoning, and, when appropriate, the subtleties of inference.

Generalizations and new understandings are the expected results of the inquiry process. Developing generalizations requires that students use the information they have collected, processed, and analyzed to make informed statements about geographic issues. Teachers should encourage students to explore multiple points of view and to seek multiple solutions to problems. Students may also use the evidence they have acquired to make decisions, solve problems, or form judgments about a question, issue, or problem.

Developing geographic generalizations may require inductive reasoning (i.e., inferring a generalization from particular instances or facts) or deductive reasoning (i.e., inferring particular instances and fact from a generalization). Inductive reasoning enables students to synthesize geographic information to answer questions and reach

conclusions. Deductive reasoning enables students to identify relevant questions, collect and assess evidence, and decide whether the generalizations are appropriate by testing them. Students should have experience in both approaches to reasoning.

Students should be able to communicate clearly and effectively when answering geographic questions. They can display geographic information in many engaging and effective ways. These include combinations of digital images, maps, graphs, video, and narratives in multimedia or web-based presentations. Geographic information may also be presented through the use of poems, collages, plays, journals, debates, and essays. It is important to know how to select the best means of presenting answers to geographic questions.

Answering geographic questions is not always the last step in the process of geographic inquiry, because the process usually begins again with new questions suggested by the conclusions and generalizations. Geographic learning is a continuous process that is both empowering and fascinating.

Being able to answer geographic questions enables students to engage in doing geography by presenting the results of their geographic inquiry to inform decision-making and offer potential solutions to problems.

4th GRADE

the student knows and understands:

Answering Geographic Questions

1. The process of making generalizations and drawing conclusions to answer geographic questions

Therefore, the student:

- A. Constructs answers to geographic questions using data, as exemplified by
 - ▶ Constructing a flowchart, map, and narrative summarizing the steps used in answering a geographic question.
 - ▶ Constructing a digital or paper map that answers a geographic question and describing the data used to inform the answer.
 - ▶ Constructing a photographic display to summarize key geographic observations based on viewing a collection of images of a place or region.

8th GRADE

the student knows and understands:

Answering Geographic Questions

1. The process of explaining generalizations and conclusions that answer geographic questions

Therefore, the student:

- A. Describes and explains the data and processes used to answer geographic questions, as exemplified by
 - ▶ Constructing an answer to a geographic question by describing the characteristics and relevance of the data used to inform the answer.
 - ▶ Describing how a GIS was developed and explaining why specific data layers were selected to answer a geographic question.
 - ▶ Explaining the steps used in answering a geographic question including how geographic information was collected, organized, and analyzed to arrive at the answer.

12th GRADE

the student knows and understands:

Answering Geographic Questions

1. The process for evaluating and defending the answers to geographic questions

Therefore, the student:

- A. Evaluates the data sources and processes used to answer geographic questions, as exemplified by
 - ▶ Constructing a narrative report that evaluates the validity and reliability of the data used and the processes used to formulate answers to geographic questions.
 - ▶ Explaining how and why the data used in an investigation supports the defense of the generalizations made in answering geographic questions.
 - ▶ Constructing a test of a geographic answer by applying it to a new study area or era to see if the same process yields a defensible answer.

4th GRADE

the student knows and understands:

Answering Geographic Questions

2. The methods for presenting answers to geographic questions

Therefore, the student:

- A. Describes various options for presenting answers to a geographic question, as exemplified by
 - ▶ Describing how maps can display geographic information to help answer geographic questions.
 - ▶ Describing how multimedia tools can be used to present answers to geographic questions.
 - ▶ Identifying and describing an example of a presentation of geographic information that may answer geographic questions (e.g., map displaying an analysis from a news article, a graph displaying data used to compare two locations).

8th GRADE

the student knows and understands:

Answering Geographic Questions

2. The construction of presentations to answer geographic questions

Therefore, the student:

- A. Constructs a presentation to answer a geographic question, as exemplified by
 - ▶ Constructing a map using a GIS that displays possible answers to geographic questions (e.g., preferred site location for business or schools, possible sources and paths of pollution plumes, areas for greatest or least crime risk in an urban area).
 - ▶ Constructing a multimedia presentation including maps, images, and video to describe the steps and data used to answer a geographic question (e.g., show how a geographic question was chosen, present where and how data were collected or acquired, use different visual methods for organizing, displaying, and analyzing geographic information).
 - ▶ Constructing an oral presentation that presents and defends the answers to a geographic question.

12th GRADE

the student knows and understands:

Answering Geographic Questions

2. The process of using valid generalizations and conclusions to inform reasoned decisions

Therefore, the student:

- A. Explains and evaluates the data and processes used to inform answers to geographic questions, as exemplified by
 - ▶ Explaining the limits of the generalizations that may be made as a result of the data used in a geographic inquiry.
 - ▶ Evaluating a news article that defends a possible answer to a geographic question and explaining how the data used does or does not support the proposed answer and what additional data might be considered.
 - ▶ Evaluating the feasibility of an answer presented by identifying additional geographic questions or concerns that may influence the proposed answer.

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Image credit: Geospatial Semester, James Madison University/Robert Kalvoord and Lurray High School/T. Meadows, C. Fox and T. Racey

Bearly Relocated

Introduction

Where are the ideal locations within the Shenandoah National Park that bears can be safely relocated away from tourists and homes? This is the question that we are trying to answer. We will use GIS to analyze the park's terrain, roads, and other features to determine the best locations for relocation. This project was created by the students of the Geospatial Semester at James Madison University and Lurray High School.

Northern Zone

Analysis

The Northern Zone of the park is characterized by steep, rugged terrain and a high density of roads. The analysis shows that the most suitable locations for bear relocation are in the more remote, high-elevation areas where human activity is minimal.

Central Zones

Hypothesis/Experiment

We hypothesized that the most suitable locations for bear relocation would be in the more remote, high-elevation areas of the park. To test this hypothesis, we used GIS to analyze the park's terrain, roads, and other features. The results of our analysis show that our hypothesis was correct, and that the most suitable locations for bear relocation are indeed in the more remote, high-elevation areas of the park.

Shenandoah National Park

Southern Zone

Sources

The data for this project was obtained from the National Geographic Society's Digital Elevation Model (DEM) of the Shenandoah National Park. Other data was obtained from the National Geographic Society's Digital Road Network (DRN) of the Shenandoah National Park.

Conclusion

The results of our analysis show that the most suitable locations for bear relocation are in the more remote, high-elevation areas of the park. These locations are characterized by steep, rugged terrain and a high density of roads. The results of our analysis also show that the most suitable locations for bear relocation are in the more remote, high-elevation areas of the park.

Using a GIS, a student presentation answers the question, "Where are the ideal locations within the Shenandoah National Park that bears can be safely relocated away from tourists and homes?"