PROMOTING INQUIRY IN THE GIFTED CLASSROOM THROUGH

GPS and GIS Technologies

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Geography is rapidly becoming more interactive, especially with the advent of the Global Positioning System (GPS) and Geographic Information Systems (GIS) and their adoption in the public and private sectors. The days of two-dimensional maps are quickly being replaced by geographic images that are stored electronically in computers and handheld devices, which also house layers of information that are available with the click of a button. This change in the way information is stored, retrieved, and used is transforming business, industry, and government, allowing for a more efficient use of time and money, and in some cases, saving lives. In order to prepare gifted learners to lead in the future, which will likely require competence in technological skills, social studies educators and teachers of the gifted should utilize GPS and GIS in their teaching, allowing students to use real-world information to address authentic problems.

Social studies and geography classrooms are appropriate venues for gifted and talented students to apply their critical thinking abilities. The study of geography should not be about memorizing facts, but rather about asking questions and solving problems. It is an integrative field that connects relationships between people and environments. An informed perspective of geography is central to the development of global citizens who recognize multiple perspectives in a variety of domains. Thus, students should develop proficiency in "geographic skills, such as locating places and understanding the context of current events, in addition to developing a spatial perspective and learning to use geographic tools, such as maps and computerized geographic information systems" (RoperASW, 2002, p. 1), in order to be competent, informed consumers and decision makers in the global, information-rich society of today and the future. The interdisciplinary nature of social studies is reflected in several national standards (i.e., geography, science, technology, and gifted education), each of which has addressed ways in which K–12 students should be prepared in order to become proficient in addressing social issues as skilled information users, problem solvers, communicators, and leaders (see Table 1). GPS and GIS technologies offer teachers the opportunity to incorporate technological applications aligned with the national standards developed by National Council for

Table 1
Alignment of National Standards With GPS and GIS Technologies

National Standards	Content Standard	Grade(s)	Developing Student Abilities and Understanding
National Social Studies Standards (National Council for the Social Studies, 1994)	Strand III. People, Places, and Environments Strand VIII. Science, Technology, and Society	K–12	• Social studies programs should include experiences that provide for the study of people, places, and environments. • Social studies programs should include experiences that provide for the study of relationships among science, technology, and society.
National Science Education Standards (National Research Council, 1997)	Content Standard E: Science and Technology	5–8	• "relationships between science and technology should be experiences with design and problem solving. . . . The understanding of technology can be developed by tasks in which students have to design something and also by studying technological products and systems" (n.p.).
		9–12	• Developing students' abilities of technological design. • Develop students' understanding about science and technology.
Technology Foundations Standards for Students (ISTE, 2000)	Basic Operations and Concepts	K–12	• Students demonstrate a sound understanding of the nature and operation of technology systems. • Students are proficient in the use of technology.
	Social, Ethical, and Human Issues	K–12	• Students understand the ethical, cultural, and societal issues related to technology. • Students practice responsible use of technology systems, information, and software. • Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.
	Technology Productivity Tools	K–12	• Students use technology tools to enhance learning, increase productivity, and promote creativity. • Students use productivity tools to collaborate in constructing technology-enhanced models, preparing publications, and producing other creative works.
	Technology Communication Tools	K–12	• Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences. • Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.
National Education Technology Standards for Students (ISTE, 2000)	Technology Research Tools	K–12	• Students use technology to locate, evaluate, and collect information from a variety of sources. • Students use technology tools to process data and report results. • Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.
	Technology Problem-Solving and Decision-Making Tools	K–12	• Students use technology resources for solving problems and making informed decisions. • Students employ technology in the development of strategies for solving problems in the real world.
National Association for Gifted Children Pre-K–12 Gifted Program Standards (Landrum, Callahan, & Shaklee, 2001)	Program Administration and Management	K–12	• Guiding Principle 4: Requisite resources and materials must be provided to support the efforts of gifted education programming. o 4.1E Gifted education programming should provide state-of-the-art technology to support appropriate services.
	Curriculum and Instruction	K–12	• Guiding Principle 5: Learning opportunities for gifted learners must consist of continuum of differentiated curricular options, instructional approaches, and resource materials. o 5.0E Appropriate service options for each student to work at assessed level(s) and advanced rates of learning should be available. o 5.1E Differentiated educational program curricula for students pre-K–12 should be modified to provide learning experiences matched to students' interests, readiness, and learning style.

Social Studies (1994), as well as the National Science Education Standards (National Research Council, 1997), the National Education Technology Standards for Students (ISTE, 2000), and the Gifted Program Standards (Landrum, Callahan, & Shaklee, 2001). Positive outcomes for students have been found through the use of GIS technologies, including increased engagement with subject-area content (Tinker, 1992), as well as increased opportunity for the development of problem-solving skills (Audet & Abegg, 1996).

In an effort to address the challenges of using technology and preparing competent geography students, educators are encouraged to educate themselves about how technology can be used to foster advanced understanding of geography and technology. The merits of using technology in teaching the gifted, an overview of both GPS and GIS technology, and an example of how one educator uses GPS and GIS is provided below.

Technology and the Gifted

The use of information technology as a tool in the gifted classroom has been advocated as a vehicle for the development of skills recognized as those most critical for gifted learners (Lee, 2001; Siegle, 2005): abstract thinking, creativity, and critical thinking (Hunt & Seney, 2001; Maker & Nielson, 1996; Sternberg, 2000). Teachers of the gifted are encouraged to use "a project/performance-based approach where technology is integrated into every area of a thematic study, and in which learning is serious, engaging, authentic, and connected to real life" (Poftak, 1998, p. 14). Furthermore, technology for gifted learners should enhance the curricula beyond what is provided for learners in general education and should be appropriately challenging to address the advanced cognitive needs of gifted learners (VanTassel-Baska, 2003).

To date, no research has been published regarding the use of GPS with the gifted. However, Baker (2001) advocates for the use of GPS technologies to "promote scientific inquiry and student-driven research" (p. 41), both of which are essential components in programs for gifted learners (Betts, 1985; Feldhusen & Kolloff, 1986; Renzulli & Reis, 1985). The emergence of GPS in the educational arena has introduced a new dimension to learning about science, social studies, mathematics, and technology. Students may undertake a multitude of geographical exercises that challenge them to "formulate spatial relationships derived from their data collection, plotting, and manipulation" (Lucking & Christmann, 2002, p. 56).

What Is GPS?

GPS is a radio system that conveys latitude, longitude, and average velocity from any location on the Earth to transmission devices (Broda & Baxter, 2003; Lucking & Christmann, 2002). Like the magnetic compass, GPS not only assists users in orienteering, but also provides other features, including the ongoing collection of satellite data, which calculates speed, direction, location, and time. GPS is useful for plotting routes to a destination and for gathering information that can be downloaded into computer software for additional manipulation. Handheld devices, or GPS units, help users determine their exact locations (within 16–20 feet) by inputting longitude and latitude coordinates (Groundspeak, 2005). Although GPS units themselves are not transmitters of information, they can generate three-dimensional location graphics if signals from four satellites are received (Smithsonian, 2006).

Although GPS was initially designed to provide support for soldiers in remote areas, GPS can now be used by the public sector in driving, water sports, and recreational activities (i.e., hunting, hiking) when location is central for success. GPS devices are now more affordable than in years past and currently range in price from $100 to as much as $1,000. They can be found at boating and camping stores and through online retailers. While admittedly an expensive technological addition to a cash-strapped classroom, such tools are less costly than a laptop or desktop computer, and they offer a multitude of educational options, even for the single handheld-device classroom (see Table 2).

GPS has recently been a vital part of search and rescue efforts following recent disasters. Using GPS technology, researchers assisted in the Hurricane Katrina rescue missions:

> The Texas search and rescue teams began to receive information from emergency calls from cell phones in New Orleans. Working with Texas Task Force One, the [Mid-American Geospatial Information Center (MAGIC)] group would establish the GPS coordinates of the 9-1-1 caller whose street address automatically appears on calls to the emergency switchboard. MAGIC would then examine post-landfall satellite photos of those coordinates to determine the depth of floodwater using information on the city's preflood surface elevations. Wells said the Texas Task Force One

Table 2
GPS Resources

The Basics of GPS	What Is GPS All About? http://www.gis2gps.com/GPS/resources/gps.html
Lesson Plans	GPS & GIS in the Classroom http://eduscapes.com/tap/topic78.htm#2
	GPS Lesson Plans http://www.gis2gps.com/GPS/lessonplans/gpsplans.htm http://www.uen.org/utahlink/activities/view_activity.cgi?activity_id=15969
	Navigation Education Materials http://www.ion.org/satdiv/education.cfm
	Resources for "Where in the World Is My School" Project http://www.state.de.us/planning/coord/dgdc/gps_sch_rsrce.htm

coordinator was then able to relay the satellite imagery and GPS coordinates from Austin to rescuers' laptops or handheld devices by satellite telephone to tell them exactly where to go and whether they needed a boat or high-axle vehicle to reach survivors ("Center for Space Research," 2005, ¶ 4).

What Is GIS?

Whereas GPS is a system for pinpointing location, GIS is a system for processing multiple layers of information, including "maps and globes, geographic data sets, work flow models, data models, and metadata" (Environmental Systems Research Institute [ESRI], 2005c, ¶ 3). GIS is comprised of four facets: advanced hardware, sophisticated software, data, and "a thinking explorer" (ERSI, 1998, p. 1), which allows the user to manipulate and analyze multiple layers of information, such as census data, topographical information (rivers, roads, terrain, crops), voting patterns, or even areas of pollution (Broda & Baxter, 2003). These layers can be analyzed visually, giving users greater understanding of the complex relationships of the information through symbolic representations. Such activities engage students on a variety of levels, as they address kinesthetic, visual, and cognitive processes through inputting data into the devices, manipulating information displayed on handheld and desktop computer screens, processing of the information displayed digitally on the handheld device, and making decisions about how to use this information in order to identify a specific location.

With the increased use and availability of computers and with the proliferation of Internet and software resources, GPS and GIS have become more affordable to the general public. Currently, both GPS and GIS technologies are experiencing widespread growth and adoption by industry and government, including health and human service providers, law enforcement officials, transportation directors, and engineers, among others (Baker, 2001). Although business and industry have quickly embraced these technologies, education has not moved as quickly in its adoption. Recognized in the early 1990s for its potential benefits to higher education (Patterson, Reeve, & Page, 2003; Tinker, 1992), GIS and GPS technologies have recently gained more attention in elementary and secondary classrooms due to (a) teachers' growing interest, (b) the enthusiastic reception of this technology by students, and (c) the decreasing expense of handheld devices and related GPS and GIS software.

Getting Started With GPS and GIS in the Classroom

GPS and GIS data can be used by K–12 educators to engage learners in analysis of information and real-world problem-solving challenges. Demonstrations and information about the components and functions of GPS and GIS are available to educators (see Tables 2 and 3). Understanding GIS jargon is another necessary step; several Web sites offer assistance with terminology and definitions, ranging from information for novices to those with more advanced understanding (see Table 4).

To begin using GIS, software must be downloaded that is specifically designed to manipulate

Table 3
GIS Resources

The Basics of GIS	Demo: What Is GIS? http://www.gis.com/whatisgis Geographic Information Systems http://erg.usgs.gov/isb/pubs/gis_poster/#display
Articles	Baker, T., & Case, S. (2000, October). Let GIS be your guide. *Science Teacher*, 24–26.
Books	National Research Council. (2006). *Learning to think spatially*. Washington, DC: Author.
Lesson Plans	ArcLessons http://esri.com/arclessons Global GIS Curriculum http://rockyweb.cr.usgs.gov/outreach/globalgis Project-Based Learning Using Online Mapping http://kangis.org/learning/index.cfm?go=1
Data Sources	American Fact Finder http://factfinder.census.gov/home/saff/main.html?_lang=en Geography Network http://www.geographynetwork.com/data/downloadable.html The GIS Portal http://www.gisportal.com The GIS Data Depot http://data.geocomm.com

Table 4
Mastering GIS and GPS Terminology

Site for GIS and GPS Novices	Sites for Advanced GIS and GPS Users
ESRI offers a list of multiple glossaries at http://www.gis.com/whatisgis/glossaries.html	NavtechGPS offers a glossary page with an extensive list of definitions at http://www.navtechgps.com/glossary.asp
	ESRI provides a searchable dictionary of GPS terms at http://support.esri.com/index.cfm?fa=knowledgebase.gisDictionary.gateway

geographic data. Free downloads of several GIS tools are available, including ArcExplorer (ESRI, 2005a) and ArcReader (ERSI, 2005b; for Windows and Macintosh users). Both allow users to view, interact with, research, display and publish GIS data. Users then import GIS data (from their computer or the Web) through these programs to view and analyze the information (see Table 3).

A variety of GIS activities are provided to guide educators in selecting appropriate tasks (see Tables 2 and 3). In one activity, students are asked to become city managers; their charge is to develop a proposed solution to a current city building issue (as noted in the local news); GIS is used by students to determine where and/or whether to build, culminating in a debate that uses the GIS data and analysis as evidence in the argument (ESRI, 2002). GIS allows students to see the connectivity of the information layers, how each layer relates to another, and how the data may change over time. GIS maps allow students to visualize data patterns and discern trends from thematic illustrations that might not otherwise be seen if the data were presented in a spreadsheet, database, or a traditional paper map. By using the GIS maps, students are encouraged to generate questions about the data and relationships. By answering their questions from the GIS maps, students will begin to solve problems. Although this process of gathering information to make informed decisions does not differ from other research-based approaches, GIS introduces another dimension to the experience as students begin to think spatially. Additionally, this type of learning experience shows how students "can learn through GIS about the value of interdisciplinary perspectives, as they integrate information from different disciplines . . . to address a broad range of real-world issues" (National Research Council, 2006, pp. 181–182).

The novice GPS user should begin learning about this system by using one of the basic GPS models, which is less expensive than a more advanced unit. Before introducing the device to students, teachers should become familiar with the functions of the unit, which are explained in the owner's manual. When introducing the unit(s) to students, provide copies of owners' manual pages that illustrate where the controls are located along with the unit. Students should have an opportunity to review the functions of the controls and practice using them. This phase can span as many as several days, as multiple lessons can be generated just to learn about the handheld GPS unit. An initial consideration should be what time format (military time versus standard time) and zone (Eastern, Central, etc.) to use. Review or introduce geographical concepts such as variances, north references, and map datum (see Appendix A for additional terms). Provide learners opportunities to use the GPS units (which function outdoors in order to pick up satellite reception) and to mark and name waypoints, make tracks and routes, and determine accuracy of the signals from the satellites.

Once the class is comfortable with the mechanics of the unit, try doing some simple locations on campus. Most of today's students, who have grown up with school and/or home access to computers, are technologically savvy and likely to quickly grasp the use of GPS units.

Using GPS Handhelds in Social Studies: Geocaching

One popular type of GPS activity is geocaching, a search for hidden objects wherein the searcher locates information about local caches through the Web (see Appendix B) and uses a handheld GPS device to aid in locating the object. This modern type of treasure hunt has found worldwide appeal, as more than 180 countries now host geocaches (Lary, 2004). Typically, a treasure will be hidden for others to locate via the posting of coordinates on a Web site along with a description of the cache, a hint, and other relevant facts to assist the searcher in locating the items (see Appendix A for geocaching terminology). Caches might be books, photographs, musical recordings, games, or other small, usually inexpensive tokens that are sealed in a waterproof container. Along with the item(s) is a logbook so that those who have successfully found the cache can record the date and time and items found, and often these items are replaced with new materials for the next person.

In addition to searches for real objects, *virtual* caches are alternate types of searches that supply clues to locating places of significance, such as historic landmarks or important school or community sites. Regardless of the type of geocache used, children learn about a *place* from this experience, and they are required to answer questions provided by the cache owner in order to log the find.

Learning to Use GPS and GIS Technologies: One Teacher's Experience With Gifted Learners

Through a weeklong summer institute sponsored by National Geographic Society, one of the authors, a sixth-grade teacher of geography with an endorsement in gifted education, joined educators from a multitude of disciplines and grade levels to learn about new innovations in teaching geography. The emphasis of the workshop included teaching orienteering skills and helping students understand the importance of place in everyday life. The primary focus of the institute was learning about GIS, including GPS technologies. Strategies and lessons for using compasses, topographic maps, and GPS were presented. The goal of the weeklong institute was for participants to learn about the use of these technologies and to create their own GIS project for implementation at their schools. Participants received their own handheld GPS for use in their classrooms.

Teachers were sent to different sites and asked to take a waypoint (coordinates on the GPS) and a digital photo of the area. Then, back in a classroom, GIS software allowed teachers to map

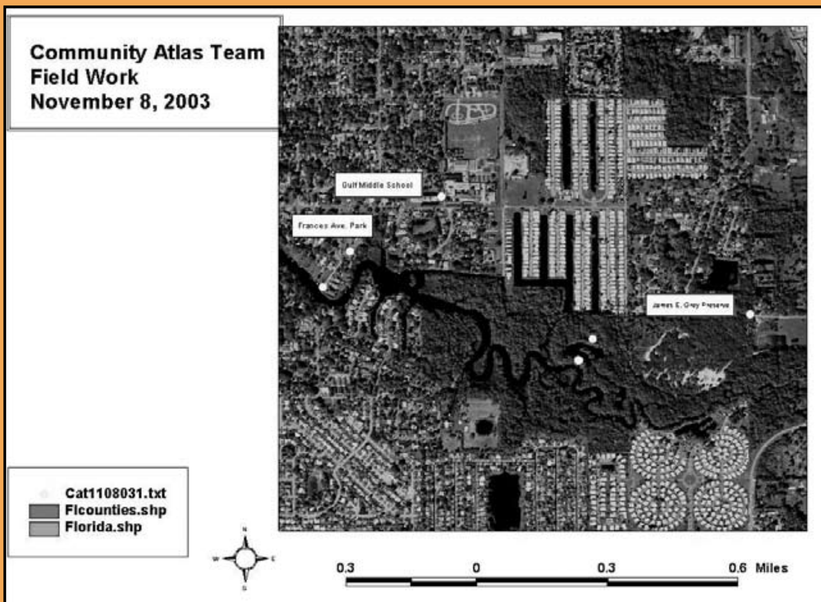

Figure 1. Students used GIS software (Arcview) to create this slide, which was a work in progress. The waypoints they took with the GPS are indicated by yellow dots layered over the aerial photo of this area. Students continued to work with the legend on this slide to indicate the GPS layers they used. Learners were making this slide as part of a PowerPoint presentation for their community atlas project.

these points and insert photographs. Teachers could now create slides to place in a PowerPoint presentation or create other types of visuals to be used in lessons. All types of classroom activities and lessons could be created using the same data collection strategies.

Applying the GPS and GIS Technologies to Practice

When the school year began, students in a gifted middle school social studies class were introduced to a few of the GPS concepts. Some students had prior knowledge about much of the material—some from experiences with scouts or hunting—some simply because they had innate abilities to think geographically and spatially. Fifteen to 20 students from this class of sixth-grade students were invited to meet as a group with the instructor before and after school and on weekends to design a GIS project. Teachers and students began to learn *together* how to use the GPS and work with GIS by teaching each other.

The GIS project these students developed was a community atlas, which presented an overview of the community and neighborhood of the school (see ESRI, 2005d, for additional community atlas information). The planning began with the students' identification of significant places in the community that they recognized as critical to the community's development and history. The group walked through these historic areas, local parks, and familiar neighborhoods, taking waypoints, digital photographs, field observations, and notes, which were later used to prepare slides and narratives (see Figure 1).

It was also necessary for students to research each topic within the atlas in order to understand the depth of these subjects in this locale. Some of the topics included weather/climate, recreation, local history, and economy. Students connected their understanding of GPS with other media, as they found articles from newspapers and magazines in which they read about how GPS was being used. Once students gathered sufficient information about each topic, they put the GIS into motion and created the community atlas.

As students read about and experimented with this technology, they asked more questions and wondered aloud about topics ranging from the history and development of their town, to what kind of careers they could pursue that used these types of technologies and skills. As a result of these questions, the teacher invited speakers from the regional water management district, the county mosquito control, the county property appraiser's office, and private industry. A manufacturer of GPS equipment used in law enforcement also visited, adding to the prior discussions and demonstrations of real-life applications of GIS. These experiences with the technology and with the guests piqued an interest in geography among the students.

Although the scope and sequence of sixth-grade geography in some states emphasizes more of a cultural approach to geography than a physical study of the world, a holistic understanding of both developed as a result of the community atlas project. Academic performance in the actual curriculum did improve for these students, but their teacher attributes this improvement to several factors, including these experiences. She does, however, feel that students' critical thinking skills and inquiry skills showed marked improvement—and this was noted by other subject area teachers on the middle school team, as well.

Suggestions for Implementing GIS and GPS Technologies in the Classroom

Teachers can plan a geocaching lesson or unit so long as prior planning and consideration is given. The basics of GPS technology should be reviewed, and educators should use the GPS devices prior to any educational excursions with learners. Students should be familiar with GIS terminology, as well as the functions of the GPS device they will use before embarking on a quest (see Appendix C for resources). The students featured in Figure 2 are working collaboratively to locate a hidden cache in a public park. Prior to the search, the classroom teacher visited the park, placed several caches in creative locations (under benches, in gazebo supports, along playground equipment), and noted waypoints. Students subsequently entered the park and worked as teams to locate the hidden caches using both waypoints and teacher-developed clues. One student (second child from left) held the GPS unit and the group discussed the possible locations and waypoints as they searched.

To allow more students to have a hands-on experience when there are a limited number of handhelds available, teachers should organize small groups or pairs of students, depending on the number of handhelds available. A benefit to working in these clusters is that students have an opportunity to think critically because they must communicate directions in a fashion that is understandable, ask questions of each other and themselves as they conduct the search, and work collaboratively to make meaning from the clues and locate the cache. Even with a single-handheld classroom, teachers can arrange for a small group to be supervised by a parent volunteer while the remainder of the class works on related assignments without the handheld unit.

Figure 2. Students use classroom handheld GPS to locate geocaches placed by the teacher at a park near school.

The emergence of GPS in the educational arena has introduced a new dimension to learning about science, social studies, mathematics, and technology.

Planning for a GPS Outing

Prior to a lesson using GPS technologies, teachers should spend time going over the categories of caches (or containers), such as regular, micro, multi, and virtual. For an excursion involving a group of 20 students with two handheld devices, several different sizes of caches should be used to vary the experience. Prior to the event, the educator can hide the caches in the search area. After students have mastered the use of the technology and locating caches, they too can become involved in the development of clues that will assist searchers in locating caches. Some clues may include riddles, analogies, mathematical formulas, or other problem-solving activities that the students can solve together.

Other environmental considerations should also be undertaken prior to the event. The educator should begin preparing for a GPS excursion by asking him- or herself several questions: Where will the search be held? Will it be on campus or nearby (at a park or other outdoor venue that is safe and where students will be supervised)? How much time is available for the outing? How much time will be needed to hide the caches, develop the clues, and generate a student guide? The teacher/coauthor was able to escort the class to a nearby local park, which provided plenty of space for hidden caches. The educator also should consider what types of caches will be hidden.

It is also advisable that the teacher simulates an authentic geocaching experience rather than search for caches already posted online, which will allow the teacher to control the safety of students and caches. Teachers will have to hide the caches and take waypoints in advance, but in this way the safety of the hunt is ensured. The sport of geocaching has basic rules of etiquette such as no weapons or perishable foods; however, when teachers create and hide the caches themselves, student safety is not compromised.

Geocaching on Campus

Teachers can plan an on-campus geocaching adventure by following the same steps that were outlined above, as long as students have access to an outdoor campus because GPS technologies operate outdoors where satellite signals are transmitted. The first step in organizing a campus geocache would be to engage students in taking waypoints from around campus for practice and then mapping these using GIS software (if available) or by hand on a paper map. Following this initial experience with learning to use the GPS system, teachers can hide caches, develop clues, and distribute the clues to students prior to their quest. After students have successfully located the caches and recorded their names in the cache log, they return to the classroom and allow another group to search. Once students have had experience searching for teacher-created caches, they are ready to design their own caches by selecting an appropriate container, cache items, and possibly a theme for the cache. Student teams can collaborate by writing challenging clues to locate the caches. This allows students to be engaged in the planning of the hunt and enjoy the rewards of a successful search.

Connecting Geocaching to Standards

GPS and GIS technologies are becoming tools that many facets of society use to solve problems and manage resources. Teachers can prepare students to understand why and how these technologies are vital to the management of our country and how geography plays a central role in this management. GIS and related activities, such as geocaching, can be used to promote inquiry-based learning. Such activities are critical to the development of problem-solving skills, which, as the world has seen with recent natural disasters, must be emphasized in the education of gifted learners so that they are prepared to effectively and efficiently solve real-world challenges. With the increased focus on the global connections of our society, the use of these technology tools will likely become more essential, requiring tomorrow's leaders to understand how these tools function and how effective decision making and leadership can be enhanced with this information. GCT

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Appendix A

Geocaching Terminology and Guidelines for Teachers and Students

1. *Learn the lingo*. All sorts of terms and acronyms are used. Students need to learn these to communicate as a geocacher (see Groundspeak, 2005, for additional terms).

- *Cache*: a small container that holds a log sheet, pencil, and perhaps a small prize or reward for the finder, which is then taken by the finder upon discovery, but replaced with a new prize.
- *Cache and dash*: a quick find; generally minimal hiking is required. One can drive up to or very close to the find, jump out, sign the log, and go.
- *Cache-in/trash-out*: locate the cache, but take trash from the area with you. Often a trash bag or container will be found inside the cache container for you to do this.
- *Geocoins*: much like a travel bug, only a coin instead of a tag attached to an item.
- *Geomuggle*: a non-GPS user.
- *Travel bug*: sometimes referred to as a hitchhiker, this is a trackable item that moves place to place within a cache, upon which finders record stories or journeys of the travel bug. The bug has an identification number, which corresponds to a

log online. Finders note the number, locate the online entry that corresponds, and add to the online log to let the originator know of its whereabouts (see Groundspeak, 2005, "Travel Bug" page for more information: http://www.geocaching.com/track/howto.aspx)
- *Waypoint*: identified/named coordinates of the Earth. Beginners will generally use decimal degrees of latitude and longitude to mark a waypoint.

2. *Prepare for the hunt*. Students study maps of the area and read comments about the contents and location of a cache. Ask questions about the area. What public places are nearby? What is the terrain? Is it a micro cache or a regular cache? Some might want to read the clue. Some might want to read earlier comments from previous finds.

3. *Begin the search*. Look for clues on the way. Where would the owner place the cache? Ask yourself where would I hide it if it were my cache?

4. *Zero in on the find*. What items should be traded? Is there a theme to this cache (i.e., books on tape, poetry, trading cards)?

5. *Plant a cache*. First establish the type of cache you are going to hide. One student wanted to expand their collection of postcards. Rules for the cache were to take something/leave something only if it met the rules of the cache—in this case, postcards. Postcards from all over were collected and then could be mapped in a GIS project later. Next, the owner must write clues to finding the cache and create a name for the cache. Language arts teachers can really get involved with lessons on figurative language.

6. *Create travel bugs with a mission*. Students start a travel bug and write its mission or goal. Possibilities are endless. Get waypoints (map) of the travel bug's journey as it moves around the world. Students can also track other travel bugs/geocoins as they move around the world.

Appendix B

Web Sites for Navigating the Geocaching World: Sites and Resources

Asking a Good Question
http://www97.intel.com/education/odyssey/day_298/day_298.htm

Finding Yourself With Global Positioning
http://www.pbs.org/wnet/innovation/teachers_lp1b.html

Geocaching Garmin-Style
http://www.garmin.com/outdoor/geocaching

Geocaching: The Official Global GPS Cache Hunt Site
http://www.geocaching.com

Geography Matters
http://www.gis.com/whatisgis/geographymatters.pdf

Getting Started
http://goknow.com/GettingStarted

GPS Resources
http://www.ncsu.edu/gisined/text-gps.htm

GPS Weblinks
http://www.tsof.edu.au/resources/gis/gps_links.asp

History, Handhelds, and Problem-Based Learning: Using Geocaching to Understand the Community
http://tps.dpi.state.nc.us/ncslma04/gpsNCSLMA.ppt

K–12 Handhelds
http://www.k12handhelds.com

Leading With Handhelds: Handheld Frequently Asked Questions
http://www.intel.com/education/handhelds/faq_hh.htm

Power in the Palm of Your Hand
http://kathyschrock.net/power/#presentation

Where Should I Put This Business? A GIS Simulation and How It Can Work for You
http://www.ncrtec.org/tl/camp/gis/gis1.htm

Appendix C

Geocaching Resources

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